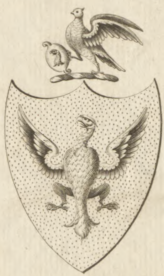

ENCYCLOPÆDIA BRITANNICA.

VOLUME the SECOND.

ENCYCLOPÆDIA Britannica:

OR, A

DICTIONARY

OF

ARTS and SCIENCES,

COMPILED UPON A NEW PLAN.

IN WHICH

The different SCIENCES and ARTS are digeſted into diſtinct Treatiſes or Syſtems;

AND

The various TECHNICAL TERMS, &c. are explained as they occur in the order of the Alphabet.

ILLUSTRATED WITH ONE HUNDRED AND SIXTY COPPERPLATES.

By a SOCIETY *of* GENTLEMEN *in* SCOTLAND.

IN THREE VOLUMES.

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Encyclopædia Britannica;

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OF

ARTS and SCIENCES.

CAABA, or CAABAH, properly ſignifies a ſquare building; but is particularly applied by the Mahometans to the temple of Mecca, built, as they pretend, by Abraham and Iſmaël his ſon. It is towards this temple they always turn their faces when they pray, in whatever part of the world they happen to be.

This temple enjoys the privilege of an aſylum for all ſorts of criminals; but it is moſt remarkable for the pilgrimages made to it by the devout muſſulmans, who pay ſo great a veneration to it, that they believe a ſingle ſight of its ſacred walls, without any particular act of devotion, is as meritorious, in the ſight of God, as the moſt careful diſcharge of one's duty, for the ſpace of a whole year, in any other temple.

CAB, an Hebrew dry meaſure, being the ſixth part of a ſeah or ſatum, and the eighteenth part of an ephah: A cab contained $2\frac{5}{6}$ pints of our corn meaſure: A quarter-cab was the meaſure of dove's dung, or more properly a ſort of chick-peaſe, called by this name, which was ſold at Samaria, during the ſiege of that city, for five ſhekels.

CABALIST, in French commerce, a factor, or perſon, who is concerned in managing the trade of another.

CABALLARIA, in middle-age writers, lands held by the tenure of furniſhing a horſeman, with ſuitable equipage, in time of war, or when the lord had occaſion for him.

CABALLEROS, or CAVALLEROS, are Spaniſh wools, of which there is a pretty conſiderable trada at Bayonne, in France.

CABALLINE denotes ſomething belonging to horſes: Thus caballine aloes is ſo called, from its being chiefly uſed for purging horſes; and common brimſtone is called ſulphur caballinum, for a like reaſon.

CABBAGE, in botany. See BRASSICA.

CABBAGE-*tree*, a name ſometimes given to the palm-tree, called by Linnæus, phœnix. See PHOENIX.

CABBAGING, among gardeners, a term uſed for the knitting of cabbages into round heads.

CABBALA, according to the Hebrew ſtyle, has a very diſtinct ſignification from that wherein we underſtand it in our language. The Hebrew cabbala ſignifies tradition; and the rabbins, who are called cabbaliſts, ſtudy principally the combination of particular words, letters, and numbers, and by this means pretend to diſcover what is to come, and to ſee clearly into the ſenſe of many difficult paſſages in ſcripture: There are no ſure principles of this knowledge, but it depends upon ſome particular traditions of the ancients; for which reaſon it is termed cabbala.

The cabbaliſts have abundance of names, which they call ſacred: Theſe they make uſe of in invoking of ſpirits, and imagine that they receive great light from them: They tell us, that the ſecrets of the cabbala were diſcovered to Moſes on mount Sinai; and that theſe have been delivered down to them from father to ſon, without interruption, and without any uſe of letters; for to write them down, is what they are by no means permitted to do. This is likewiſe termed the oral law, becauſe it paſſed from father to ſon, in order to diſtinguiſh it from the written laws.

There is another cabbala, called artificial, which conſiſts in ſearching for abſtruſe and myſterious ſignifications of a word in ſcripture, from whence they borrow certain explanations, by combining the letters which

which compoſe it: this cabbala is divided into three kinds, the gematrie, the notaricon, and the temura or themurah. The firſt whereof conſiſts in taking the letters of a Hebrew word for ciphers or arithmetical numbers, and explaining every word by the arithmetical value of the letters whereof it is compoſed. The ſecond ſort of cabbala, called notaricon, conſiſts in taking every particular letter of a word for an entire diction; and the third, called themurah, *i. e.* change, conſiſts in making different tranſpoſitions or changes of letters, placing one for the other, or one before the other.

Among the Chriſtians likewiſe, a certain ſort of magic is, by miſtake, called cabbala, which conſiſts in uſing improperly certain paſſages of ſcripture for magic operations, or in forming magic characters or figures with ſtars and taliſmans.

Some viſionaries, among the Jews, believe, that Jeſus Chriſt wrought his miracles by virtue of the myſteries of the cabbala.

CABBALISTS, the Jewiſh doctors who profeſs the ſtudy of the cabbala.

In the opinion of theſe men, there is not a word, letter, or accent in the law, without ſome myſtery in it. The Jews are divided into two general ſects; the karaites, who refuſe to receive either tradition or the talmud, or any thing but the pure text of ſcripture; and the rabbiniſts, or talmudiſts, who, beſides this, receive the traditions of the ancients, and follow the talmud.

The latter are again divided into two other ſects; pure rabbiniſts, who explain the ſcripture, in its natural ſenſe, by grammar, hiſtory, and tradition; and cabbaliſts, who, to diſcover hidden myſtical ſenſes, which they ſuppoſe God to have couched therein, make uſe of the cabbala, and the myſtical methods above mentioned.

CABECA, or CABESSE, a name given to the fineſt ſilks in the Eaſt Indies, as thoſe from 15 to 20 *per cent.* inferior to them are called barina. The Indian workmen endeavour to paſs them off one with the other; for which reaſon, the more experienced European merchants take care to open the bales, and to examine all the ſkains one after another. The Dutch diſtinguiſh two ſorts of cabecas; namely, the moor cabeca, and the common cabeca. The former is ſold at Amſterdam for about 21½ ſchellinghen Flemiſh, and the other for about 18½.

CABENDA, a port-town of Congo, in Africa, and ſubject to the Portugueſe: E. long. 12°, and S. lat. 4°.

CABIDOS, or CAVIDOS, a long meaſure uſed at Goa, and in other places of the Eaſt Indies belonging to the Portugueſe, to meaſure ſtuffs, linens, &c. and equal to 4/7 of the Paris ell.

CABIN, in the ſea-language, a ſmall room, or apartment, whereof there are a great many in ſeveral parts of a ſhip; particularly on the quarter-deck, and on each ſide of the ſteerage, for the officers of the ſhip to lie in.

The great cabin is the chief of all, and that which properly belongs to the captain or chief commander.

CABINET, or CABBINET, the moſt retired place in the fineſt part of a building, ſet apart for writing, ſtudying, or preſerving any thing that is precious.

A complete apartment conſiſts of a hall, anti-chamber, chamber, and cabinet, with a gallery on one ſide. Hence we ſay, a cabinet of paintings, curioſities, &c.

CABINET alſo denotes a piece of joiner's workmanſhip, being a kind of preſs or cheſt, with ſeveral doors and drawers.

There are common cabinets of oak or of cheſnut, varniſhed cabinets of China and Japan, cabinets of inlaid work, and ſome of ebony, or the like ſcarce and precious woods.

Formerly the Dutch and German cabinets were much eſteemed in France, but are now quite out of date, as well as the cabinets of ebony, which came from Venice.

CABIRI, a term in the theology of the ancient Pagans, ſignifying great and powerful gods; being a name given to the gods of Samothracia. They were alſo worſhipped in other parts of Greece, as Lemnos and Thebes, where the cabiria were celebrated in honour of them: theſe gods are ſaid to be, in number, four, *viz.* Axieros, Axiocerſa, Axiocerſus, and Caſmilus.

CABIRIA, feſtivals in honour of the cabiri, celebrated in Thebes and Lemnos, but eſpecially in Samothracia, an iſland conſecrated to the cabiri. All who were initiated into the myſteries of theſe gods, were thought to be ſecured thereby from ſtorms at ſea, and all other dangers. The ceremony of initiation was performed by placing the candidate, crowned with olive-branches, and girded about the loins with a purple ribband, on a kind of throne, about which the prieſts, and perſons before initiated, danced.

CABLAN, the name of a kingdom and city of India, beyond the Ganges.

CABLE, a thick, large, ſtrong rope, commonly of hemp, which ſerves to keep a ſhip at anchor.

There is no merchant-ſhip, however weak, but has at leaſt three cables; namely, the chief cable, or cable of the ſheet-anchor, a common cable, and a ſmaller one.

Cable is alſo ſaid of ropes, which ſerve to raiſe heavy loads, by the help of cranes, pullies, and other engines. The name of cable is uſually given to ſuch as have, at leaſt, three inches in diameter; thoſe that are leſs are only called ropes of different names, according to their uſe.

Every cable, of what thickneſs ſoever it be, is compoſed of three ſtrands; every ſtrand of three ropes; and every rope of three twiſts: the twiſt is made of more or leſs threads, according as the cable is to be thicker or thinner.

In the manufacture of cables, after the ropes are made, they uſe ſticks, which they paſs firſt between the ropes of which they make the ſtrands, and afterwards between the ſtrands of which they make the cable, to the end that they may all twiſt the better, and be more regularly wound together; and alſo, to prevent them from twining or intangling, they hang, at

at the end of each ſtrand and of each rope, a weight of lead or of ſtone.

The number of threads each cable is compoſed of is always proportioned to its length and thickneſs; and it is by this number of threads that its weight and value are aſcertained: thus a cable of three inches circumference, or one inch diameter, ought to conſiſt of 48 ordinary threads, and weigh 192 pounds; and on this foundation is calculated the following table, very uſeful for all people engaged in marine commerce, who fit out merchant-men for their own account, or freight them for the account of others.

A table of the number of threads and weight of cables of different circumferences.

Circumf.	Threads.	Weight.
3 inches.	48	192 pounds
4	77	308
5	121	484
6	174	696
7	238	952
8	311	1244
9	393	1572
10	485	1940
11	598	2392
12	699	2796
13	821	3284
14	952	3808
15	1093	4372
16	1244	4976
17	1404	5616
18	1574	6296
19	1754	7016
20	1943	7772

Sheet-anchor CABLE, is the greateſt cable belonging to a ſhip.

Serve or plate the CABLE, is to bind it about with ropes, clouts, *&c.* to keep it from galling in the hawſe.

To ſplice a CABLE, is to make two pieces faſt together, by working the ſeveral threads of the rope, the one into the other.

Pay more CABLE, is to let more out of the ſhip. *Pay cheap the cable,* is to hand it out apace. *Veer more cable,* is to let more out, *&c.*

CABLED, in heraldry, a term applied to a croſs, formed of the two ends of a ſhip's cable; ſometimes alſo to a croſs covered over with rounds of rope, more properly called a croſs-corded.

CABLED-*flute,* in architecture, ſuch flutes as are filled up with pieces, in the form of a cable.

CABO DE ISTRIA, the capital of the province of Iſtria, in the dominion of Venice, ſituated on the gulph of Venice, about twelve miles ſouth of Trieſte: E. long. 14° 20′, and N. lat. 45° 50′.

CABOCHED, in heraldry, is when the heads of beaſts are borne without any part of the neck, full-faced.

CABOLETTO, in commerce, a coin of the republic of Genoa, worth about 3 d. of our money.

CABUL, the capital of a province of the ſame name, on the north-weſt of India. Both the town and province of Cabul were ceded to the Perſians in 1739: E. long. 69°, and N. lat. 33° 30′.

CABURNS, on ſhip-board, are ſmall lines, made of ſpun yarn, to bind cables, ſeize tackles, or the like.

CACACA, a city of Africa, in the kingdom of Fez.

CACAGOGA, among ancient phyſicians, ointments, which, applied to the fundament, procure ſtools. Paulus Ægineta directs to boil alum, mixed with honey, for that purpoſe.

CACALIA, in botany, a genus of the ſyngeneſia polygamia æqualis claſs. The receptacle is naked; the pappus is hairy; and the calix is cylindrical, oblong, and has a kind of ſmall cup at the baſe. There are 12 ſpecies, none of which are natives of Britain.

CACALIANTHEMUM, in botany, a ſynonime of the cacalia. See CACALIA.

CACAO, in botany. See THEOBROMA.

CACERES, a town of Eſtremadura, in Spain, about ſeventeen miles ſouth-eaſt of Alcantara: W. long. 6° 45′, and N. lat. 39° 12′.

CACHAN, a city of Perſia, ſituated in a large plain, about 20 leagues from Iſpahan.

It is remarkable for its manufactures of gold and ſilver ſtuffs, and of fine earthen ware.

CACHAO, or KECHIO, the capital of the kingdom of Tonquin, ſituated on the weſtern ſhore of the river Domea: E. long. 105°, and N. lat. 22° 30′.

CACHECTIC, ſomething partaking of the nature of, or belonging to a cachexy. See CACHEXY.

CACHEMIRE, or KACHEMIRE, a province of Aſia, in the country of the Mogul. The inhabitants are thought to have been originally Jews, becauſe they ſpeak much of Moſes and Solomon, whom they believe to have travelled into their country.

CACHEMIRE is alſo the capital of that province, ſituated in 76° E. long. and 34° 30′ N. lat.

CACHEXY, in medicine, a vitious ſtate of the humours and whole habit. See MEDICINE.

CACHRYS, in botany, a genus of the pentandria digynia claſs. The fruit is oval and a little angled. There are but two ſpecies, *viz.* the libanotis, a native of Sicily; and the ſicula, a native of Sicily and Spain.

CACOETHES, in medicine, an epithet applied, by Hippocrates, to malignant and difficult diſtempers: when applied to ſigns or ſymptoms, it imports what is very bad and threatening; and if given to tumours, ulcers, *&c.* it denotes a great malignancy.

CACTUS, in botany, a genus of the icoſandria monogynia claſs. The calix conſiſts of one leaf, imbricated, and above the fruit. The berry has but one cell, containing many ſeeds. The ſpecies are twenty-three, one of which is the cochineal-plant. See COCHINEAL.

CAD, or CADE. See CADE.

CADARI, or KADARI, a ſect of Mahometans, which attributes the actions of men to men alone, and not to the divine decree determining his will; and denies all abſolute decrees, and predeſtination. Ben Aun calls the cadari, the magi or manichees of the muſſulmans.

CADE, a cag, caſk, or barrel. A cade of herrings is a veſſel containing the quantity of 500 red herrings, or of ſprats 1000.

CADE-LAMB, a young lamb, weaned and brought up by hand in a houſe.

CADE-OIL, an oil much uſed in France and Germany: it is prepared from the fruit of a ſpecies of cedar, called *oxycedrus*.

CADE-WORM, in zoology, the maggot or worm of a fly, called phryganea. See PHRYGANEA.

CADENCE, in reading, is a falling of the voice below the key note at the cloſe of every period. In reading, whether proſe or verſe, a certain tone is aſſumed which is called the key-note; and in this tone the bulk of the words are ſounded; but this note is generally lowered towards the cloſe of every ſentence.

CADENCE, in muſic, according to the ancients, is a ſeries of a certain number of notes, in a certain interval, which ſtrike the ear agreeably, and eſpecially at the end of the ſong, ſtanza, *&c.* It conſiſts ordinarily of three notes.

Cadence, in the modern muſic, may be defined a certain concluſion of a ſong, or of the parts of a ſong, which divide it, as it were, into ſo many numbers or periods. It is when the parts terminate in a chord or note, the ear ſeeming naturally to expect it; and is much the ſame in a ſong, as the period that cloſes the ſenſe in a paragraph of a diſcourſe.

A cadence is either perfect, conſiſting of two notes ſung after each other, or by degrees conjoined in each of the two parts, and by theſe means ſatisfying the ear; or imperfect, when its laſt meaſure is not in the octave or uniſon, but a ſixth or third. It is called imperfect, becauſe the ear doth not acquieſce in the concluſion, but expects a continuation of the ſong. The cadence is ſaid to be broken, when the baſs, inſtead of falling a fifth, as the ear expects, riſes a ſecond, either major or minor. Every cadence is in two meaſures; ſometimes it is ſuſpended, in which caſe it is called a repoſe, and only conſiſts of one meaſure, as when the two parts ſtop at the fifth, without finiſhing the cadence. With regard to the baſs-viol, Mr Rouſſeau diſtinguiſhes two cadences, one with a reſt, when the finger, that ſhould ſhake the cadence, ſtops a little, before it ſhakes, on the note immediately above that which requires the cadence; and one without a reſt, when the ſtop is omitted.

CADENCE, in the menage, an equal meaſure or proportion, obſerved by a horſe in all his motions; ſo that his times have an equal regard to one another, the one does not embrace or take in more ground than the other, and the horſe obſerves his ground regularly.

CADENE, one of the ſorts of carpets which the Europeans import from the Levant. They are the worſt ſort of all, and are ſold by the piece from one to two piaſters per carpet.

CADET, the younger ſon of a family, is a term naturalized in our language from the French. At Paris, among the citizens, the cadets have an equal patrimony with the reſt. At Caux, in Normandy, the cuſtom, as with us, is to leave all to the eldeſt, except a ſmall portion to the cadets. In Spain, it is uſual for one of the cadets in great families to take the mother's name.

CADET is alſo a military term denoting a young gentleman who chuſes to carry arms in a marching regiment as a private man. His views are, to acquire ſome knowledge in the art of war, and to obtain a commiſſion in the army. Cadet differs from volunteer, as the former takes pay, whereas the latter ſerves without any pay.

CADI, or CADHI, a judge of the civil affairs in the Turkiſh empire.

It is generally taken for the judge of a town; judges of provinces being diſtinguiſhed by the appellation of molla's.

In Biledulgerid in Africa, the cadi decides in ſpiritual affairs.

CADILESCHER, a capital officer of juſtice among the Turks, anſwering to a chief juſtice among us.

It is ſaid, that this authority was originally confined to the ſoldiery; but that, at preſent, it extends itſelf to the determination of all kinds of law-ſuits; yet nevertheleſs ſubject to appeals.

There are but three cadileſchers in all the grand ſignior's territories; the firſt is that of Europe; the ſecond, of Natolia; and the third reſides at Grand Cairo. This laſt is the moſt conſiderable: they have their ſeats in the divan next to the grand vizir.

CADIZ, a city and port-town of Andaluſia in Spain, ſituated on the north-weſt end of the iſland of Leon, or Lyon, oppoſite to Port St Mary on the continent, about ſixty miles ſouth-weſt of Seville, and forty north-weſt of Gibraltar: W. long. 6° 40, N. lat. 36° 30′.

The iſland it ſtands on is in length about eighteen miles; the ſouth-weſt end is about nine broad, but the other end, where the city ſtands, not above two. It has a communication with the continent by means of a bridge; and, with the oppoſite ſhore, forms a bay of twelve miles long and ſix broad. About the middle of this bay, there are two head-lands, or promontories, one on the continent, and the other on the iſland, which advance ſo near together, that the forts upon them, called the Puntal and Matagorda, command the paſſage; and within theſe forts is the harbour, which it is impoſſible for an enemy to enter till he has firſt taken the forts.

CADIZADELITES, a ſect of Mahometans very like the ancient ſtoics. They ſhun feaſts and diverſions, and affect an extraordinary gravity in all their actions; they are continually talking of God, and ſome of them make a jumble of Chriſtianity and Mahometaniſm; they drink wine, even in the faſt of the ramazan; they love and protect the Chriſtians; they believe that Mahomet is the Holy Ghoſt, practiſe circumciſion, and juſtify it by the example of Jeſus Chriſt.

CADMIA, a metallic ſubſtance ſeparated from the ore of zinc by fuſion. See CHEMISTRY, *Of zinc.*

CADORIN, a province of Italy, in the territories of Venice, bounded by the biſhopric of Brixen on the north;

north; by Friuli, on the eaſt; by the Bellunese, on the ſouth; and by the Trentin, on the weſt.

CADRITES, a ſort of Mahometan friars, who once a-week ſpend great part of the night in turning round, holding each other's hand, and repeating inceſſantly the word *hai*, which ſignifies living, and is one of the attributes of God; during which one of them plays on a flute. They never cut their hair, nor cover their heads, and always go bare footed; they have liberty to quit their convent when they pleaſe, and to marry.

CADSAND, an iſland on the coaſt of Dutch Flanders, ſituated at the mouth of the Scheld, whereby the Dutch command the navigation of that river.

CADUCEUS, in antiquity, Mercury's rod, or ſceptre, being a wand entwiſted by two ſerpents, borne by that deity, as the enſign of his quality and office, given him, according to the fable, by Apollo, for his ſeven-ſtringed harp.

Wonderful properties are aſcribed to this rod by the poets, as laying men aſleep, raiſing the dead, *&c.* It is uſed alſo as a ſymbol of peace. The caduceus, as found on ſome medals, is a common ſymbol, ſignifying good conduct, peace, and proſperity.

CADUS, in antiquity, a wine-veſſel of a certain capacity, containing eighty amphoræ, or firkins, each of which, according to the beſt accounts, held nine gallons.

CÆCILIA, in zoology, a genus of ſerpents belonging to the amphibia claſs. The cæcilia has no ſcales; it is ſmooth, and moves by means of lateral rugæ or prickles. The upper lip is prominent, and furniſhed with two tentacula. It has no tail. There are but two ſpecies of this ſerpent, viz. 1. The tentaculata, has 135 rugæ. It is about a foot long and an inch in circumference, preſerving an uniform cylindrical ſhape from the one end to the other. The teeth are very ſmall. It has ſuch a reſemblance to an eel, that it may eaſily be miſtaken for one; but as it has neither fins nor gills, it cannot be claſſed with the fiſhes. It is a native of America, and its bite is not poiſonous. 2. The glutinoſa has 340 rugæ or prickles above and ten below the anus. It is of a browniſh colour, with a white line on the ſide, and is a native of the Indies.

CÆCUM, or Coecum, in anatomy, the blind-gut. See p. 260. col. 2.

CÆMENT, in a general ſenſe, any glutinous ſubſtance, capable of uniting and keeping things together in cloſe coheſion: in this ſenſe, under cæment, are comprehended mortar, ſolder, glue, *&c.* but, ſtrictly ſpeaking, the term cæment only denotes a glutinous compoſition, uſed in cæmenting broken glaſſes, china-ware, or earthen-ware.

One of the fineſt, and at the ſame time ſtrongeſt cæment for this purpoſe, is the juice of garlic ſtamped in a ſtone mortar: this, if the operation is done with care, leaves little or no mark. Another cæment is made by beating the white of an egg very clear, and mixing with it fine powdered quick-lime: or iſing-glaſs, powdered chalk, and a little lime may be mixed together, and diſſolved in fair water. With theſe, the glaſſes, *&c.* are to be cæmented, and then ſet in the ſhade to dry; a caution which ſhould always be obſerved, whichever of the above cæments is uſed.

A cæment for cracked chemical-glaſſes, that will ſtand the fire, may be thus prepared: take wheat flour, fine powdered Venice glaſs, and pulverized chalk, of each an equal quantity; of fine brick-duſt, one half of the ſaid quantity; and a little ſcraped lint: mix them all together with the whites of eggs; then, ſpreading this mixture upon a linen cloth, apply it to the cracks of the glaſſes, which muſt be well dried before they are uſed. Old varniſh is another cæment that will anſwer the ſame purpoſe.

Cæment, among builders, a ſtrong ſort of mortar, uſed to bind bricks or ſtones together for ſome kind of mouldings; or in cæmenting a block of bricks for the carving of capitals, ſcrolls, or the like. There are two ſorts, 1. Hot cæment, which is the moſt common, made of reſin, bees-wax, brick-duſt, and chalk, boiled together. The bricks to be cæmented with this kind, muſt be made hot with the fire, and rubbed to and fro after the cæment is ſpread, in the ſame manner as joiners do when they glue two boards together. 2. Cold cæment, made of Cheſhire-cheeſe, milk, quick-lime, and whites of eggs. This cæment is leſs uſed than the former, and is accounted a ſecret known but to few bricklayers.

Cæment, among engravers, jewellers, *&c.* a compoſition of fine brick-duſt well ſifted, reſin, and bees-wax, in uſe among theſe artificers to keep the metals to be engraven or wrought on firm to the block; and alſo to fill up what is to be cheſſeled.

Cæment, in chemiſtry, a kind of menſtruum compounded of ſalts, ſulphurs, and brick, reduced to dry powders, and ſtrewed betwixt plates of metal, in order to raiſe their colour, or ſeparate one metal from another. See Chemistry.

Cæment-pots, or thoſe uſed in the cæmentation of metals, are made of fine potter's clay, and that either pure, or mixed with ſand in different proportions.

CÆMENTATION, in a general ſenſe, the corroding of metals in a dry form, by means of the fumes of acid ſalts. See Chemistry, Part II.

CAEN, the capital of a county of the ſame name in Normandy, ſituated on the river Orne, about ſeventy-five miles weſt of Rouen, and thirty ſouth-weſt of Havre de Grace: W. long. 25′, N. lat. 49° 20′.

It has an univerſity, firſt founded by king Henry VI. of England, in 1431.

CAERFILLY, a town of Glamorganſhire, about five miles north of Landaff: W. long. 3° 15′, and N. lat. 51° 35′.

CÆRITES, or Cæritum tabulæ, in Roman antiquity, tables or regiſters in which the names of the Cærites were regiſtered. The people of Cære were accounted citizens of Rome, but had no privilege of voting; hence when a Roman citizen was degraded, if a ſenator, he was expelled the ſenate; if a knight, he loſt the public horſe; and if a plebeian, his name was inſerted in the regiſter of the Cærites; that is, he was

was ſubject to all taxes, but incapable of voting or enjoying any public office.

CAERLEON, a market-town of Monmouthſhire, ſituated on the river Uſke, about ſixteen miles ſouth-weſt of Monmouth: W. long. 3°, N. lat. 51° 40′.

CAERMARTHEN, the capital of Caermarthenſhire in Wales, ſituated upon the river Tivy, about five miles from the ſea.

CAERNARVAN, the chief town of Caernarvanſhire in Wales, ſituated upon the river Menay.

CAERWIS, a market-town in Flintſhire, in north Wales, about five miles eaſt of St Aſaph, and four weſt of Flint: W. long. 3° 25′, N. lat. 53° 20′.

CÆSALPINIA, in botany, a genus of the decandria monogynia claſs. The calix has five ſegments, the loweſt of which is largeſt; the corolla conſiſts of five petals; the capſule is of the pod kind. There are four ſpecies, all natives of the Indies.

CÆSALPINOIDES, in botany, a ſynonime of the gleditſia. See GLEDITSIA.

CÆSAR, in Roman antiquity, a title borne by all the emperors, from Julius Cæſar, to the deſtruction of the empire. It was alſo uſed as a title of diſtinction, for the intended or preſumptive heir of the empire, as King of the Romans is now uſed for that of the German empire.

This title took its riſe from the ſurname of the firſt emperor, C. Julius Cæſar, which, by a decree of the ſenate, all the ſucceeding emperors were to bear. Under his ſucceſſor, the appellation of Auguſtus being appropriated to the emperors, in compliment to that prince, the title Cæſar was given to the ſecond perſon in the empire, though ſtill it continued to be given to the firſt; and hence the difference betwixt Cæſar uſed ſimply, and Cæſar with the addition of Imperator Auguſtus.

The dignity of Cæſar remained the ſecond of the empire, till Alexius Comnenus having elected Nicephorus Meliſſenus Cæſar, by contract; and it being neceſſary to confer ſome higher dignity on his own brother Iſaacius, he created him Sebaſtocrator, with the precedency over Meliſſenus; ordering, that in all acclamations, *&c.* Iſaacius Sebaſtocrator ſhould be named the ſecond, and Meliſſenus Cæſar, the third.

CÆSARIAN operation, in midwifery. See MIDWIFERY.

CÆSARIANS, *cæſarienſes*, in Roman antiquity, were officers or miniſters of the Roman emperors: They kept the account of the revenues of the emperors, and took poſſeſſion, in their name, of ſuch things as devolved, or were confiſcated to them.

CÆSTUS, in antiquity, a large gantlet made of raw hide, which the wreſtlers made uſe of when they fought at the public games.

This was a kind of leathern ſtrap, ſtrengthened with lead, or plates of iron, which encompaſſed the hand, the wriſt, and a part of the arm, as well to defend theſe parts, as to enforce their blows.

CÆSTUS, or CÆSTUM, was alſo a kind of girdle, made of wool, which the huſband untied for his ſpouſe the firſt day of marriage, before they went to bed.

This relates to Venus's girdle, which Juno borrowed of her, to entice Jupiter to love her. See CESTUS.

CÆSURA, in the ancient poetry, is when, in the ſcanning of a verſe, a word is divided ſo, as one part ſeems cut off, and goes to a different foot from the reſt; as,

Menti|ri no|li, nun|quam men|dacia| proſunt.

where the ſyllables *ri*, *li*, *quam*, and *men*, are cæſuras.

CÆSURE, in the modern poetry, denotes a reſt, or pauſe, towards the middle of an Alexandrian verſe, by which the voice and pronunciation are aided, and the verſe, as it were, divided into two hemiſtichs. See PAUSE.

CAFFA, in commerce, painted cotton-cloths manufactured in the E. Indies, and ſold at Bengal.

CAFFA, or KAFFA, a city and port-town of Crim Tartary, ſituated on the ſouth-eaſt part of that peninſula: E. long. 37°, N. lat. 44° 55′.

It is the moſt conſiderable town in the country, and gives name to the ſtraits of Caffa, which run from the Euxine or Black ſea, to the Palus Meotis, or ſea of Azoph.

CAFFILA, a company of merchants or travellers, who join together in order to go with more ſecurity thro' the dominions of the Grand Mogul, and through other countries on the continent of the E. Indies.

The Caffila differs from a caravan, at leaſt in Perſia; for the caffila belongs properly to ſome ſovereign, or to ſome powerful company in Europe; whereas a caravan is a company of particular merchants, each trading upon his own account. The Engliſh and Dutch have each of them their caffila at Gambron.

CAFFILA on the coaſt of Guzerat or Cambaya, ſignifies a ſmall fleet of merchant-ſhips.

CAFFRARIA, the country of the Caffers, or Hottentots, in the moſt ſoutherly part of Africa, lying in the form of a creſcent about the inland country of Monomotapa, between 35° S. lat. and the tropic of Capricorn; and bounded on the eaſt, ſouth, and weſt, by the Indian and Atlantic oceans.

Moſt of the ſea-coaſts of this country are ſubject to the Dutch, who have built a fort near the moſt ſouthern promontory, called the Cape of Good-Hope.

CAG, or KEG, a barrel or veſſel, that contains from four to five gallons.

CAGE, an incloſure made of wire, wicker, or the like, interwoven lattice-wiſe, for the confinement of birds, or wild beaſts.

The cage, in the Roman amphitheatres, was a place wherein ſavage animals were confined. It was incloſed with iron rails, and open at top, ſo as to be ſeen to the bottom by the ſpectators.

CAGLI, a town of the province of Urbino, in the pope's territories, about twenty-five miles ſouth of the city of Urbino: E. long. 14°, N. lat. 43° 15′.

CAGLIARI, the capital of the iſland of Sardinia, ſituated on a bay of the ſea in the ſouthern part of that iſland: E. long. 9° 12′, N. lat. 39°.

CAGUI, in zoology, a ſynonime of two ſpecies of monkey, *viz.* the jaccchus and œdipus. See SIMIA.

CAHERAH,

CAHERAH, or AL-CAHERAH, the capital of Egypt, which we call Grand Cairo. See CAIRO.

CAHLO, the name by which ſome call the lupus piſcis or wolf-fiſh.

CAHORS, the capital of the territory of Querci, in the province of Guienne in France, ſituated about forty-five miles north of Tholouſe: E. long. 1°, N. lat. 44° 25′.

It is the ſee of a biſhop, and has an univerſity.

CAHYS, a dry meaſure for corn, uſed in ſome parts of Spain, particularly at Seville and at Cadiz. It is near a buſhel of our meaſure.

CAJANABURG, the capital of the province of Cajania, or eaſt Bothnia in Sweden, ſituated on the north-eaſt part of the lake Cajania, about three hundred miles north-eaſt of Abo: E. long. 27°, N. lat. 63° 50′.

CAJAZZO, a town of the province of Lavoro in the kingdom of Naples, ſituated about ſixteen miles north-eaſt of the city of Naples: E. long. 15°, N. lat. 41° 15′.

CAJEPUT, an oil brought from the E. Indies, which reſembles that of cardamoms.

CAIFUM, a city of China, ſituated in the province of Honan, on the river Crocceus, three hundred and fifty miles north-weſt of Nanking: E. long. 113° 30′, and N. lat. 35°.

CAIMACAN, or CAIMACAM, in the Turkiſh affairs, a dignity in the Ottoman empire, anſwering to lieutenant, or rather deputy, among us.

There are uſually two caimacans, one reſiding at Conſtantinople, as governor thereof; the other attending the grand vizir, in quality of his lieutenant, ſecretary of ſtate, and firſt miniſter of his council; and gives audience to ambaſſadors. Sometimes there is a third caimacan, who attends the ſultan; whom he acquaints with any public diſturbances, and receives his orders concerning them.

CAIMAN, or CAIMAN-ISLANDS, certain American iſlands lying ſouth of Cuba, and north-weſt of Jamaica, between 81° and 86° of W. long. and in 21° of N. lat.

They are moſt remarkable on account of the fiſhery of tortoiſe, which the people of Jamaica catch here, and carry home alive, keeping them in pens for food, and killing them as they want them.

CAINIANS, or CAINITES, in church-hiſtory, Chriſtian heretics, that ſprung up about the year 130, and took their name from Cain, whom they looked upon as their head and father: They ſaid, that he was formed by a celeſtial and almighty power, and that Abel was made but by a weak one.

This ſect adopted all that was impure in the hereſy of the gnoſtics, and other heretics of thoſe times: They acknowledged a power ſuperior to that of the Creator; the former they called *Wiſdom*, the latter, *Inferior Virtue*: They had a particular veneration for Korah, Abiram, Eſau, Lot, the Sodomites, and eſpecially Judas, becauſe his treachery occaſioned the death of Jeſus Chriſt: They even made uſe of a goſpel, which bore that falſe apoſtle's name.

CAINITO, in botany. See CHRYSOPHYLLUM.

CAIRO, or GRAND CAIRO, the capital of Egypt, ſituated in a plain at the foot of a mountain, about two miles eaſt of the Nile, and 100 miles ſouth of the mouth of that river: E. long. 32°, N. lat. 30°.

The town is ten miles in circumference, and full of inhabitants. The caſtle ſtands on the ſummit of a hill, at the ſouth end of the town, and is three miles round. The Britiſh and other European ſtates have their conſuls and factors here, for the protection of trade.

CAIROAN, a town of the kingdom of Tunis in Africa, ſituated on the river Magrida, about eighty miles ſouth of Tunis: E. long. 9°, N. lat. 36°.

CAINS, a name given to the Greeks in the iſle of Crete, who revolt from the Turks to the Venetians.

CAISSON, in the military art, a wooden cheſt, into which ſeveral bombs are put, and ſometimes only filled with gun-powder: This is buried under ſome work whereof the enemy intends to poſſeſs themſelves, and, when they are maſters of it, is fired, in order to blow them up.

CAISSON is alſo uſed for a wooden frame or cheſt, uſed in laying the foundations of the piers of a bridge.

CAITHNESS. See CATHNESS.

CAKILE, in botany. See BUNIAS.

CALABA, in botany. See CALOPHYLLUM.

CALABASH-*tree*, in botany. See CRESCENTIA.

CALABRIA, the moſt ſoutherly part of the kingdom of Naples, ſituated over againſt Sicily.

There are two provinces of Calabria called the Hither and Farther Calabria, with reſpect to the city of Naples; Coſenza being the capital of the former, and Rheggio of the latter.

CALADE, in the menage, the deſcent or ſloping declivity of a riſing menage ground, being a ſmall eminence upon which we ride down a horſe ſeveral times, putting him to a ſhort gallop, with his fore-hams in the air, to make him learn to ply or bend his haunches, and form his ſtop upon the aids of the calves of the legs, the ſtay of the bridle, and the caveſon ſeaſonably given.

CALAHORRA, a city of Old Caſtile in Spain, ſituated on the river Ebro, near the confines of Navarre, about ſixty miles north-weſt of Saragoſſa: W. long. 2°, N. lat. 42° 20′.

CALAIS, a port-town of Picardy in France, ſituated on the Engliſh channel, about twenty-two miles ſouth-eaſt of Dover: E. long. 2°, N. lat. 51°.

CALAMANCO, a ſort of woolen ſtuff manufactured in England and in Brabant. It has a fine gloſs, and is chequered in the warp, whence the checks appear only on the right ſide. Some calamancos are quite plain, others have broad ſtripes adorned with flowers; ſome with plain broad ſtripes, ſome with narrow ſtripes, and others watered.

CALAMINARIS, or LAPIS CALAMINARIS, in natural hiſtory, a kind of foſſil, the general ore of zinc, of a ſpungy ſubſtance and a lax and cavernous texture, yet conſiderably heavy.

It is of no determinate ſhape or ſize, but is found in maſſes of a very various and irregular figure. It is,

when

when moſt pure and perfect, of a pale browniſh grey. It is found in Germany, Saxony, Bohemia, and England. See CHEMISTRY, *Of zinc*.

After roaſting the calamine, in order to purge it of ſulphureous or arſenical matter, it is uſed by phyſicians in collyria againſt defluxions of thin acrid humours upon the eyes, for drying up moiſt running ulcers, and healing excoriations.

CALAMINT, in botany. See MELISSA, and MENTHA.

CALAMITA, in natural hiſtory, a name given to ſtyrax. See STYRAX.

CALAMITA is ſometimes alſo uſed for the magnet or load-ſtone.

CALAMITES. See OSTEOCOLLA.

CALAMUS, in botany, a genus of the hexandria monogynia claſs. The calix has ſix leaves; it has no corolla; the berry is imbricated, and contains but one ſeed. There is but one ſpecies, *viz.* the rotang, a native of India.

CALAMUS *aromaticus*, or ſweet-ſcented flag, in the materia medica, a ſpecies of flag called acorus by Linnæus. See ACORUS. The root is generally looked upon as a carminative and ſtomachic medicine, and as ſuch is ſometimes uſed in practice.

CALAMUS *ſcriptorius*, in antiquity, a reed or ruſh to write with.

The ancients made uſe of ſtyles to write on tables covered with wax; and of reed, or ruſh, to write on parchment, or Egyptian paper.

CALANGAY, in ornithology. See PSITTACUS.

CALASH, or CALESH, a light and very low kind of chariot, uſed chiefly for taking the air in parks and gardens.

CALASIRIS, in antiquity, a linen tunic fringed at the bottom, and worn by the Egyptians under a white woolen garment; but this laſt they were obliged to pull off when they entered the temples, being only allowed to appear then in linen habits.

CALATAJUD, a city of Aragon, in Spain, ſituated on the river Xalo, about fifty miles weſt of Saragoſſa: W. long. 2° 5′, N. lat. 41° 15′.

CALATHUS, in antiquity, a baſket, hamper, or pannier of oſiers, reeds, or twigs, for women to put their work in, or to gather flowers in.

CALATHUS was alſo a veſſel, or pan, for cheeſe-curds and milk; alſo the name of a cup for wine, uſed in ſacrifices.

CALATOR, in antiquity, was a public ſervant, and a freeman, ſuch as a bailiff or crier, a ſumner, to ſummon courts, ſynods, and other public aſſemblies.

CALATRAVA, a city of new Caſtile, in Spain, ſituated on the river Guadiana, forty-five miles ſouth of Toledo: W. long. 4° 20′, N. lat. 39°.

Knights of CALATRAVA, a military order in Spain, inſtituted under Sancho III. king of Caſtile, upon the following occaſion. When that prince took the ſtrong fort of Calatrava from the moors of Andaluſia, he gave it to the templars, who, wanting courage to defend it, returned it him again. Then Don Reymond, of the order of the Ciſtercians, accompanied with ſeveral perſons of quality, made an offer to defend the place, which the king thereupon delivered up to them, and inſtituted that order. It increaſed ſo much under the reign of Alphonſus, that the knights deſired they might have a grand maſter, which was granted. Ferdinand and Iſabella afterwards, with the conſent of pope Innocent VIII. reunited the grand maſterſhip of Calatrava to the Spaniſh crown; ſo that the kings of Spain are now become perpetual adminiſtrators thereof.

The knights of Calatrava bear a croſs gules, fluerdeliſed with green, *&c.* their rule and habit was originally that of the Ciſtercians.

CALCADA, or St DOMINGO DE CALCADA, a city of Old Caſtile, in Spain, forty-eight miles eaſt of Burgos: W. long. 3°, N. lat. 42° 36′.

CALCANEUM, or OS CALCIS, in anatomy. See p. 186. col. 1.

CALCAR, in zoology, the trivial name of a ſpecies of nautilus. See NAUTILUS.

CALCAR, in glaſs-making, a ſort of oven, or reverberatory furnace, in which, being well heated, the cryſtal frit, or bollito, is made.

CALCAR, in geography, a town of the duchy of Cleves, and circle of Weſtphalia, in Germany: E. long. 5° 50′, and N. lat. 51° 45′.

CALCARIOUS, in general, denotes ſomething belonging to, or partaking of the nature of calx. See CALX.

CALCARIUS *lapis*, in natural hiſtory, the ſame with lime-ſtone. See LIME.

CALCEARIUM, in antiquity, a term uſed to denote the allowance made the ſoldiers to buy their ſhoes.

CALCEOLUS, in botany. See CYPRIPEDIUM.

CALCINATION, in chemiſtry, the reducing of ſubſtances to a calx by fire. See CHEMISTRY.

CALCITRAPA, and CALCITRAPOIDES, in botany. See CENTAUREA.

CALCULUS, in natural hiſtory, properly denotes a little ſtone or pebble. See PEBBLE.

CALCULUS, or CALCULUS HUMANUS, in medicine, the ſtone in the bladder or kidneys. See MEDICINE, and SURGERY.

CALCULUS alſo denotes a method of computation, ſo called from the calculi, or counters, anciently uſed for this purpoſe. Hence,

CALCULUS SPECIALIS, or LITERALIS, is the ſame with algebra. See ALGEBRA.

CALCULUS *differentialis* is a method of differencing quantities, that is, of finding an infinitely ſmall quantity, which being taken an infinite number of times, ſhall be equal to a given quantity. See FLUXIONS.

CALCULUS *exponentialis*, among mathematicians, a method of differencing exponential quantities, and ſumming up the differentials of exponential quantities. See FLUXIONS.

CALCULUS INTEGRALIS, or SUMMATORIUS, is a method of ſumming up differential quanties; that is, from a differential quantity given, to find the quantity from whoſe differencing the given differential reſults. See FLUXIONS.

CALDARIUM, in the ancient baths, a certain vault, or

or room, made ſo as to collect the vapours, and produce ſweating: whence it ſignifies a hot houſe, bagnio, ſtove, or ſweating-room.

CALEFACTION, the production of heat in a body from the action of fire, or that impulſe impreſſed by a hot body upon other bodies about it. This word is uſed in pharmacy, by way of diſtinction from coction, which implies boiling; whereas calefaction is only heating a thing.

CALENBURG-CASTLE, the capital of a duchy of the ſame name, in Lower Saxony, in Germany, ſituated upon the river Leine, about fifteen miles ſouth of Hanover: E. long. 9° 40′, and N. lat. 52° 20′.

CALENDAR, a diſtribution of time, accommodated to the various uſes of life, but more eſpecially ſuch as regard civil and eccleſiaſtical polity. See ASTRONOMY, *Of the diviſion of time.*

Julian Chriſtian CALENDAR. See ASTRONOMY, *Of the diviſion of time.*

Gregorian CALENDAR. See ASTRONOMY, *Of the diviſion of time.*

CALENDER, a machine uſed in manufactories, to preſs certain woollen and ſilken ſtuffs, and linens, to make them ſmooth, even, and gloſſy, or to give them waves, or water them, as may be ſeen in mohairs and tabbies. This inſtrument is compoſed of two thick cylinders, or rollers, of very hard and poliſhed wood, round which the ſtuffs to be calendered are wound: theſe rollers are placed croſs-ways between two very thick boards, the lower ſerving as a fixed baſe, and the upper moveable, by means of a thick ſcrew, with a rope faſtened to a ſpindle, which makes its axis: the uppermoſt board is loaded with large ſtones weighing 20000 lb. or more. It is this weight that gives the poliſh and makes the waves on the ſtuffs about the rollers, by means of a ſhallow indenture or engraving cut in it.

CALENDS, in Roman antiquity, the firſt day of each month, ſo called from the Greek [*kalein*], to proclaim: it being cuſtomary, on thoſe days, to proclaim the number of holy-days in each month.

The Roman method of reckoning the days of their months has ſomething extremely ſingular in it: inſtead of computing forwards, in the natural order of the numbers 1, 2, 3, *&c.* they reckoned backwards, in the manner expreſſed in the following verſes:

Prima dies menſis cujuſque eſt dicta calendæ:
Sex Maius, nonas, *Julius*, *October*, *& Mars*;
Quatuor at reliqui: habet idus *quilibet octo*;
Inde dies reliquos omnes dic eſſe calendas;
Quas retro numerans, dices a menſe ſequente.

Hence to find the day of our month anſwering to that of the calends, to the number of days in the preceding month add two, and from this ſum ſubtracting the number of calends given, the remainder will be the day of our month: thus the fourth of the calends of June is found to anſwer to the twenty-ninth of May; and ſo in other caſes.

CALENDULA, or MARYGOLD, in botany, a genus of the ſyngeneſia polygamia neceſſaria claſs. The receptacle is naked; it has no pappus; the calix conſiſts of many equal leaves; the ſeeds of the diſk are membranaceous. There are eight ſpecies, none of them natives of Europe. The flowers of the calendula officinalis, or garden marygold, are ſaid to be aperient and attenuating, as alſo cordiac, alexipharmic, and ſudorific. They are principally celebrated in uterine obſtructions, and for throwing out the ſmall pox.

CALF, in zoology, the young of the ox-kind. See BOS.

Among ſportſmen, the term calf is uſed for a hart or hind of the firſt year: the ſame term is alſo uſed for the young of the whale.

Sea CALF. See PHOCA.

CALF'S-*ſnout*, in botany. See ANTIRRHINUM.

CALIACA, a town of Bulgaria, ſituated upon the Black-ſea, belonging to the Turks.

CALIBER, or CALIPER, properly denotes the diameter of any body: thus we ſay, two columns of the ſame caliber, the caliber of the bore of a gun, the caliber of a bullet, *&c.*

CALIBER-*compaſſes*, the name of an inſtrument, made either of wood, iron, ſteel, or braſs: that uſed for meaſuring bullets conſiſts of two branches, bending inwards, with a tongue fixed to one of them, and the other graduated in ſuch a manner, that if the bullet be compreſſed by the ends of the two branches, and the tongue be applied to the graduated branch, it will ſhew the weight of the bullet.

CALIBER alſo ſignifies an inſtrument uſed by carpenters, joiners, and bricklayers, to ſee whether their work be well ſquared.

CALICUT, a town ſituated on the Malabar coaſt, in the hither peninſula of India, ſubject to its own prince: E. long. 75°, and N. lat. 11° 20′.

This was the firſt port the Portugueſe made in India, after ſailing round the Cape of Good Hope.

CALIDUCT, in antiquity, a kind of pipes, or canals, diſpoſed along the walls of houſes and apartments, uſed, by the ancients, for conveying heat to ſeveral remote parts of the houſe, from one common furnace.

CALIFORNIA. See CALLIFORNIA.

CALIMUS. See CALLIMUS.

CALIN, a compound metal, whereof the Chineſe make tea-caniſters, and the like. The ingredients ſeem to be lead and tin.

CALIPH, the ſupreme eccleſiaſtical dignity among the Saracens; or, as it is otherwiſe defined, a ſovereign dignity among the Mahometans, veſted with abſolute authority in all matters relating both to religion and policy.

It ſignifies in the Arabic, ſucceſſor or vicar: the Saracen princes aſſumed this title as deſcendants from Mahomet; the caliphs bearing the ſame relation to Mahomet, that the popes pretend they do to Jeſus Chriſt or St Peter. It is at this day one of the grand ſignior's titles, as ſucceſſor of Mahomet; and of the ſophi of Perſia, as ſucceſſor of Ali.

CALIPPIC PERIOD, an improvement of the cycle of Meton, of nineteen years, which Calippus, a famous Grecian aſtronomer, finding in reality to contain nineteen

teen of Nabonaſſar's years, four days, and $\frac{311}{450}$, he, to avoid fractions, quadrupled the golden number, and by that means made a new cycle of ſeventy-ſix years; which time being expired, he ſuppoſed the lunation, or changes of the moon, would happen on the ſame day of the month, and hour of the day, that they were on ſeventy-ſix years before.

CALIX. See CALYX.

CALIXTINS, in church-hiſtory, a ſect of Chriſtians, in Bohemia and Moravia: the principal point in which they differed from the church, was the uſe of the chalice, or communicating in both kinds.

CALIXTINS, is alſo a name given to thoſe, among the Lutherans, who follow the ſentiments of George Calixtus, a celebrated divine, who oppoſed the opinion of St Auguſtine, on predeſtination, grace, and free-will.

CALKA, a kingdom of Tartary, in Aſia, to the eaſt of Siberia.

CALKING. See CAULKING.

CALKINS, the prominent parts at the extremities of a horſe-ſhoe, bent downwards, and forged to a ſort of point.

Calkins are apt to make horſes trip; they alſo occaſion blymes, and ruin the back ſinews. If faſhioned in form of a hare's ear, and the horn of a horſe's heel be pared a little low, they do little damage; whereas the great ſquare calkins quite ſpoil the foot.

Calkins are either ſingle or double, that is, at one end of the ſhoe, or at both: theſe laſt are deemed leſs hurtful, as the horſe can tread more even.

CALL, among hunters, a leſſon blown upon the horn, to comfort the hounds.

CALLS, *natural and artificial*, among fowlers, a ſport much practiſed during the wooing ſeaſon of partridges, eſpecially for taking cock-partridges; for which they put a hen into a cadge, to call and bring them near. The hen-partridge ſhould be ſet near a hedge, in a thin, open, wire-cage, ſo that ſhe may be ſeen at a good diſtance: then the net, called hallier, ſhould be placed quite round the cage, each part about the diſtance of twenty feet: the fowler ſhould retire behind the hedge.

Artificial CALLS are beſt made of box, walnut-tree, or the like: they are formed of the bigneſs of an hen's egg, bored through from end to end; about the middle there muſt be a hole hollowed within, to the bottom; then have a pipe of a ſwan's quill, and the bone of a cat's foot, opened at one end, which muſt be conveyed into the hole at the end, and ſo thruſt into the hole at the middle; take afterwards a gooſe-quill, opened at both ends, and put it in at the other end of the call; blow into the quill, and it will make the like noiſe as the partridge-cock does.

CALLA, in botany, a genus of the gynandria polyandria claſs. The ſpatha is plain; the ſpadix is covered with floſcules; it has no corolla; the berry contains many ſeeds. There are three ſpecies, none of them natives of Britain.

CALLABAS, a town of Indoſtan in Aſia, upon the road from Surat to Agra.

CALLAO, a port-town in a little iſland on the coaſt of Peru, in South America, oppoſite to Lima: W. long. 76°, and S. lat. 12°.

CALLEN, a town of Ireland, in the county of Kilkenny, and province of Leinſter, about ten miles ſouthweſt of Kilkenny: W. long. 7° 22′, and N. lat. 52° 25′.

CALLICHTYS, in ichthyology, the trivial name of a ſpecies of ſilurus. See SILURUS.

CALLICO, in commerce, a kind of linen manufacture, made of cotton, chiefly in the Eaſt Indies, ſome of which are painted with various flowers of different colours; and others that are never dyed, having a ſtripe of gold and ſilver quite through the piece; and at each end they fix a tiſſue of gold, ſilver, and ſilk, intermixed with flowers. This manufacture is brought hither by the Eaſt-India company, and is re-exported by merchants to other parts of Europe. The general wear of ſtained or printed India calicoes in this nation having become a general grievance, and occaſioning unſpeakable diſtreſs upon our own manufacturers, they were prohibited by ſtat. 7 Geo. I. cap. vii.

CALLIDRYS, in ornithology, the trivial name of a ſpecies of motacilla. See MOTACILLA.

CALLIFORNIA, a large country of the Weſt Indies, lying between 116° and 138° W. long. and between 23° and 46° N. lat. It is uncertain whether it be a peninſula or an iſland.

CALLIGONUM, in botany, a genus of the polyandria digynia claſs. The calix has five leaves; the petals are four; it has two ſtyli; and the capſule is divided into two partitions, each containing two ſeeds. There is but one ſpecies, *viz.* the polygonoides, a native of mount Ararat.

CALLIGRAPHUS, in antiquity, a copiſt or ſcriviner, who tranſcribed, in a fair hand, what the notaries had taken down in notes, or minutes, being generally in a kind of cypher or ſhort-hand, which, as they were in that hand, being underſtood by few, were copied over fair and at length by perſons who had a good hand, for ſale, *&c.*

CALLING *the houſe*, in the Britiſh parliament, is the calling over the members names, every one anſwering to his own, and going out of the houſe, in the order in which he is called: this they do, in order to diſcover whether there be any perſons there not returned by the clerk of the crown; or if any member be abſent without leave of the houſe.

CALLIONYMUS, in ichthyology, a genus of fiſhes belonging to the order of jugulares. The upper lip is doubled up; the eyes are very near each other; the membrane of the gills has ſix radii; the operculum is ſhut; the body is naked; and the belly-fins are at a great diſtance from each other. There are three ſpecies of callionymus, *viz.* 1. The lyra, with the firſt bone of the back-fin as long as the body of the animal, and a cirrhus at the anus. It is of the Atlantic. 2. The dracunculus, with the firſt bone of the back-fin ſhorter than its body; which is of a ſpotted yellow colour. It frequents the ſhores of Genoa and Rome. 3. The indicus, has a ſmooth head with longitudinal wrinkles; the lower jaw is a little longer than the upper

per

per one; the tongue is obtuſe and emarginated; the apertures of the gills are large: it is of a livid colour, and the anus is in the middle of the body. It is a native of Aſia.

CALLISTEA, in Grecian antiquity, a Leſbian feſtival, wherein the women preſented themſelves in Juno's temple, and the prize was aſſigned to the faireſt. There was another of theſe contentions at the feſtival of Ceres Eleuſinia, among the Parrhaſians, and another among the Eleans, where the moſt beautiful man was preſented with a complete ſuit of armour, which he conſecrated to Minerva, to whoſe temple he walked in proceſſion, being accompanied with his friends, who adorned him with ribbands, and crowned him with a garland of myrtle.

CALLOSUM *corpus*, in anatomy. See p. 285. c. 2.

CALLUS, or CALLOSITY, in a general ſenſe, any cutaneous, corneous, or oſſeous hardneſs, whether natural or preternatural: but moſt frequently it means the callus generated about the edges of a fracture, provided by nature to preſerve the fractured bones, or divided parts, in the ſituation in which they are replaced by the ſurgeon.

CALM, in the ſea-language, is when there is no wind ſtirring.

That tract of ſea, to the northward of the equator, between 4° and 10° of latitude, lying between the meridians of Cape Verde, and of the eaſtermoſt iſland of that name, ſeems to be a place condemned to perpetual calms: the little winds that are being only ſome ſudden uncertain guſts of very ſmall continuance, and leſs extent. The Atlantic ocean, near the equator, is very much ſubject, nay, always attended with theſe calms.

CALMAR, the capital of the province of Gothland, in Sweden, ſituated on the coaſt of the Baltic ſea, about forty miles north of Carelſcroon: E. long. 16°, and N. lat. 56° 40′.

CALMUCKS, certain wandering tribes or hords of Tartars, inhabiting the country north of the Caſpian ſea, under the protection of Ruſſia

CALNE, a borough-town of Wiltſhire, about twenty miles north of Saliſbury, which ſends two members to parliament: W. long. 2°, and N. lat. 51° 30′.

CALOGERI, in church-hiſtory, monks of the Greek church, divided into three degrees, the novices, called archari; the ordinary profeſſed, called michrochemi; and the more perfect, called megalochemi: they are likewiſe divided into cœnobites, anchorets, and recluſes. The cœnobites are employed in reciting their office from midnight to ſun-ſet; they are obliged to make three genuflexions at the door of the choir, and returning, to bow to the right and to the left, to their brethren. The anchorets retire from the converſation of the world, and live in hermitages, in the neighbourhood of the monaſteries; they cultivate a little ſpot of ground, and never go out but on Sundays and holy-days, to perform their devotions at the next monaſtery. As for the recluſe, they ſhut themſelves up in grottos and caverns, on the tops of mountains, which they never go out of, abandoning themſelves entirely to Providence: They live on the alms ſent them by the neighbouring monaſteries.

CALOMEL, or dulcified ſublimate of mercury, is prepared in the following manner. Take of corroſive ſublimate, one pound; purified quick ſilver, nine ounces. Having powdered the ſublimate, add to it the quick-ſilver, and digeſt them together in a matraſs, with a gentle ſand heat, until they unite; then increaſing the heat, let the mixture be ſublimed. The ſublimed matter, freed from the acrimonious part at top and ſuch mercurial globules as happen to appear diſtinct in it, is to be reduced into powder, and ſublimed again; and this ſublimation muſt be repeated ſix times. This dulcified mercury, or calomel, is one of the beſt preparations for general uſe. The doſe, for raiſing a ſalivation, is ten or fifteen grains, taken in the form of a bolus, or pills, every night or oftener, till the ptyaliſm begins. As an alterant and diaphoretic, it is given in doſes of five or ſix grains, a purgative being occaſionally interpoſed, to prevent its affecting the mouth. It anſwers however much better when given in ſmaller quantities, as one, two, or three grains every morning and evening, in conjunction with ſuch ſubſtances as determine its action to the ſkin, as the extract or reſin of guaicum; the patient at the ſame time keeping warm, and drinking freely of warm diluting liquors. By this method of managing it, obſtinate, cutaneous, and veneral diſtempers have been ſucceſsfully cured, without any remarkable increaſe of the ſenſible evacuations.

CALOPHYLLUM, in botany, a genus of the polyandria monogynia claſs. The corolla conſiſts of five petals; the calix has five teeth; and the drupa is globular. There are but two ſpecies, viz. the inophyllum, and calaba, both natives of India.

CALOTTE, a cap or coif of hair, ſatin, or other ſtuff: an eccleſiaſtical ornament in moſt popiſh countries. See CAP.

CALOTTE, in architecture, a round cavity or depreſſure, in form of a cap or cup, lathed and plaſtered, uſed to diminiſh the riſe or elevation of a moderate chapel, cabinet, alcove, *&c.* which, without ſuch an expedient, would be too high for other pieces of the apartment.

CALPE, the mountain, at the foot of which, towards the ſea, Gibraltar ſtands. It is half a league in height towards the land, and ſo ſteep, that there is no approaching it on that ſide.

CALQUING, or CALKING, a term uſed in painting, *&c.* where the backſide of any deſign is covered with a black or red colour, and the ſtrokes, or lines, traced through, on a waxed plate, wall, or other matter, by paſſing lightly over each ſtroke of the deſign with a point, which leaves an impreſſion of the colour on the plate or wall.

CALTHA, in botany, a genus of the polyandria polygynia claſs. It has no calix; there are five petals; and the capſules are many, containing a great number of ſeeds. There is but one ſpecies, viz. the paluſtris, or marſh-marygold, a native of Britain.

CALTROP, in botany, the Engliſh name of the tribulus. See TRIBULUS.

CALVARIA,

CALVARIA, in anatomy, the hairy ſcalp. See p. 151.

Calvary, in heraldry, a croſs ſo called, becauſe it reſembles the croſs on which our Saviour ſuffered. It is always ſet upon ſteps.

CALVI, a town of the province of Lavoro, in the kingdom of Naples, ſituated near the ſea, about fifteen miles north of the city of Naples: E. long. 14° 45′, and N. lat. 41° 15′.

Calvi is alſo the name of a ſea-port in the iſland of Corſica, ſituated on a bay, on the weſt ſide of the iſland, about forty miles ſouth-weſt of Baſtia: E. long. 9° 5′, and N. lat. 42° 16.

CALVINISTS, in church-hiſtory, thoſe who follow the opinions of John Calvin, one of the principal reformers of the church, in the XVIth century, a perſon of great parts and induſtry, and of conſiderable learning; whoſe doctrine ſtill ſubſiſts in its greateſt purity at Geneva, where it was firſt broached, and from whence it was propagated. This is the prevailing religion of the United Provinces. In England, it is confined among the diſſenters; and, in Scotland, it is the only orthodox faith.

The Calviniſts are great advocates for the abſoluteneſs of God's decrees, and hold that election and reprobation depend on the mere will of God, without any regard to the merit or demerit of mankind; that he affords to the elect an irreſiſtible grace, a faith that they cannot loſe, which takes away the freedom of will, and neceſſitates all their actions to virtue.

The Calviniſts believe that God foreknew a determinate number, whom he pitched upon to be perſons, in whom he would manifeſt his glory; and that having thus foreknown them, he predeſtinated them to be holy, in order to which he gives them an irreſiſtible grace, which makes it impoſſible for them to be otherwiſe.

CALVITIES, or Calvitium, in medicine, baldneſs, or a want of hair, particularly on the ſinciput, occaſioned by the moiſture of the head, which ſhould feed it, being dried up, by ſome diſeaſe, old age, or the immoderate uſe of powder, *&c.* See Alopecia.

CALUMET, a ſymbol of peace among the Indians, in the north of America; It is made of a red ſtone, like our marble; the head reſembles our tobacco-pipes, but larger; and is fixed on a hollow reed, to hold it for ſmoking: They adorn it with fine wings of ſeveral colours, and is the calumet of the ſun, to whom they preſent it, eſpecially if they want fair weather, or rain. This pipe is a paſs and ſafe conduct amongſt all the allies of the nation who has it given: in all embaſſies the embaſſador carries it as an emblem of peace, and it always meets with a profound regard; for the ſavages are generally perſuaded, that a great misfortune would befal them, if they violated the public faith of the calumet.

CALX, properly ſignifies lime, but is alſo uſed by chemiſts and phyſicians for a fine powder remaining after the calcination or corroſion of metals and other mineral ſubſtances. See Chemistry.

Calx *antimonii.* See Chemistry, *Of antimony.*

Calx *nativa,* in natural hiſtory, a kind of marly earth, of a dead whitiſh colour, which, if thrown into water, makes a conſiderable bubbling and hiſſing noiſe, and has, without previous burning, the quality of making a cæment like lime, or plaſter of Paris.

Calx *viva,* or quick-lime, that whereon no water has been caſt, in contradiſtinction to lime which has been ſlaked by pouring water on it. See Chemistry, *Of lime.*

Calx, in anatomy. See Calcaneum.

CALYCISTÆ, an appellation given by Linnæus to thoſe botaniſts who have claſſed plants according to the different ſtructure of the calyx, or cup of the flower; ſuch was Magnolius.

CALYPTRA, among botaniſts, a thin membranaceous involucrum, uſually of a conic figure, which covers the parts of fructification. The capſules of moſt of the moſſes have calyptræ. See Botany.

CALYX, among botaniſts, a general term expreſſing the cup of a flower, or that part of a plant which ſurrounds and ſupports the other parts of the flower.

The cups of flowers are very various in their ſtructure, and on that account diſtinguiſhed by ſeveral names, as perianthium, involucrum, ſpatha, gluma, *&c.* See Botany.

CAM, a river, anciently called Grant, which, ariſing in Hertfordſhire, runs north-eaſt by Cambridge, and afterwards continues its courſe northwards, to the iſle of Ely, where it falls into the river Ouſe.

CAMÆA, in natural hiſtory, a genus of the ſemipellucid gems, approaching to the onyx ſtructure, being compoſed of zones, and formed on a cryſtalline baſis; but having their zones very broad and thick, and laid alternately on one another, with no common matter between; uſually leſs tranſparent, and more debaſed with earth, than the onyxes.

1. One ſpecies of the camæa is the dull-looking onyx, with broad black and white zones; and is the camæa of the moderns, and the Arabian onyx: This ſpecies is found in Egypt, Arabia, Perſia, and the Eaſt Indies. 2. Another ſpecies of the camæa is the dull, broad-zoned, green and white camæa, or the jaſpi-cameo of the Italians: It is found in the Eaſt Indies, and in ſome parts of America. 3. The third is the hard camæa, with broad white and cheſnut-coloured veins. 4. The hard camæa, with bluiſh, white, and fleſh-coloured broad veins, being the ſardonyx of Pliny's time, only brought from the Eaſt Indies.

CAMAIEU, a term in painting, when there is only one colour, the lights and ſhades being of gold, or on a golden and azure ground. It is chiefly uſed to repreſent baſſo-relievos.

CAMALDULIANS, a religious order founded by St Romauld, in a little plain, on the mount Apennine, called Camaldalia, ſituated in the ſtate of Florence.

The manner of life firſt enjoined this order was, that they dwelt in ſeparate cells, and met together only at the time of prayer: Some of them, during the two lents of the year, obſerved an inviolable ſilence; and others, for the ſpace of an hundred days. On Sundays and Thurſdays they fed on herbs, and the reſt of the

Plate LIX.

Fig. 3. BACTRIANUS or BACTRIAN CAMEL

Fig. 2. DROMADERICUS or AFRICAN CAMEL

Fig. 1. BRADYPUS or SLOTH

the week only on bread and water. These constitutions were, however, a little moderated some time afterwards. This hermitage is now accounted very rich.

CAMARA, in botany, See LANTANA.

CAMARANA, an island of Arabia in the Red sea, situated in 15° N. lat.

CAMBAIA, a city of the province of Cambaia, or Guzarat, in the higher peninsula of India; it is a very large city, and had once a great trade, now removed to Surat: E. long. 72°, and N. lat. 23° 30′.

CAMAYES, in commerce, cotton linens made at Bengal, at Madrass, and some other places on the coast of Coromandel.

CAMBER-*beam*, among builders, a piece of timber in an edifice, cut archwise, or with an obtuse angle in the middle, commonly used in platforms, as church-leads, and on other occasions where long and strong beams are required.

CAMBLET, or CAMLET, a plain stuff, composed of a warp and woof, which is manufactured on a loom, with two treddles, as linens and flannels are.

There are camblets of several sorts, some of goat's hair, both in the warp and woof; others, in which the warp is of hair, and the woof half hair and half silk; others again, in which both the warp and the woof are of wool; and lastly, some of which the warp is of wool and the woof of thread. Some are dyed in thread, others are dyed in the piece, others are marked or mixed; some are stripped, some weaved or watered, and some figured.

Camblets are proper for several uses, according to their different kinds and qualities; some serve to make garments both for men and women; some for bed-curtains; others for household-furniture, *&c.*

CAMBODIA, the capital of a kingdom of the same name in India, beyond the Ganges: E. long. 104°, N. lat. 12° 30′.

The kingdom of Cambodia extends from 9° to 15° of N. lat. being bounded by the kingdom of Laos on the north, Cochin-china on the east, the Indian ocean on the south, and by the bay of Siam on the west.

CAMBRAY, a city in the French Netherlands, situated on the river Schelde, near its source: E. long. 3° 15′, and N. lat. 50° 15′.

It is a large and well-built city, considerable for its linen manufacture, especially cambricks, which took their name from hence.

CAMBRICKS, a species of very fine white linen, made of flax at Cambray.

CAMBRIDGE, the capital of Cambridgeshire, situated upon the river Cam, about fifty-five miles north of London, and sixty north-east of Oxford.

Cambridge is most remarkable on account of its university, which consists of sixteen colleges, wherein are educated about fifteen hundred students. There are fourteen parishes in the town, which is said to contain about six thousand inhabitants.

New CAMBRIDGE, a town of New England, about three miles west of Boston; likewise remarkable for an university, consisting of three colleges: W. long. 70° 4′, and N. lat. 42°.

CAMEL, in zoology. See CAMELUS.

CAMELFORD, a borough-town of Cornwall, about twenty miles west of Launceston: W. long. 5°, and N. lat. 50° 40′.

It sends two members to parliament.

CAMELIA, in botany, a genus of the monodelphia polyandria class. The calix is imbricated, and consists of many leaves, the anterior of which are longest. There is but one species, *viz.* the japonica, a native of China and Japan.

CAMELOPARDALIS, in zoology, the trivial name of a species of cervus. See CERVUS.

CAMELUS, or CAMEL, in zoology, a genus of quadrupeds belonging to the order of pecora. The characters of the camel are these: It has no horns, it has six foreteeth in the under-jaw; the laniarii are wide set, three in the upper, and two in the lower jaw; and there is a fissure in the upper lip, resembling the cleft in the lip of a hare. The species are four, *viz.* 1. The dromedarius, or African camel, (Plate LIX. fig. 2.) with one bunch or protuberance on the back. It has four callous protuberances on the fore-legs, and two on the hind ones. The hoof, or rather callous skin of their feet, which is softer than the hoofs of other animals, enables the camel to walk along the sandy paths of warm climates with greater ease; by yielding to the pressure, it is not so subject to be injured by friction. The structure and constitution of the camel is admirably adapted to the climate which produces them. In Africa and Arabia, where this animal is most frequent, and is employed in carrying all kinds of burdens, there is great scarcity of water. The camel has often been observed to travel longer than any other creature without drink. This it is enabled to do, from a singular construction in its stomachs. It is one of the ruminating animals, and has four stomachs. At the top of the second stomach, there are several square holes, which are the orifices of about twenty cavities or sacks, placed between the two membranes which compose the substance of this stomach. These sacks are so many reservoirs which they fill over and above what satisfies their present thirst, and serve for supplying them with water in long journeys through the dry and sandy desarts, where wells or rivers are seldom to be met with. Travellers, when much oppressed with drought, are sometimes obliged to kill their camels, in order to have a supply of drink from these reservoirs. The camel carries very heavy burdens, and travels long, but with a slow pace. They have sometimes been known to travel several days without a fresh supply of water. When fatigued, they lie on their breast. 2. The Bactrianus, or Bactrian camel (fig. 3.), has two bunches on the back, the hindmost of which is by much the largest. It is a native of Africa, and is more rarely to be met with than the dromedary. It is also much swifter in its motion. 3. The glama, or South-American camel-sheep, has a smooth skin, and very short hair; it has a bunch or protuberance on the breast, which se-

cretes a liquor. They are very impatient of cold; are eafily tamed, and carry burdens of about fifty or fixty pounds weight. When reftive, they are pufhed on by fqueezing their tefticles. When enraged by their driver, they throw out from their mouth a liquor which corrodes and makes the fkin rife into blifters. 4. The pacos, or fheep of Chili, has no bunch on the back. It is covered with a fine valuable wool, which is of a blood-red colour on the back of the animal, and white on the belly. It is unfit for carrying burdens, and is kept principally for the fake of the wool, and the flefh, which is exceedingly well-tafted.

CAMERA *obfcura*, in optics, a machine reprefenting an artificial eye, wherein the images of external objects are exhibited diftinctly, in their native colours, either inverted or erect. See OPTICS.

CAMERARIA, in botany, a genus of the pentandria monogynia clafs. The flower of which is a petal of a funnel-form, with a cylindrical long tube, ventricofe both at the bafe and top, and a plane limb divided into five lanceolated fegments: The fruit is compofed of two oblong follicles, bent horizontally, obtufe at both ends, and fending out a lobe on each fide, near the bafe; they have one cell, with one valve, containing numerous, oval, and imbricated feeds, inferted in a large oval membrane at the bafe. There are two fpecies, *viz.* the latifolia, and anguftifolia, both natives of America.

CAMERATED, among builders, the fame with vaulted or arched.

CAMERET-BAY, in the province of Britany in France, forms the harbour of Breft. See BREST.

CAMERINO, a town of the ecclefiaftical ftate in Italy.

CAMERLINGO, according to Ducange, fignified formerly the pope's or emperor's treafurer: At prefent, camerlingo is nowhere ufed, but at Rome, where it notes the cardinal who governs the ecclefiaftical ftate, and adminifters juftice. It is the moft eminent office at the court of Rome, becaufe he is at the head of the treafury. During a vacation of the papal chair, the cardinal camerlingo publifhes edicts, coins money, and exerts every other prerogative of a fovereign prince; he has under him a treafurer-general, auditor-general, and twelve prelates called clerks of the chamber.

CAMERONIANS, a party of prefbyterians, which fprung up in Scotland in the reign of king Charles II. They affirmed that the king had forfeited his right to the crown, by breaking the folemn league and covenant, which were the terms on which he received it. They pretended both to dethrone and excommunicate him; and broke out into an open rebellion. Upon the revolution, they were reconciled to the kirk, and their preachers fubmitted to the general affembly of the church of Scotland, in 1690. That fect is now greatly declined. They are few in number, and fplit into many parties.

CAMERY, or FROUNCE, in horfes. See FROUNCE.

CAMILLI, and CAMILLÆ, in Roman antiquity, a certain number of boys and girls, who affifted in the facrifices to the gods, but more efpecially attended the flamen dialis.

CAMIS, or KAMIS, in the Japonefe affairs, denote the deified fouls of illuftrious perfonages, believed to intereft themfelves in the welfare of their countrymen: In which fenfe they anfwer to the deified heroes of antiquity. See HERO.

CAMISARDS, a name given by the French to the Calvinifts of the Cevennes, who formed a league, and took up arms in their own defence, in 1688.

CAMLETINE, a flight ftuff, made of hair and coarfe filk, in the manner of camblet. It is now out of fafhion.

CAMMIN, a port-town of Brandenburg-Pomerania in Germany, fituated on the eaftern mouth of the river Oder, about thirty miles north of Stetin: E. long. 15°, N. lat. 54°.

CAMP, the ground upon which an army pitch their tents. It is marked out by the quarter-mafter general, who appoints every regiment their ground.

The chief advantages to be minded in chufing a camp for an army, are, to have it near the water, in a country of forage, where the foldiers may find wood for dreffing their victuals; that it have a free communication with garrifons, and with a country from whence it may be fupplied with provifions; and, if poffible, that it be fituated on a rifing ground, in a dry gravelly foil. Befides, the advantages of the ground ought to be confidered, as marfhes, woods, rivers, and inclofures; and if the camp be near the enemy, with no river or marfh to cover it, the army ought to be intrenched. An army always encamps fronting the enemy; and generally in two lines, running parallel about five hundred yards diftance; the horfe and dragoons, on the wings, and the foot in the centre: Sometimes a body of two, three, or four brigades is encamped behind the two lines, and is called the body of referve. The artillery and bread-waggons are generally encamped in the rear of the two lines. A battalion of foot is allowed eighty or an hundred paces for its camp; and thirty or forty for an interval betwixt one battalion and another. A fquadron of horfe is allowed thirty for its camp, and thirty for an interval, and more if the ground will allow it.

The difpofition of the Hebrew encampment was at firft laid out by God himfelf. Their camp was of a quadrangular form, furrounded with an inclofure of the height of ten hands-breadth. It made a fquare of twelve miles in compafs about the tabernacle; and within this was another, called the Levites camp. The Greeks had alfo their camps, fortified with gates and ditches. The Lacedemonians made their camp of a round figure, looking upon that as the moft perfect and defenfible of any form: We are not, however, to imagine, that they thought this form fo effential to a camp, as never to be difpenfed with when the circumftance of the place required it. Of the reft of the Grecian camps, it may be obferved, that the moft valiant of the foldiers were placed at the extremities, the reft in the middle. Thus we learn from Homer, that

that Achilles and Ajax were posted at the ends of the camp before Troy, as bulwarks on each side of the rest of the princes.

The camps of the Romans were generally of an exact square form, or else oblong; though this, without doubt, was often accommodated to the situation of the place. They were always fortified, and a very exact discipline maintained in them, in order to prevent surprises from the enemy.

CAMP is also used, by the Siamese, and some other nations in the E Indies, as the name of the quarters which they assign to the foreigners who come to trade with them.

In these camps, every nation forms, as it were, a particular town, where they carry on all their trade, not only keeping all their ware-houses and shops there, but also live in these camps with their whole families. The Europeans, however, are so far indulged, that at Siam, and almost every where else, they may live either in the cities or suburbs, as they shall judge most convenient.

CAMPAGNA, in geography. See CAMPANIA.

CAMPAIGN, in the art of war, denotes the space of time that an army keeps the field, or is incamped, in opposition to quarters.

CAMPANIA, a city of the hither principate in the kingdom of Naples, situated about thirty-five miles south-east of the city of Naples: E. long. 15° 30′, N. lat. 4° 45′.

CAMPANIA, or CAMPAGNA DI ROMA, a province of the pope's territories in Italy, extending from the city of Rome south-east, as far as the frontiers of the kingdom of Naples.

CANPANIFORM, or CAMPANULATED, an appellation given to flowers resembling a bell.

CAMPANINI, a name given to a marble of Italy, dug out of the mountains of Carrara, because when it is worked it resounds like a bell.

CAMPANULA, or BELL-FLOWER, in botany, a genus of the pentandria monogynia class. The corolla is campaniform or bell-shaped, the bottom of which is closed with five valvulous nectaria; the stigma is trifid; and the capsule is below the flower, and opens at the sides. There are forty-one species of campanula, only nine of which are natives of Britain, *viz.* the rotundifolia, or lesser round-leaved bell flower; the patula, or field bell-flower; the uniflora, or mountain bell-flower; the rapunculus, or rampions; the latifolia, or giant throat-wort; the trachelium, great throat-wort, or Canterbury bells; and the glomerata, lesser throat-wort, or Canterbury-bells.

CAMPBELL-TOWN, a parliament town of Argyleshire in Scotland, situated on the eastern shore of Kintire, about ten miles west of the island of Arran: W. long. 5° 10′, N. lat. 55° 35′.

CAMPDEN, a market-town in Gloucestershire, about eighteen miles north-east of Gloucester: W. long. 1° 50′, and N. lat. 52°.

CAMPEACHY, or CAMPECHY, a town of the province of Jucatan, on the bay or gulf of Mexico: W. long. 93°, N. lat. 19°.

CAMPEACHY-WOOD, in botany. See HÆMATOXYLUM.

CAMPEN, a port-town, in the provine of Overyssel, in the united Netherlands, near the mouth of the river Issel, about forty-two miles north-east of Amsterdam: E. long. 5° 40′, and N. lat. 52° 35′.

CAMPHOR, or CAMPHIRE, a solid concrete juice extracted from the wood and roots of the laurus camphora, which grows in Japan. The camphor is extracted in the same way by which we extract essential oils. As it first sublimes from the wood, it appears brownish, composed of semipellucid grains mixed with dirt. In this state it is exported by the Dutch, and purified by a second sublimation; after which it is reduced to loaves, probably by fusion in close vessels, and in this form it is sold to us. Pure camphor is very white, pellucid, somewhat unctuous to the touch; of a bitterish, aromatic, acrid taste, yet accompanied with a sense of coolness. It has a fragrant smell, somewhat like that of rosemary, but much stronger. It is totally volatile and inflammable; soluble in vinous spirits, oils, and mineral acids; but not in water, alkaline liquors, or the vegetable acids. Camphor is esteemed one of the most efficacious diaphoretics, and has long been celebrated in fevers, malignant and epidemical distempers. In deliria, where opiates fail of procuring sleep, this medicine frequently succeeds.

Artificial CAMPHOR is prepared with gum-sandarach and white vinegar distilled, kept twenty days in horse-dung, and afterwards exposed a month to the sun to dry, at the end of which the camphor is found in form of the crust of a white loaf. This is also called juniper-gum, and mastic.

CAMPHOR-TREE. See LAURUS.

CAMPHORATA, in botany. See POLYCNEMUM.

CAMPION, in botany. See LYCHNIS.

CAMPOIDES, in botany. See SCORPIURUS.

CAMPREDON, a town of Catalonia, in Spain, about fifty miles north of Barcelona: E. long. 2°, and N. lat. 42° 20′.

CAMPUS MAII, in ancient customs, an anniversary assembly of our ancestors held on May-day, when they confederated together for defence of the kingdom against all its enemies.

CAMPUS MARTIUS, among the Romans, a field, by the side of the Tiber, where the youth exercised themselves in warlike exercises. It was so called, on account of a temple that stood on it, consecrated to the god Mars. The consuls Brutus and Collatinus made it the place for holding the comitia or assemblies of the people, and in after-times it was adorned with a great quantity of fine statues.

CAMUS, a person with a low flat nose, hollowed in the middle.

The Tartars are great admirers of camus beauties. Rubruquis observes, that the wife of the great Jenghis Kan, a celebrated beauty, had only two holes for a nose.

CAN, in the sea-language, as can-pump, a vessel, wherewith seamen pour water into the pump to make it go.

CAN-BUOY, a larger size of buoy, used to discover dangerous

gerous rocks and ſhelves, by being placed over them.

CAN-HOOK. See HOOK.

CANADA, or NEW FRANCE, an extenſive tract of North America, bounded by New Britain and the Britiſh colonies on Hudſon's bay, on the north; by the river of St Lawrence, the Iroquois, or five Indian nations, the Huron and Illonois lakes, on the eaſt and ſouth; and by unknown lands, on the weſt. Its chief town is Quebec.

CANAL *of communication*, an artificial cut in the ground, ſupplied with water from rivers, ſprings, *&c.* in order to make a navigable communication betwixt one place and another.

The particular operations neceſſary for making artificial navigations depend upon a number of circumſtances. The ſituation of the ground; the vicinity or connection with rivers; the eaſe or difficulty with which a proper quantity of water can be obtained; theſe and many other circumſtances neceſſarily produce great variety in the ſtructure of artificial navigations, and augment or diminiſh the labour and expence of executing them. When the ground is naturally level, and unconnnected with rivers, the execution is eaſy, and the navigation is not liable to be diſturbed by floods; but, when the ground riſes and falls, and cannot be reduced to a level, artificial methods of raiſing and lowering veſſels muſt be employed; which likewiſe vary according to circumſtances.

A kind of temporary ſluices are ſometimes employed for raiſing boats over falls or ſhoals in rivers by a very ſimple operation. Two poſts or pillars of maſonwork, with grooves, are fixed, one on each bank of the river, at ſome diſtance below the ſhoal. The boat having paſſed theſe poſts, planks are let down acroſs the river by pullies into the grooves, by which the water is dammed up to a proper height for allowing the boat to paſs up the river over the ſhoal.

The Dutch and Fleemings at this day, ſometimes when obſtructed by caſcades, form an inclined plane or rolling-bridge upon dry land, alongſt which their veſſels are drawn from the river below the caſcade into the river above it. This, it is ſaid, was the only method employed by the ancients, and is ſtill uſed by the Chineſe, who are ſaid to be entirely ignorant of the nature and utility of locks. Theſe rolling-bridges conſiſt of a number of cylindrical rollers which turn eaſily on pivots, and a mill is commonly built near by, ſo that the ſame machinery may ſerve the double purpoſe of working the mill and drawing up veſſels.

A LOCK is a baſon placed lengthwiſe in a river or canal, lined with walls of maſonry on each ſide, and terminated by two gates, placed where there is a caſcade or natural fall of the country; and ſo conſtructed, that the baſon being filled with water by an upper ſluice to the level of the waters above, a veſſel may aſcend through the upper gate; or the water in the lock being reduced to the level of the water at the bottom of the caſcade, the veſſel may deſcend through the lower gate; for when the waters are brought to a level on either ſide, the gate on that ſide may be eaſily opened. But as the lower gate is ſtrained in proportion to the depth of water it ſupports, when the perpendicular height of the water exceeds 12 or 13 feet, more locks than one become neceſſary. Thus, if the fall be 17 feet, two locks are required, each having 8½ feet fall; and if the fall be 26 feet, three locks are neceſſary, each having 8 feet 8 inches fall. The ſide-walls of a lock ought to be very ſtrong. Where the natural foundation is bad, they ſhould be founded on piles and platforms of wood: They ſhould likewiſe ſlop outwards, in order to reſiſt the preſſure of the earth from behind.

Plate LX. fig. 1. A perſpective view of part of a canal: the veſſel L, within the lock A C.—Fig. 2. Section of an open lock: the veſſel L about to enter.—Fig. 3. Section of a lock full of water: the veſſel L raiſed to a level with the water in the ſuperior canal.—Fig. 4. Ground ſection of a lock. L, a veſſel in the inferior canal. C, the under gate. A, the upper gate. G H, a ſubterraneous paſſage for letting water from the ſuperior canal run into the lock. K F, a ſubterraneous paſſage for water from the lock, to the inferior canal.

X and Y (fig. 1.) are the two flood-gates, each of which conſiſts of two leaves, reſting upon one another, ſo as to form an obtuſe angle, in order the better to reſiſt the preſſure of the water. The firſt (X) prevents the water of the ſuperior canal from falling into the lock; and the ſecond (Y) dams up and ſuſtains the water in the lock. Theſe flood-gates ought to be very ſtrong, and to turn freely upon their hinges. In order to make them open and ſhut with eaſe, each leaf is furniſhed with a long lever A *b*, A *b*; C *b*, C *b*. They ſhould be made very tight and cloſe, that as little water as poſſible may be loſt.

By the ſubterraneous paſſage G H (fig. 2, 3, & 4.) which deſcends obliquely, by opening the ſluice G, the water is let down from the ſuperior canal D, into the lock, where it is ſtopt and retained by the gate C when ſhut, till the water in the lock comes to be on a level with the water in the ſuperior canal D; as repreſented, fig. 3. When, on the other hand, the water contained by the lock is to be let out, the paſſage G H muſt be ſhut by letting down the ſluice G, the gate A muſt be alſo ſhut, and the paſſage K F opened by raiſing the ſluice K: A free paſſage being thus given to the water, it deſcends through K F, into the inferior canal, until the water in the lock is on a level with the water in the inferior canal B; as repreſented, fig. 2.

Now, let it be required to raiſe the veſſel L (fig. 2.) from the inferior canal B, to the ſuperior one D; if the lock happens to be full of water, the ſluice G muſt be ſhut, and alſo the gate A, and the ſluice K opened, ſo that the water in the lock may run out till it is on a level with the water in the inferior canal B. When the water in the lock comes to be on a level with the water at B, the leaves of the gate C are opened by the levers C *b*, which is eaſily performed, the water on each ſide of the gate being in equilibrio; the veſſel then ſails into the lock. After this the gate C, and the ſluice

Fig. 1.
Perspective View of part of a Canal with Locks

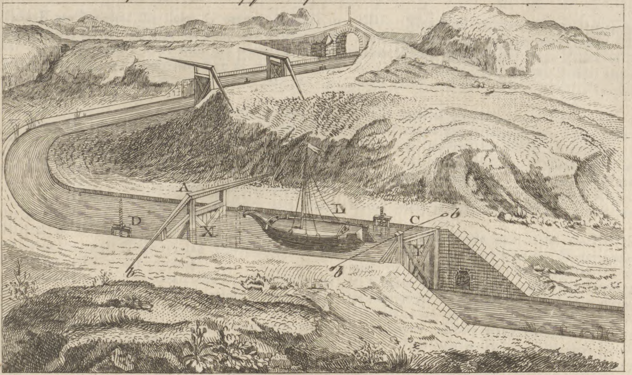


Fig. 2.
Section of a Lock

Fig. 3. Section of a Lock full of Water

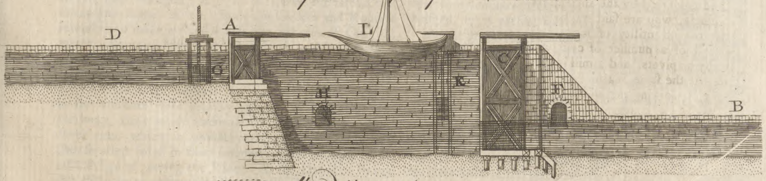
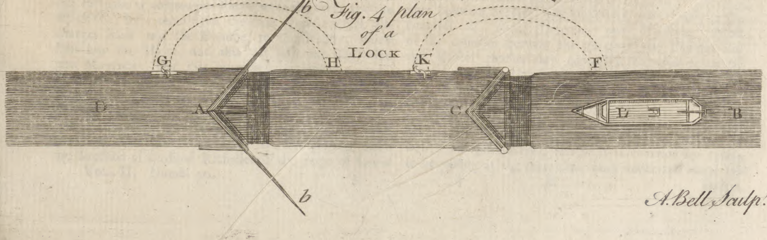


Fig. 4 plan of a Lock



A. Bell Sculp^t.

fluice K are fhut, and the fluice G opened, in order to fill the lock, till the water in the lock, and confequently the veffel, be upon a level with the water in the fuperior canal D; as is reprefented in fig. 3. The gate A is then opened, and the veffel paffes into the canal D.

Again, let it be required to make a veffel defcend from the canal D, into the inferior canal B. If the lock is empty, as in fig. 2. the gate C and fluice K muft be fhut, and the upper fluice G opened, fo that the water in the lock may rife to a level with the water in the upper canal D. Then open the gate A, and let the veffel pafs through into the lock. Shut the gate A and the fluice G: then open the fluice K, till the water in the lock be on a level with the water in the inferior canal; then the gate C is opened, and the veffel paffes along into the canal B, as was required.

It is almoft needlefs to fpend time in enumerating the many advantages which neceffarily refult from artificial navigations. Their utility is now fo apparent, that moft nations in Europe give the higheft encouragement to undertakings of this kind where-ever they are practicable. The advantages of navigable canals did not efcape the obfervation of the ancients. From the moft early accounts of fociety we read of attempts to cut through large ifthmufes, in order to make a communication by water, either betwixt different nations, or diftant parts of the fame nation, where land-carriage was long and expenfive. Herodotus relates, that the Cnidians, a people of Caria in Afia Minor, defigned to cut the Ifthmus which joins that Peninfula to the continent; but were fuperftitious enough to give up the undertaking, becaufe they were interdicted by an oracle. Several Kings of Egypt attempted to join the Red-fea to the Mediterranean. Cleopatra was exceedingly fond of this project. Soliman II. emperor of the Turks, employed 50,000 men in this great work. This canal was compleated under the caliphate of Omar, but was afterwards allowed to fall into difrepair; fo that it is now difficult to difcover any traces of it. Both the Greeks and Romans intended to make a canal acrofs the Ifthmus of Corinth, which joins the Morea and Achaia, in order to make a navigable paffage by the Ionian fea into the Archipelago. Demetrius, Julius Cæfar, Caligula, and Nero, made feveral unfuccefsful efforts to open this paffage. But, as the ancients were intirely ignorant of the ufe of water-locks, their whole attention was employed in making level cuts, which is probably the principal reafon why they fo often failed in their attempts. Charlemagne formed a defign of joining the Rhine and the Danube, in order to make a communication between the ocean and the Black-fea, by a canal from the river Almutz which difcharges itfelf into the Danube, to the Reditz, which falls into the Maine, and this laft falls into the Rhine near Mayence: For this purpofe he employed a prodigious number of workmen; but he met with fo many obftacles from different quarters, that he was obliged to give up the attempt.

The French at prefent have many fine canals: That of Briare was begun under Henry IV. and finifhed under the direction of cardinal Richelieu in the reign of Lewis XIII. This canal makes a communication betwixt the Loire and the Seine by the river Loing. It extends eleven French great leagues from Briare to Montargis. It enters the Loire a little above Briare, and terminates in the Loing at Cepoi. There are forty-two locks on this canal.

The canal of Orleans, for making another communication between the Seine and the Loire, was begun in 1675, and finifhed by Philip of Orleans, regent of France, during the minority of Lewis XV. and is furnifhed with twenty locks. It goes by the name of the canal of Orleans; but it begins at the village of Combleux, which is a fmall French league from the town of Orleans.

But the greateft and moft ufeful work of this kind is the junction of the ocean with the Mediterranean by the canal of Languedoc. It was propofed in the reigns of Francis I. Henry IV. and was undertaken and finifhed under Lewis XIV. It begins with a large refervoir 4000 paces in circumference, and 24 feet deep, which receives many fprings from the mountain Noire. This canal is about 64 leagues in length, is fupplied by a number of rivulets, and is furnifhed with 104 locks, of about eight feet rife each. In fome places it paffes over bridges of vaft height; and in others it cuts through folid rocks for 1000 paces. At one end it joins the river Garonne near Tholoufe, and terminates at the other in the lake Tau, which extends to the port of Cette. It was planned by Francis Riquet in the 1666, and finifhed before his death, which happened in the 1680.

In the Dutch, Auftrian, and French Netherlands, there is a very great number of canals; that from Bruges to Oftend carries veffels of 200 tons.

The Chinefe have alfo a great number of canals; that which runs from Canton to Pekin, extends about 825 miles in length, and was execute about 800 years ago.

It would be an endlefs tafk to defcribe the numberlefs canals in Holland, Ruffia, Germany, *&c.* We fhall therefore confine ourfelves to thofe that are either already finifhed, or at prefent executing in our own country.

As the promoting of commerce is the principal intention of making canals, it is natural to expect that their frequency in any nation fhould bear fome proportion to the trade carried on in it, providing the fituation of the country will admit of them. The prefent ftate of England and Scotland confirms this obfervation. Though the Romans made a canal between the Nyne, a little below Peterborough, and the Witham, three miles below Lincoln, which is now almoft entirely filled up, yet it is not long fince canals were revived in England. They are now however become very numerous, particularly in the counties of York, Lincoln, and Chefhire. Moft of the counties betwixt the mouth of the Thames and the Briftol channel are connected together either by natural or artificial navigations; thofe upon the Thames and Ifis reaching within about twenty miles of thofe upon the Severn. The duke of Bridgewater's canal in Chefhire runs twenty-feven miles on a perfect level; but at Barton it is carried by a very high aqueduct bridge over the Irwell, a navigable river; fo that it is common for veffels to be paffing at the fame time both under and above the bridge.

bridge. It is likewise cut some miles into the hills, where the Duke's coal mines are wrought.

Though a navigable communication between the rivers Forth and Clyde in Scotland had been long talked of, it was never considered with a view to execution till the year 1761, when the ground was surveyed by Mr Smeaton, at the desire of the trustees for fisheries and manufactures in Scotland. From Mr Smeaton's survey and report, the practicability of this canal was fully demonstrated. But, after the scheme became an object of general attention, it was found that a canal of larger dimensions than the one originally proposed would be productive of still greater advantages to the nation. Mr Smeaton was therefore directed to make a second survey, and to report to the intended proprietors an estimate of the expence of making a canal 24 feet broad at bottom, 54 at top, containing seven feet deep of water, and extending from the Forth to the Clyde, a distance of about 31 miles, with a collateral branch to the town of Glasgow, which is about six miles, and another from Bainsford to the river Carron, below Carron-works, making in all about 37 miles. This report was approved of, an act of parliament was obtained, and the canal is now cutting upon this very plan. It begins at the Holemerrie in the mouth of the Carron, and terminates at Dalmuir-burn-foot on the river Clyde, about seven miles below Glasgow. Above seven miles are already cut, from the Holemerrie westward; a number of hands are likewise employed at the point of partition in Dollater-bog, and the whole is expected to be finished in five years. At the point of partition, which is 168 feet above the level of the sea at low water, a very large reservoir is to be made for supplying the canal; and the vessels are to be raised and lowered by means of 41 locks. Where the course of the canal is intersected by burns or rivers, it is to be carried over them by aqueduct-bridges; three of these bridges will be large, and require considerable labour and expence, *viz.* one over the Grange-burn, one over Bony-mill-burn, and a third over the Kelvin in the Glasgow branch. The expence of executing the whole is computed to be about 150,000 l.

Sea-vessels, about 20 feet wide and 60 feet long, and carrying 70 or 80 tons, may pass along by this canal from the one frith to the other. But it will admit a free passage to vessels of 140 tons, provided they be built in the manner of the flat vessels used by the Dutch. The toll-duty, allowed by the act of parliament, is not to exceed 2 d. a ton *per* mile. Privileged goods, such as lime and lime-stone, are to pay only one third of the usual toll-duty; stones, gravel, and other materials for making or repairing roads, likewise dung, soil, marle, and all sorts of manure, are exempted from paying any toll-duty, provided they do not pass any lock but when the water shall flow over the place made for discharging the overplus-water in the canal.

We must not conclude this article without observing, that in Ireland also the utility of artificial navigations has not been unattended to. Several canals are there making; in particular, one from Loch-Neach to Newry, about 20 miles; and another from the river Shannon to Dublin, about 70 miles.

CANAL, in anatomy, a duct or passage through which any of the juices flow.

CANARIES, islands, to the number of seven, situated in the Atlantic ocean, between 12° 21′ W. long. and between 27° and 29° N. lat. the most easterly of them lying about 150 miles from Cape Non, on the coast of Biledulgerid, in Africa.

CANARY, properly so called, is a considerable island, about 150 miles in circumference; the chief town of which is Palma, from whence comes the excellent palm-sack, and other rich wines.

It lies in 16° W. long. and between 27° and 28° N. lat.

CANARY-*bird*. See FRINGILLA.

CANCALE, a small town of France, near St Malo's, where ships may ride in eight fathoms water, with a sandy bottom.

CANCELIER, in falconry, is when a light-brown hawk, in her stooping, turns two or three times upon the wing, to recover herself, before she seizes.

CANCELLI, a term used to denote lattice-windows, or those made of cross-bars, disposed lattice-wise; it is also used for rails or ballusters, inclosing the communion-table, a court of justice, and the like, and for the net-work in the inside of hollow bones.

CANCER, or CRAB, in zoology, a genus of insects belonging to the order of insecta aptera. The generic characters are these: They have eight legs, (seldom ten or six), besides the two large claws which answer the purpose of hands. They have two eyes at a considerable distance from each other, and for the most part supported by a kind of pedunculi or foot-stalks; the eyes are likewise elongated and moveable. They have two clawed palpi; and the tail is jointed. There are no less than 87 species of cancer, distinguished principally by the length of their tails and the margins of their breasts. This genus includes the lobster, shrimp, *&c.*

CANCER, in medicine, a roundish, unequal, hard, and livid tumour, generally seated in the glandulous parts of the body, supposed to be so called, because it appears at length, with turgid veins shooting out from it, so as to resemble, as it is thought, the figure of a crab-fish; or, as others say, because, like that fish, where it has once got, it is scarce possible to drive it away. See MEDICINE, and SURGERY.

CANCER, in astronomy, one of the twelve signs of the zodiac, represented on the globe in the form of a crab, and thus marked (♋) in books.

Tropic of CANCER, in astronomy, a lesser circle of the sphere parallel to the equator, and passing through the beginning of the sign cancer.

CANCHERIZANTE, or CANCHERIZATO, in the Italian music, a term signifying a piece of music that begins at the end, being the retrograde motion from the end of a song, *&c.* to the beginning.

CANDAROR, the capital of a territory of the same name, subject to Persia: E. long. 67°, and N. lat. 33°.

CANDIA, the modern name of Crete, an island situated in-

in the Mediterranean fea, between 22° and 27° E. long. and between 35° and 36° N. lat.

There is no river of any confequence in the whole ifland, which is watered by a multitude of rivulets; whereof Lethe is one. Here too is mount Ida, fo much celebrated in the writings of the ancients.

CANDIA, or MUTIUM, is the capital of the above ifland, fituated on its northern coaft, in 25° E. long. and 35° 30′ N. lat.

CANDIDATE, a perfon who afpires to fome public office.

In the Roman commonwealth, they were obliged to wear a white gown, during the two years of their foliciting for a place. This garment, according to Plutarch, they wore without any other cloaths, that the people might not fufpect they concealed money for purchafing votes; and alfo, that they might the more eafily fhow to the people, the fcars of thofe wounds they had received in fighting for the defence of the commonwealth.

CANDIDATI MILITES, an order of foldiers, among the Romans, who ferved as the emperor's body-guards, to defend him in battle. They were the talleft and ftrongeft of the whole troops, and moft proper to infpire terror. They were called *candidati*, becaufe cloathed in white, either that they might be more confpicuous, or becaufe they were confidered in the way of preferment.

CANDISH, a province of the hither India, bounded by Chitor and Malva, on the north; by Orixa, on the eaft; by Decan, on the fouth; and by Guzurat, on the weft: It is fubject to the Mogul.

CANDLE, a fmall taper of tallow, wax, or fpermaceti; the wick of which is commonly of feveral threads of cotton, fpun and twifted together.

A tallow-candle, to be good, muft be half fheeps, and half bullocks tallow; for hogs tallow makes the candle gutter, and always gives an offenfive fmell, with a thick black fmoke. The wick ought to be pure, fufficiently dry, and properly twifted; otherwife the candle will emit an unconftant vibratory flame, which is both prejudicial to the eyes, and infufficient for the diftinct illumination of objects.

There are two forts of tallow-candles; the one dipped, the other moulded: The former are the common candles; the others are the invention of the fieur le Brege at Paris.

As to the method of making candles, in general; After the tallow has been weighed, and mixed in the due proportions, it is cut into very fmall pieces, that it may melt the fooner; for the tallow in lumps, as it comes from the butchers, would be in danger of burning or turning black, if it were left too long over the fire. Being perfectly melted and fkimmed, they pour a certain quantity of water into it, proportionable to the quantity of tallow. This ferves to precipitate, to the bottom of the veffel, the impurities of the tallow, which may have efcaped the fkimmer. No water, however, muft be thrown into the tallow defigned for the three firft dips; becaufe the wick, being ftill quite dry, would imbibe the water, which makes the candles crackle in burning, and renders them of bad ufe. The tallow, thus melted, is poured into a tub, through a coarfe fieve of horfe-hair, to purify it ftill more, and may be ufed after having ftood three hours. It will continue fit for ufe twenty-four hours in fummer, and fifteen in winter.

The wicks are made of fpun cotton, which the tallow-chandlers buy in fkains, and which they wind up into bottoms or clues. Whence they are cut out, with an inftrument contrived on purpofe, into pieces of the length of the candle required; then put on the fticks or broaches, or elfe placed in the moulds, as the candles are intended to be either dipped or moulded. Wax-candles are made of a cotton or flaxen wick, flightly twifted, and covered with white or yellow wax. Of thefe, there are feveral kinds; fome of a conical figure, ufed to illumine churches, and in proceffions, funeral ceremonies, *&c.* See TAPER.

Others of a cylindrical form, ufed on ordinary occafions.

The firft are either made with a ladle or the hand.

To make wax candles with the ladle.

The wicks being prepared, a dozen of them are tied by the neck, at equal diftances, round an iron circle, fufpended directly over a large bafon of copper tinned, and full of melted wax: A large ladle full of this wax is poured gently on the tops of the wicks one after another, and this operation continued till the candle arrive at its deftined bignefs; with this precaution, that the three firft ladles be poured on at the top of the wick, the fourth at the height of $\frac{3}{4}$, the fifth at $\frac{1}{2}$, and the fixth at $\frac{1}{4}$, in order to give the candle its pyradimal form. Then the candles are taken down, kept warm, and rolled and fmoothed upon a walnut-tree table, with a long fquare inftrument of box, fmooth at the bottom.

As to the manner of making wax-candles by the hand, they begin to foften the wax, by working it feveral times in hot water, contained in a narrow, but deep caldron. A piece of the wax is then taken out, and difpofed by little and little, around the wick, which is hung on a hook in the wall, by the extremity oppofite to the neck; fo that they begin with the big end, diminifhing ftill as they defcend towards the neck. In other refpects, the method is nearly the fame as in the former cafe. However, it muft be obferved, that in the former cafe, water is always ufed to moiften the feveral inftruments, to prevent the wax from fticking; and in the latter, oil of olives, or lard, for the hands, *&c.* The cylindrical wax-candles are either made, as the former, with a ladle, or drawn. Wax-candles drawn, are fo called, becaufe actually drawn in the manner of wire, by means of two large rollers of wood, turned by a handle, which turning backwards and forwards feveral times, pafs the wick through melted wax contained in a brafs bafon, and at the fame time through the holes of an inftrument like that ufed for drawing wire faftened at one fide of the bafon.

Makers of candles are not to ufe melting-houfes, without due entry thereof at the excife-office, on pain

of

of 100l.; and to give notice of making candles to the excise-officer for the duties, and of the number, &c. or shall forfeit 50l. Removing the candles before weighed by the officer, or mixing them with others, is likewise liable to penalties.

CANDLE is also a term in medicine, and is reckoned among the instruments of surgery. Thus the candela fumalis, or the candela pro suffitu odorata, is a mass of an oblong form, consisting of odoriferous powders, mixed up with a third, or more, of the charcoal of willow or lime-tree, and reduced to a proper consistence with a mucilage of gum-tragacanth, ladanum, or turpentine. It is intended to excite a grateful smell without any flame, to correct the air, to fortify the brain, and to excite the spirits.

Medicated CANDLE, or BOUGIE, in surgery, a small stick of wax in form of a candle, which surgeons introduce into the uretha, either to dilate it and keep it open, or to consume carnosities. There are two sorts of these candles, the one simple, and the other compound. The simple are made of wax, of cat-gut, or even of lead; and the intention of them is to keep the canal of the urethra properly distended. Their thickness, therefore, should be proportioned to the diameter of that canal. The compound bougies are loaded with some medicine capable of producing a suppuration, or of destroying carnosities and excrescences in the urethra. See SURGERY.

CANDLE. Sale or auction by inch of candle, is when a small piece of candle being lighted, the bystanders are allowed to bid for the merchandise that is selling; but the moment the candle is out, the commodity is adjudged to the last bidder.

There is also an excommunication by inch of candle; when the sinner is allowed to come to repentance while a lighted candle continues burning; but after it is consumed, he remains excommunicated to all intents and purposes.

CANDLE-BERRY-TREE, in botany. See MYRICA.

CANDLEMAS, a feast of the church held on the second day of February, in honour of the purification of the Virgin Mary. It is borrowed from the practice of the ancient Christians, who on that day used abundance of lights both in their churches and processions, in memory, as is supposed, of our Saviour's being, on that day, declared by Simeon, "to be a light to lighten the Gentiles." In imitation of this custom, the Roman catholics, on this day, consecrate all the tapers and candles which they use in their churches during the whole year. At Rome, the pope performs that ceremony himself, and distributes wax-candles to the cardinals and others, who carry them in procession through the great hall of the pope's palace. This ceremony was prohibited in England, by an order of council in 1548.

CANDLESTICK, an instrument to hold a candle, made in different forms, and of all sorts of matter.

The golden candlestick was one of the sacred utensils made by Moses to be placed in the Jewish tabernacle. It was made of hammered gold, a talent in weight. It consisted of seven branches, supported by a base or foot. These branches were adorned at equal distances with six flowers like lilies, and with as many bowls and knobs placed alternately. Upon the stock and six branches of the candlestick, were the golden lamps, which were immoveable, wherein were put oil and cotton.

These seven lamps were lighted every evening, and extinguished every morning. The lamps had their tongs or snuffers to draw the cotton in or out, and dishes underneath them to receive the sparks and droppings of the oil. This candlestick was placed in the antichamber of the sanctuary on the south-side, and served to illuminate the altar of perfume, and the table of the shew-bread. When Solomon had built the temple of the Lord, he placed in it ten golden candlesticks, of the same form as that described by Moses, five on the north, and five on the south-side of the holy. But after the Babylonish captivity, the golden candlestick was again placed in the temple, as it had been before in the tabernacle by Moses. This sacred utensil, upon the destruction of the temple by the Romans, was lodged in the temple of Peace, built by Vespasian; and the represensation of it is still to be seen on the triumphal arch at the foot of mount Palatine, on which Vespasian's triumph is delineated.

Water-CANDLESTICK, a kind of fountain, the spout of which is raised upon a pedestal in form of a large balustrade, which carries a small bason like a table or stand, from which the water falls into a larger bason, level with the alleys in a garden.

CANDY, in geography, the capital of the island of Ceylon, situated in the middle of the island: E. long. 79°, N. lat. 8°.

CANDY, or *Sugar*-CANDY, a preparation of sugar, made by melting and crystalizing it six or seven times over, to render it hard and transparent. It is of three kinds, white, yellow, and red. The white comes from the loaf-sugar, the yellow from the cassonado, and the red from the muscovado.

CANDYING, in pharmacy, the act of preserving simples in substance, by boiling them in sugar.

The performance of this originally belonged to the apothecaries, but is now become a part of the business of a confectioner.

CANE, in botany. See ARUNDO.

CANE denotes also a walking-stick. It is customary to adorn it with a head of gold, silver, agate, &c. Some are without knots, and very smooth and even; others are full of knots, about two inches distant from each other. These last have very little elasticity, and will not bend so well as the others.

Canes of Bengal, are the most beautiful which the Europeans bring into Europe. Some of them are so fine, that people work them into vessels or bowls, which being varnished over in the inside with black or yellow lacca, will hold liquors as well as glass or china-ware does, and the Indians use them for that purpose.

CANE is also the name of a long measure, which differs according to the several countries where it is used.

At Naples, the cane is equal to 7 feet $3\frac{1}{2}$ inches English

English meafure: The cane of Tholoufe and the upper Languedoc is equal to the varre of Arragon, and contains 5 feet $8\frac{2}{7}$ inches; at Montpelier, Provence, Dauphine, and the lower Languedoc, to 6 Englifh feet $5\frac{1}{2}$ inches.

CANEA, a fea-port town on the north fide of Candia, efteemed the fecond in the ifland. It is a pretty good harbour, but the fortifications are out of repair: E. long. 24°, N. lat. 35° 36′.

CANEPHORÆ, in Grecian antiquity, virgins who, when they became marriageable, prefented certain bafkets full of little curiofities to Diana, in order to get leave to depart out of her train, and change their ftate of life.

CANEPHORIA, in Grecian antiquity, a ceremony which made part of a feaft celebrated by the Athenian virgins, on the eve of their marriage-day.

At Athens, the canephoria confifted in this; that the maid, conducted by her father and mother, went to the temple of Minerva, carrying with her a bafket full of prefents, to engage the goddefs to make the marriage-ftate happy; or, as the fcholiaft of Theocritus has it, the bafket was intended as a kind of honourable amends made to that goddefs, the protectrix of virginity, for abandoning her party; or a ceremony to appeafe her wrath. Suidas calls it a feftival in honour of Diana.

CANEPHORIA is alfo the name of a feftival of Bacchus, celebrated particularly by the Athenians, on which the young maids carried golden bafkets full of fruit, which bafkets were covered, to conceal the myftery from the uninitiated.

CANETO, a fortified town of the duchy of Mantua, fituated on the Oglio, about twelve miles fouth-weft of Mantua: E. long. 10° 50′, N. lat. 45°.

CANG, a gulf or fea, lying between China and Tartary, at the eaft end of the long wall.

CANICULA, in ichthyology, the trivial name of a fpecies of fqualus. See SQUALUS.

CANICULA, or CANICULUS, in aftronomy. See ASTRONOMY, *Of fixed ftars.*

It is alfo a name given to one of the ftars of the conftellation canis major, called the dog-ftar, and by the Greeks, firius.

CANICULAR *days*, commonly called dog-days, a certain number of days preceding and enfuing the heliacal raifing of canicula, or the dog-ftar, in the morning. The Ethiopians and Egyptians began their year at the rifing of the dog-ftar, reckoning to its rife again the next year, which is called the annus canarius. The Romans fuppofed it to be the caufe of the fultry weather ufually felt in the dog-days; and therefore facrificed a brown dog every year at its rifing, to appeafe its wrath.

The dog-days begin towards the end of July, and end the beginning of September.

CANINE, whatever partakes of, or has any relation with the nature of a dog. Thus,

CANINE *teeth*, are two fharp-edged teeth in each jaw; one on each fide, placed between the incifores and molares.

CANIS, or DOG, in zoology, a genus of quadrupeds, belonging to the order of feræ. The characters of the dog are thefe: He has fix fore-teeth in the upper jaw, thofe in the fides being longer than the intermediate ones, which are lobated; in the under jaw there are likewife fix fore-teeth, thofe on the fides being lobated. He has fix grinders in the upper, and feven in the lower jaw. The teeth called dog-teeth are four, one on each fide, both in the lower and upper jaw; they are fharp-pointed, bent a little inward, and ftand at a diftance from any of the reft.

There are nine fpecies of this genus, *viz.* 1. The familiaris, or domeftic dog, is diftinguifhed from the other fpecies, by having his tail bent to the left fide; which mark is fo fingular, that perhaps the tail of no other quadruped is bent in this manner. Of this fpecies there are a great number of varieties. Linnæus enumerates eleven, and Bouffon gives figures of no lefs than twenty-feven, *viz.* the moloffus, or maftiff, which is about the fize of a wolf, with the fides of the lips hanging down, and a full robuft body. The large Danifh dog, differs only from the former in being fuller in the body, and generally of a larger fize. The grey-hound is likewife the fame with the maftiff; but its make is more flender and delicate. Indeed the difference betwixt thefe three dogs, although perfectly diftinguifhable at firft fight, is not greater than that betwixt a Dutchman, a Frenchman, and an Italian. The fhepherd's dog, the wolf-dog, and what is commonly called the Siberian dog, to which may be joined the Lapland dog, the Canada dog, and, in general, all thofe which have ftrait ears and a pointed fnout, are all one kind, differing only in thicknefs, the roughnefs or fmoothnefs of their fkin, the length of their legs, and tails. The hound, or beagle, the terrier, the braque, or fhort-tailed fetting-dog, and the fpaniel, may be confidered as the fame kind: they have the fame form and the fame inftincts; and differ only in the length of their legs, and fize of their ears, which in each of them are long, foft, and pendulous. The bull-dog, the fmall Danifh dog, the Turkifh dog, and the Iceland dog, may likewife be confidered as the fame kind, all the varieties in their appearance taking their rife merely from climate. For inftance, the Turkifh dog, which has no hair, is nothing elfe but the fmall Danifh dog tranfported to a warm climate, which makes the hair fall off. A dog of any kind lofes its hair in very warm climates. But this is not the only change which arifes from difference of climate. In fome countries, the voice is changed; in others, dogs become altogether filent. In fome climates, they lofe the faculty of barking, and howl like wolves, or yelp like foxes. Warm climates even change their form and inftincts: They turn ill-fhaped, and their ears become ftrait and pointed. It is only in temperate climes that dogs preferve their natural courage, ardour, and fagacity.

In order to give an idea of the different kinds of dogs, in different climates, and of the varieties produced by commixtures, we fhall give an explanation of Bouffon's genealogical tree, See Plate LXI. fig. 1. This tree is conftructed in the form of a geographical chart, in which the fituation of the different climates to which the parti-

cular dogs belong, is obferved as accurately as the nature of the thing will admit.

The fhepherd's dog is the ftump of the tree. This dog, when tranfported to Lapland, or any very cold climate, affumes an ugly appearance, and its legs become fhort. But in Britain, Ruffia, Siberia, *&c.* where the cold is not fo rigorous, and the people are more civilized, he arrives at greater perfection, both in form and fagacity. The fame fhepherd's dog, when brought up in a country fully civilized, as Britain or France, lofes his favage air, his ftrait ears, his thick long hair, and becomes what is called a bull-dog, a maftiff, a beagle, or hound. Thefe changes, Bouffon attributes to the influence of the climate, the manners of the people, *&c.* The maftiff and the bull-dog have their ears ftill partly ftrait, or half-pendent, and refemble in their manners and fanguine difpofition the dog from which they derive their origin. The beagle or hound preferves lefs of the appearance of its origin than the other two; its ears are long and entirely pendent; the foftnefs, the tractability, the timidity of this dog, Bouffon confiders as fo many proofs of its great degeneracy, or rather of that perfection which it acquires by culture, and living among a civilized people.

The hound, the fmall fpotted fetting-dog, and the terrier, are all of the fame family; for all the three kinds are often produced at the fame litter, although the female hound had been covered only by one of thefe kinds.

When the hound is tranfported to Spain, or Barbary, where almoft every animal has fine, long, downy hair, it is changed into a water hound, or fpaniel. And the fmall and large fpaniel, which differ only in the tail, when carried to Britain, are changed from a white to a black colour, and become what is called the large and fmall fhagged dogs.

The maftiff, when carried to the north, is changed into the large Danifh dog; and when tranfported to the fouth, it becomes a grey-hound. The large grey-hounds come from the Levant; thofe of a leffer fize come from Italy; and the Italian grey-hounds, when brought to Britain, become what the French call *levrons*, that is, grey-hounds of the leaft fize.

The great Danifh dog, when carried to Ireland, the Ukrain, Tartary, *&c.* is changed into the Irifh dog, which is the largeft of all dogs.

The bull-dog, when carried from Britain to Denmark, becomes the fmall Danifh dog; and this fmall Danifh dog, when tranfported into a warm climate, lofes its hair, and is changed into the Turkifh dog.

All thefe races or families, with their varieties, are produced by the influence of climate, food, and education: The other kinds marked in the tree are not pure or diftinct families, but are produced by the commixture of the other families. Thefe mungrel dogs, with the particular parents which produce them, are marked out in the tree by dotted lines. For example,

The grey-hound and maftiff produce the mungrel grey-hound, which is likewife called the grey-hound with wolf's hair. The large Danifh dog and the large fpaniel produce the Calabrian dog; which is a beautiful dog, with long bufhy hair, and of a larger fize than the maftiff. The fpaniel and the fmall Danifh dog produce the lion-dog, which is a very rare kind. It is needlefs to give more examples, as they can eafily be traced from the dotted lines in the tree.

Having thus traced the varieties of the dog, and the probable fources of thefe varieties, we fhall now give an account of his nature and inftincts.

From the ftructure of the teeth, it might be concluded *à priori* that the dog is a carnivorous animal. He does not however eat indifcriminately every kind of animal fubftance. There are fome birds, as the colymbus arcticus, which the water-dog will lay hold off with keennefs, but will not bring out of the water, becaufe its fmell is exceedingly offenfive to him. He will not eat the bones of a goofe, crow, or hawk: But he devours even the purtrid flefh of moft other animals. He is poffeffed of fuch ftrong digeftive powers, as to draw nourifhment from the hardeft bones. When flefh cannot be procured, he will eat fifh, fruits, fucculent herbs, and bread of all kinds. When oppreffed with ficknefs, to which he is very fubject, efpecially in the beginning of fummer, in order to procure a puke, he eats the leaves of the quicken grafs, the bearded wheat-grafs, or the rough cock's-foot-grafs, which gives him immediate relief. When he fteals a piece of flefh, as confcious of the immorality of the action, he runs off with his tail hanging and bent in betwixt his feet.

His drink is water, which he takes in fmall quantities at a time, by licking with his tongue. He is in fome meafure obliged to lick in this manner, otherwife his nofe would be immerfed in the water.

His excrements are generally hard fcybals, which, efpecially after eating bones, are white, and go by the name of *album græcum* among phyficians. This album græcum was for a long time in great repute as a feptic; but it is now entirely difregarded. He does not throw out his excrements promifcuoufly upon every thing that happens to be in the way, but upon ftones, trunks of trees, or barren places. This is a wife inftitution of nature; for the excrements of a dog deftroy almoft every vegetable or animal fubftance. They are of fuch a putrid nature, that if a man's fhoe touches them when recently expelled, that particular part will rot in a few days. He obferves the fame method in making his urine, which he throws out at a fide. It is remarkable, that a dog will not pafs a ftone or a wall againft which any other dog has piffed, without following his example, although a hundred fhould occur in a few minutes, in fo much, that it is aftonifhing how fuch a quantity can be fecreted in fo fhort a time.

The dog is an animal not only of quick motion, but remarkable for travelling very long journeys. He can eafily keep up with his mafter, either on foot or horfeback, for a whole day. When fatigued, he does not fweat, but lolls out his tongue. Every kind of dog can fwim; but the water-dog excells in that article.

The dog runs round when about to lie down, in order to difcover the moft proper fituation. He lies generally on his breaft, with his head turned to one fide, and fometimes with his head above his two fore-feet. He fleeps little, and even that does not feem to be very quiet; for he often

Fig. 1.

A GENEALOGICAL TABLE *of the different races of* DOGS

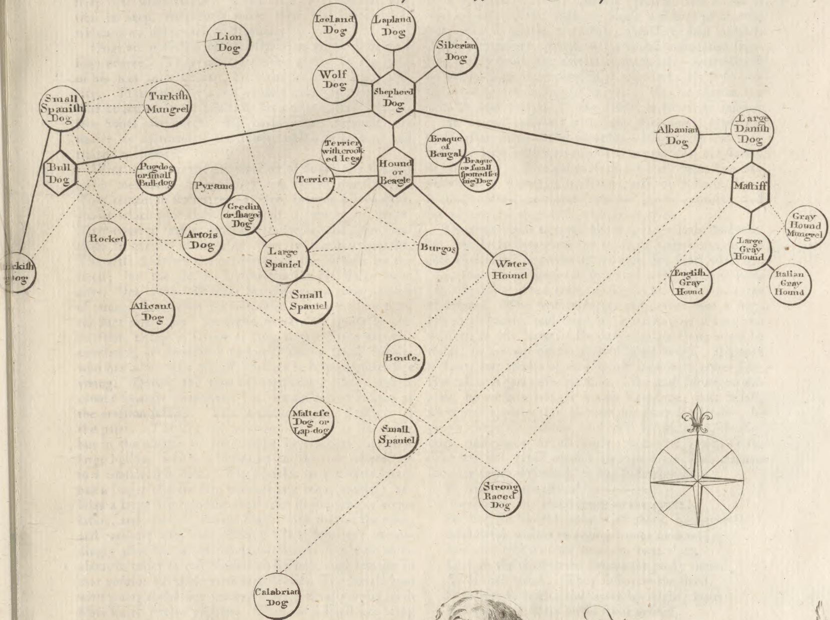
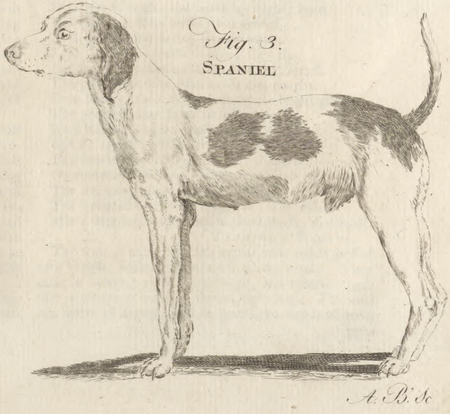


Fig. 2.

SHEPHERD'S DOG

Fig. 3.

SPANIEL



A. B. Sc

often ſtarts, and ſeems to hear with more acuteneſs in ſleep than when awake. They have a tremulous motion in ſleep, frequently move their legs, and bark, which is an indication of dreaming.

Dogs are poſſeſſed of the ſenſation of ſmelling in a high degree. They can trace their maſter by the ſmell of his feet in a church, or in the ſtreets of a populous city. This ſenſation is not equally ſtrong in every kind. The hound can trace game, or his maſter's ſteps, twenty-four hours afterwards. He barks more furiouſly the nearer he approaches the fowls, unleſs he be beat and trained to ſilence.

With regard to the propagation of dogs; the females admit the males before they are twelve months old. They remain in ſeaſon ten, twelve, or even fifteen days, during which time they will admit a variety of males. They come in ſeaſon generally twice in the year, and more frequently in the cold than in the hot months. The male diſcovers the condition of the female by the ſmell; but ſhe ſeldom admits him the firſt ſix or ſeven days. One coitus will make her conceive a great number of young; but, when not reſtrained, ſhe will admit ſeveral dogs every day: ſhe ſeems to have no choice or predilection, except in favour of large dogs: From this circumſtance, it ſometimes happens, that a ſmall female, who has admitted a maſtiff, periſhes in bringing forth her young. During the time of copulation, theſe animals cannot ſeparate themſelves, but remain united ſo long as the erection ſubſiſts. This is owing to the ſtructure of the parts. The dog has not only a bone in his penis, but in the middle of the corpus cavernoſum there is a large hollow, which is blown up in the time of erection to a conſiderable bulk. The female, on the other hand, has a larger clitoris then perhaps any other animal; beſides a large firm protuberance riſes in the time of copulation, and remains perhaps longer than that of the male, and prevents him from retiring till it ſubſides: Accordingly after the act of copulation is over, the male turns about in order to reſt himſelf on his legs, and remains in that poſition till theſe parts turn flaccid. The female goes with young about nine weeks. They generally bring forth from ſix to twelve puppies. Thoſe of a ſmall ſize bring forth five, four, and ſometimes but two. They continue to copulate and bring forth during life, which laſts generally about fourteen or fifteen years. The whelps are commonly blind, and cannot open their eyes till the tenth or twelfth day. In the fourth month, they loſe ſome of their teeth, which are ſoon ſucceeded by others.

The dog has ſuch a ſtrong reſemblance to the wolf and the fox, that he is commonly ſuppoſed to be the production of one or other of theſe animals tamed and civilized. Bouffon informs us, that he kept a young dog and a young wolf together till they were three years of age, without their diſcovering the leaſt inclination to copulate. He made the ſame experiment upon a dog and a fox; but their antipathy was rather increaſed when the female was in ſeaſon. From theſe experiments he concludes, that dogs, wolfs, and foxes, are perfectly diſtinct ſpecies of animals.

With regard to the natural diſpoſition of the dog: In a ſavage ſtate, he is fierce, cruel, and voracious; but, when civilized and accuſtomed to live with men, he is poſſeſſed of every amiable quality. He ſeems to have no other deſire than to pleaſe and protect his maſter. He is gentle, obedient, ſubmiſſive, and faithful. Thoſe diſpoſitions, joined to his almoſt unbounded ſagacity, juſtly claim the eſteem of mankind. Accordingly no animal is ſo much careſſed or reſpected: He is ſo ductile, and ſo much formed to pleaſe, that he aſſumes the very air and temper of the family in which he reſides.

An animal endowed with ſuch uncommon qualities, muſt anſwer many uſeful purpoſes. His fidelity and vigilance are daily employed to protect our perſons, our flocks, or our goods. The acuteneſs of his ſmell gains him employment in hunting; in ſome parts of Siberia, he is trained to draw carriages from one inn to another; and the negroes eat dogs fleſh with great reliſh.

The dog is liable to many diſeaſes, as the ſcab, madneſs, *&c.* and he ſeldom wants the tænia or tape-worm in his guts, eſpecially if he drinks dirty water. See Plate VIII. 62.

2. The ſecond ſpecies of this kind is the lupus or wolf, which is diſtinguiſhed from the dog by having its tail turned inward. The wolf is larger and fiercer than a dog. His eyes ſparkle, and there is a great degree of fury and wildneſs in his looks. He draws up his claws when he walks, to prevent his tread from being heard. His neck is ſhort, but admits of very quick motion to either ſide. His colour is generally blackiſh. Like moſt ferocious animals, he can bear hunger a very long time; but, at laſt, when the appetite for victuals becomes intolerable, he grows perfectly furious, and will attack men, horſes, dogs, and cattle of all kinds; even the graves of the dead are not proof againſt his rapacity. This circumſtance is finely deſcribed, in the following lines.

By wintry famine rous'd,——————
Cruel as death, and hungry as the grave!
Burning for blood! bony, and ghant, and grim!
Aſſembling wolves in raging troops deſcend;
And, pouring o'er the country, bear along,
Keen as the north-wind ſweeps the gloſſy ſnow.
All is their prize. They faſten on the ſteed,
Preſs him to earth, and pierce his mighty heart.
Nor can the bull his awful front defend,
Or ſhake the murthering ſavages away.
Rapacious at the mother's throat they fly,
And tear the ſcreaming infant from her breaſt.
The god-like face of Man avails him nought.
Even beauty, force divine! at whoſe bright glance
The generous lion ſtands in ſoften'd gaze,
Here bleeds, a hapleſs undiſtinguiſh'd prey.
But if, appris'd of the ſevere attack,
The country be ſhut up, lur'd by the ſcent,
On church-yards drear (inhuman to relate!)
The diſappointed prowlers fall, and dig
The ſhrouded body from the grave; o'er which,
Mix'd with foul ſhades, and frighted ghoſts, they howl.

Thomson's Winter.

The wolf is extremely ſuſpicious, and, unleſs preſſed with hunger, ſeldom ventures out of the woods. They make a howling noiſe in the night, and aſſemble together in troops in order to devour their prey. The wolf is a native of Europe, and frequents the woods of many

parts of the continent to this day. This country, a few centuries ago, was much infefted with them. So late as the year 1457, there is an act of parliament obliging all the gentlemen and tenants in the different fhires of Scotland, to rife, properly armed, four times in the year, in order to deftroy the wolves. But they are now fo effectually rooted out, that not one of them has been feen wild, even in the highlands, for a century paft. See Plate LXII. fig. 5.

3. The hyæna, has a ftrait jointed tail, with the hair of its neck erect, fmall naked ears, and four toes on each foot. It is about the fize of a fow, and its head refembles that of a boar. The hairs on the back are about a fpan long, erect, and black at the points, and the eyes are near each other. The hyæna is a native of India and Africa. He digs holes in the earth like a fox, where he retires from danger. He is very fond of human flefh, which he digs out of church-yards in the night. When irritated, he lays hold of a weapon, or any thing that offends, and keeps it faft in his teeth, which makes him an eafy prey to hunters.

4. The vulpes, or fox, has a ftrait tail, white at the point. His body is yellowifh, or rather ftraw-coloured; his ears are fmall and erect; his lips are whitifh, and his fore-feet are black. From the bafe of the tail, a ftrong fcent is emitted, which to fome people is very fragrant, and to others extremely difagreeable. The fox is a native of almoft every quarter of the globe: He digs holes or dens in the earth; and is of fuch a wild and favage difpofition, that it is impoffible fully to tame him. He is efteemed to be the moft crafty and cunning of all beafts of prey. His craftinefs is principally difcovered by the fchemes he falls upon in order to catch lambs, geefe, hens, and all kinds of fmall birds. When the females are in feafon, they make a difagreeable yelping noife in the night. He flies when he hears the explofion of a gun, or fmells gun-powder. He is exceedingly fond of grapes, and does much mifchief in vineyards. Various methods are daily employed to deftroy foxes; they are hunted with dogs; iron-traps are often fet at their holes; and their holes are fometimes fmoked to make them run out, that they may the more readily fall into the fnares, or be killed by dogs or fire-arms. But all the arts that have been employed are infufficient for the purpofe of rooting him out of any country. They have fo many paffages in their dens, and often at a great diftance, that they often make their efcape. When hunted, they never run directly foreward, but make a great many doublings and turnings; and when in danger of being taken, they emit fuch a fmell from their pofteriors, that the hunters can hardly endure it. See Plate LXII. fig. 4.

5. The alopex, or field-fox, is every way the fame with the common fox, except in the point of the tail, which is black.

6. The lagopus, or white fox, with a ftrait tail, and the apex of different colours. The legs are very hairy. It inhabits the mountains of Lapland and Siberia.

7. The aureus, or jackall, is a native of the Eaft Indies. There is no genuine defcription of this animal. They affemble in large troops in the night, in feveral parts of Afia, and make a hideous howling noife. When one calls, he is anfwered by numbers even at great diftances; fo that in a fhort time the whole woods refound with their noife. This noife roufes all the other wild animals, as lions, tygers, *&c.* who take advantage of the general confternation, and devour the weaker animals. This circumftance has probably given rife to the notion of the jackall's being the lion's provider. They hide themfelves in holes during the day, and go in queft of their prey in the night: They fometimes fall upon children, and devour them when no affiftance is near.

8. The Mexicanus, has a fmooth crooked tail. The body is afh-coloured, variegated with yellow fpots. It is a native of Mexico, and is called the mountain-cat by Seba.

9. The thous, has a fmooth, crooked tail. The upper part of his body is grey, and the belly is white. He is about the fize of a large cat, and is found at Surinam.

CANIS, the DOG-FISH, a name given to feveral fpecies of fqualus. See SQUALUS.

CANIS *major*, in aftronomy, a conftellation of the fouthern hemifphere.

CANIS *minor*, CANICULUS, or CANICULA, in aftronomy, a conftellation of the northern hemifphere.

CANKER, a difeafe incident to trees, proceeding chiefly from the nature of the foil. It makes the bark rot and fall. If the canker be in a bough, cut it off; in a large bough, at fome diftance from the tree; and in a fmall one, clofe to it: But for over-hot ftrong ground, the mold is to be cooled about the roots with pond-mud, and cow-dung.

CANNA, in botany, a genus of the monandria monogynia clafs. There are four fpecies of this plant, all natives of the Indies.

CANNABIS, hemp, in botany, a genus of the diœcia pentandria clafs. The calix of the male is divided into five fegments, and it has no corolla. The calix of the female confifts of one leaf, open at the fide; it has two ftyli; and the nut or capfule confifts of two valves. There is but one fpecies, *viz.* the fativa, or common hemp, a native of India. For the method of cultivating and preparing hemp, fee FLAX, and HEMP.

CANNACORUS, in botany. See CANNA.

CANNEL-COAL, a fubftance which has a long time, though with very little reafon, been confounded, both by authors and druggifts, with jet. It is dug up in many parts of England in great abundance, particularly in Lancafhire, where it is burnt as common fuel. It is worked into toys and utenfils of various kinds, under the name of jet. In medicine, it is faid to be good in the colic; but the prefent practice takes no notice of it.

CANNON, in the military art, an engine or fire-arm for throwing iron, lead, or ftone bullets, by force of gunpowder.

Cannons at firft were called bombardæ, from the noife they made. They had likewife the name of culverin, bafilifk, *&c.* from the beafts that were reprefented upon them; and the Spaniards, from devotion, gave them the name of faints; witnefs the twelve apoftles which Charles V. ordered to be caft at Malaga, for his expedition to Tunis.

The metal of which cannons are compofed, is either iron, or which is more ufual, a mixture of copper, tin, and brafs; the tin being added to the copper,

Plate LXII.

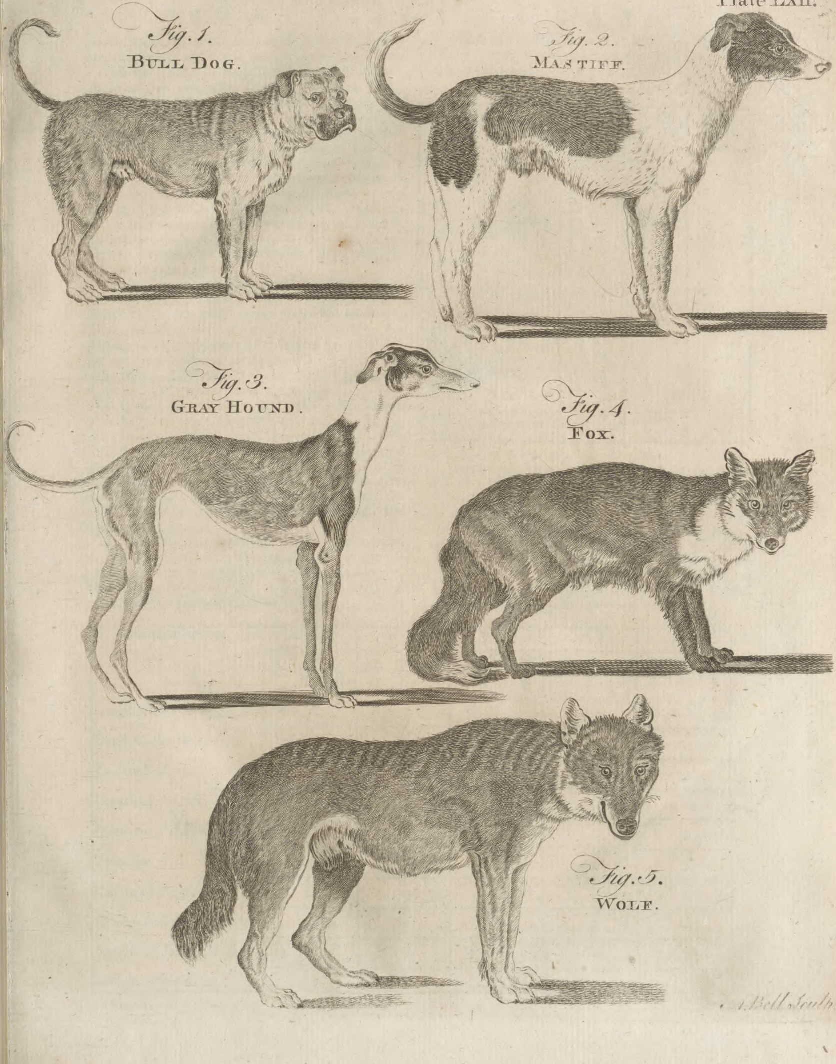


Fig. 1.
BULL DOG.
Fig. 2.
MASTIFF.
Fig. 3.
GRAY HOUND.
Fig. 4.
FOX.
Fig. 5.
WOLF.
A. Bell Sculpt.

per, to make the metal more denſe and compact; ſo that the better and heavier the copper is, the leſs tin is required. Some to an hundred pounds of copper, add ten of tin, and eight of braſs; others ten of tin, five of braſs, and ten of lead. The ſieur Bereau pretends, that when old pieces of metal are uſed, the founder ought to add to one hundred weight of that metal, twenty-five pounds of good copper, and five pounds of tin. Braudius deſcribes a method of making cannon of leather; and it is certain the Swedes made uſe of ſuch in the long war of the laſt century; but theſe burſt too eaſily to have much effect. With regard to iron cannon, they are not capable of ſo much reſiſtance as thoſe of braſs; but as they are leſs expenſive, they are often uſed on board of ſhips, and alſo in ſeveral fortified places.

Cannons are diſtinguiſhed by the diameters of the balls they carry. The rule for their length is, that it be ſuch as that the whole charge of powder be on fire, before the ball quit the piece. If it be too long, the quantity of air to be drawn out before the ball, will give too much reſiſtance to the impulſe; and that impulſe ceaſing, the friction of the ball againſt the ſurface of the piece will take off from the motion.

In former days, cannon were made much longer than they are now; but experience has taught us, that a ball moves with a greater impetus through a leſs ſpace than a greater: and accordingly it is found, that an iron ball of forty-eight pound weight goes farther from a ſhort cannon, than another ball of ninety-ſix pound out of a longer piece; whereas, in other reſpects, it is certain, the larger the bore and ball, the greater the range.

It is found too, by experience, that of two cannons of equal bore, but different lengths, the longer requires a greater charge of powder than the ſhorter. The ordinary charge of a cannon is, for the weight of its gun-powder to be half that of its ball.

We ſhall here ſubjoin a table exhibiting the names of the ſeveral cannon, their length, their weight, and that of their ball.

Names of cannon.	weight of an iron ball.		weight of the cannon.	length of the cannon.	
	lb.	oz.	lb.	f.	inch.
Cannon royal	48	0	8000	12	0
Demi cannon large	36	0	6000	12	0
Demi cannon ordinary	32	0	5600	12	0
Demi cannon leaſt	30	0	5400	11	0
Culverin largeſt	20	0	4800	12	0
Culverin ordinary	17	5	4500	12	0
Culverin leaſt	15	0	4000	11	0
Demi culverin ordinary	10	11	2700	11	0
Demi culverin leaſt	9	0	2000	10	0
Saker ordinary	6	0	1500	10	0
Saker leaſt	4	12	1400	8	0
Minion largeſt	3	12	1000	8	0
Minion ordinary	3	4	800	7	0
Falcon	2	8	750	6	0
Falconet	1	5	400	5	6
Rabinet	0	8	300	5	6
Baſe	0	5	200	4	6

Cannon are likewiſe diſtinguiſhed according to the diameter of their mouth, or calibre. This calibre is divided, in conſequence of an order from the king of France, into thirty-ſix parts, in order to determine by theſe parts the dimenſions of the different moulds for cannon. We hope the reader, then, will not be diſſatisfied to find an account of the dimenſions of the ſeveral parts of cannon of five different calibres, as they are regulated by that order of the king of France, on Oct. 7, 1732, in the following table:

Pieces of cannon	of 24			of 16			of 12			of 8			of 4		
	feet.	inch.	lines.	feet.	inch.	lines.	feet.	inch.	lines.	feet.	inch.	lines.	feet.	inch.	lines.
Length of the bore	9	6		9	2		8	8		7	10		6	6	
Depth of the chamber	2	6			1	10									
Thickneſs of metal at breech		5	5		4	9		4	4		3	9		3	
Length of the caſcabel		10	11		9	6		8	8		7	7		6	
Diameter of the trunions		5	5		4	9		4	4		3	10		3	
Projection of the trunions		5	5		4	9		4	4		3	10		3	
Calibre of the piece		5	8		4	11		4	6		3	11		3	2
Diameter of the ball		5	6		4	9		4	4		3	9		3	
Length of the whole piece	11			10	6		10			8	10		7	3	
Weight of the piece	5400			4200			3200			2100			1150 lb.		

CANNON, with letter-founders and printers, the name of the largest fize of the letters they ufe.

CANNULA, in furgery, a tube made of different metals, principally of filver and lead, but fometimes of iron.

They are introduced into hollow ulcers, in order to facilitate a difcharge of pus or any other fubftance; or into wounds, either accidental or artificial, of the large cavities, as the thorax or abdomen: they are ufed in the operation of branchotomy, and by fome, after cutting for the ftone, as a drain for the urine.

Other cannulas are ufed for introducing cauteries, either actual or potential, in hollow parts, in order to guard the parts adjacent to that to be cauterifed, from injury. They are of various figures; fome being oval, fome round, and others crooked.

CANOE, a fmall boat, made of the trunk of a tree, bored hollow; and fometimes alfo of pieces of bark fewed together.

It is ufed by the natives of America to go a-fifhing in the fea, or upon fome other expedition, either by fea, or upon the rivers and lakes.

CANON, commonly called prebendary, a perfon who poffeffes a prebend, or revenue allotted for the performance of divine fervice in a cathedral or collegiate church. Originally, canons were only priefts, or inferior ecclefiaftics, who lived in community, refiding near the cathedral church to affift the bifhop, depending entirely on his will, fupported by the revenues of his bifhopric, and living in the fame houfe as his domeftics or counfellors, *&c.* By degrees thefe communities of priefts, fhaking off their dependence, formed feparate bodies; in time they freed themfelves from their rules, and at length ceafed to live in a community. It is maintained, that the colleges of canons, which have been introduced into each cathedral, were not in the ancient church, but are of modern appointment.

In the Romifh church, when a perfon is promoted to the office of a canon, he muft be prefented in a very ceremonious manner to the chapter, who affemble in the cathedral, in order to receive him: he kiffes the altar thrice, after which he goes and takes his place in the choir; he afterwards makes his confeffion of faith aloud, and fwears to obferve the ordinances of the church and his holinefs the pope; being thus folemnly inftalled, he is impowered to affift at the chapter, to chaunt the office of the choir, *&c.*

Canons are of various kinds, as,

Cardinal-CANONS, thofe attached, or, as the Latins call it, *incardinati*, to a church, as a prieft is to a parifh.

Domicellory-CANONS, young canons, who, not being in orders, had no right in any particular chapters.

Expectative-CANONS were fuch as, without having any revenue or prebend, had the titles and dignities of canons, a voice in the chapter, and a place in the choir, till fuch time as a prebend fhould fall.

Foreign CANONS, fuch as did not officiate in the canonries to which they belonged. To thefe were oppofed manfionary canons.

Regular CANONS, thofe who ftill live in community, and who, like religious, have, to the practice of their rules, added the folemn profeffion of vows.

Tertiary CANON, a perfon who had only the third part of the revenues of the canonicate.

CANON, in an ecclefiaftical fenfe, a law, rule, or regulation of the policy and difcipline of a church, made by councils either general, national, or provincial.

CANONS *of the apoftles*, a collection of ecclefiaftical laws, which, though very ancient, were not left us by the apoftles. It is true, they were fometimes called apoftolic canons; but this means no more than that they were made by bifhops, who lived foon after the apoftles, and were called apoftolical men. They confift of regulations, which agree with the difcipline of the fecond and third centuries: The Greeks generally count eighty-five, but the Latins receive only fifty, nor do they obferve all thefe.

CANON *of mafs*, in the Romifh church, the name of a prayer which the prieft reads low to himfelf, the people kneeling.

In this part of the mafs, the prieft particularly mentions fome perfons for whom he is going to offer the facrifices, and prays to God for the redemption of their fouls, the hopes of their falvation, *&c.*

Pafchal CANON, a table of the moveable feafts, fhewing the day of Eafter, and the other feafts depending on it, for a cycle of nineteen years.

CANON *of fcripture*, a catalogue or lift of the infpired writings, or fuch books of the Bible as are called canonical; becaufe they are in the number of thofe books which are looked upon as facred, in oppofition to thofe which are either not acknowledged as divine books, or are rejected as heretical and fpurious, and are called apocryphal.

CANON, in monaftic orders, a book wherein the religious of every convent have a fair tranfcript of the rules of their order, frequently read among them, as their local ftatutes.

CANON is alfo ufed for the catalogue of faints acknowledged and canonized in the Romifh church.

CANON, in mufic, a fhort compofition of two or more parts, in which one leads, and the other follows: Or it is a line of any length, fhewing, by its divifions, how mufical intervals are diftinguifhed, according to the ratios, or proportions, that the founds terminating the intervals, bear one to another, when confidered according to their degree of being acute or grave.

CANON-LAW, a collection of ecclefiaftical laws, ferving as the rule and meafure of church-government.

The power of making laws was exercifed by the church before the Roman empire became Chriftian. The canon-law that obtained throughout the Weft, till the twelfth century, was the collection of canons made by Dionyfius Exiguus in 520, the capitularies of Charlemagne, and the decrees of the popes, from Sircius to Anaftafius.

The canon-law, even when papal authority was at its height in England, was of no force when it was found to contradict the prerogative of the king, the laws,

laws, ſtatutes, and cuſtoms of the realm, or the doctrine of the eſtabliſhed church.

The eccleſiaſtical juriſdiction of the ſee of Rome in England, was founded on the canon-law; and this created quarrels between kings and ſeveral archbiſhops and prelates, who adhered to the papal uſurpation.

Beſides the foreign canons, there were ſeveral laws and conſtitutions made here for the government of the church; but all theſe received their force from the royal aſſent: And if, at any time, the eccleſiaſtical courts did, by their ſentence, endeavour to enforce obedience to ſuch canons, the courts at common law, upon complaints made, would grant prohibitions. The authority veſted in the church of England of making canons, was aſcertained by a ſtatute of Henry VIII. commonly called the act of the clergy's ſubmiſſion; by which they acknowledged, that the convocation had been always aſſembled by the king's writ; ſo that though the power of making canons reſided in the clergy met in convocation, their force was derived from the authority of the king's aſſenting to, and confirming them.

The old canons continued in force till the reign of James I., when the clergy being aſſembled in convocation, the king gave them leave to treat and conſult upon canons; which they did, and preſented them to the king, who gave them the royal aſſent: Theſe were a collection out of the ſeveral preceding canons and injunctions. Some of theſe canons are now obſolete. In the reign of Charles I. ſeveral canons were paſſed by the clergy in convocation.

CANONESS, in the Romiſh church, a woman who enjoys a prebend, affixed, by the foundation, to maids, without their being obliged to renounce the world, or make any vows.

CANONIZATION, a ceremony in the Romiſh church, by which perſons deceaſed are ranked in the catalogue of the ſaints. It ſucceeds beatification. See BEATIFICATION.

Before a beatified perſon is canonized, the qualifications of the candidate are ſtrictly examined into, in ſome conſiſtories held for that purpoſe; after which one of the conſiſtorial advocates, in the preſence of the pope and cardinals, makes the panegyric of the perſon who is to be proclaimed a ſaint, and gives a particular detail of his life and miracles: Which done, the holy father decrees his canonization, and appoints the day.

On the day of canonization, the pope officiates in white, and their eminences are dreſſed in the ſame colour. St Peter's church is hung with rich tapeſtry, upon which the arms of the pope, and of the prince or ſtate requiring the canonization, are embroidered in gold and ſilver. An infinite number of lights blaze all round the church, which is crowded with pious ſouls, who wait, with a devote impatience, till the new ſaint has made his public entry, as it were, into paradiſe, that they may offer up their petitions to him, without danger of being rejected.

The following maxim, with regard to canonization, is now obſerved, though it has not been followed above a century, *viz.* not to enter into the inquiries prior to canonization, till fifty years, at leaſt, after the death of the perſon to be canonized. By the ceremony of canonization, it appears, that this rite of the modern Romans, has ſomething in it very like the apotheoſis or deification of the ancient Romans, and in all probability owes its riſe to it; at leaſt, ſeveral ceremonies of the ſame nature are conſpicuous in both.

CANONOR, a town on the Malabar coaſt, in the Hither India: E. long. 75°, N. lat. 10°.

Here the Dutch have a fort and factory, which they took from the Portugueſe in 1663.

CANONRY, the benefice filled by a canon. It differs from a prebend, in that the prebend may ſubſiſt without the canonicate; whereas the canonicate is inſeparable from the prebend; again, the rights of ſuffrages, and other privileges, are annexed to the canonicate, and not to the prebend.

CANOPUS, in aſtronomy, a ſtar of the firſt magnitude in the rudder of Argo, a conſtellation of the ſouthern hemiſphere. See ASTRONOMY, *Of the fixed ſtars*.

CANTABRICA, in botany, a ſynonime of a ſpecies of convolvulus. See CONVOLVULUS.

CANTALIVERS, in architecture, pieces of wood framed into the front or other ſides of a houſe, to ſuſpend the mouldings and eyes over it.

CANTAR, or CANTARO, in commerce, a weight uſed in Italy, particularly at Leghorn, to weigh ſome ſorts of merchandiſes.

There are three ſorts of cantari, or quintals, one weighs 150 pounds, the other 151, and the third 160: The firſt ſerves to weigh alum and cheeſe, the ſecond is for ſugar, and the third for wool and codfiſh.

CANTAR is alſo a meaſure of capacity uſed at Cochin, and containing four rubis.

CANTATA, in muſic, a ſong or compoſition, intermixed with recitatives, airs, and different movements, chiefly intended for a ſingle voice, with a thorough baſs, though ſometimes for other inſtruments.

The cantata, when performed with judgment, has ſomething in it very agreeable; the variety of the movement not clogging the ear, like other compoſitions. It was firſt uſed in Italy, then in France, whence it paſſed to us.

CANTERBURY, the capital city of Kent, fifty-five miles eaſt of London, and ſixteen north-weſt of Dover: E. long. 1° 15′, N. lat. 51° 16′.

It is a county of itſelf, and the ſee of an archbiſhop, who is primate and metropolitan of all England. It is a large, populous, and trading city; has a good ſilk manufactory, and ſends two members to parliament.

CANTERBURY-BELL, in botany. See CAMPANULA.

CANTHARIS, in zoology, a genus of inſects belonging to the order of inſecta coleoptera. The feelers of this genus are ſetaceous; the breaſt is marginated, and ſhorter than the head; the elytra, or wing-caſes, are flexile; and the ſides of the belly are plaited and papillous. Linnæus enumerates 27 ſpecies of the cantharis, moſt of them to be found in differents parts of Europe,

Europe. The cantharis ufed in making bliftering plafters, is ranked under a different genus, *viz.* the Meloe. See MELOE.

CANTICLES, a canonical book of the Old Teftament. The Talmudifts afcribe it to Hezekiah, but the learned are agreed that king Solomon was the author of it; and his name is prefixed to it in the title of the Hebrew text, and of the ancient Greek verfion.

CANTO, in mufic, the treble, or at leaft the higher part of a piece.

This word more properly fignifies the firft treble, unlefs the word *fecundo*, for the fecond, or *ripieno*, for the treble of the grand chorus, be added.

CANTON, in geography, denotes a fmall country, or diftrict, conftituting a diftinct government: fuch are the cantons of Switzerland.

CANTON is alfo the name of a large, populous, and wealthy city and port-town of China, fituated on the river Ta, about fifty miles from the Indian ocean: E. long. 112° 30′, N. lat. 23° 25′.

It is a fortified place, within the walls of which no Chriftians are permitted to enter, notwithftanding their great trade thither; it being from thence that they import all manner of Chinefe goods, as china-ware, tea, cabinets, raw and wrought filks, gold-duft, *&c.*

CANTONING, in the military art, is the allotting diftinct and feparate quarters to each regiment of an army; the town where they are quartered, being divided into fo many cantons, or divifions, as there are regiments.

CANTRED, or CANTREF, fignifies an hundred villages, being a Britifh word, compounded of the adjective *cant*, i. e. hundred, and *tref*, a town or village. In Wales, fome of the countries are divided into cantreds, as in England into hundreds.

CANVAS, in commerce, a very clear unbleached cloth of hemp, or flax, wove very regularly in little fquares. It is ufed for working tapeftry with the needle, by paffing the threads of gold, filver, filk, or wool, through the intervals or fquares.

CANVAS is alfo a coarfe cloth of hemp, unbleached, fomewhat clear, which ferves to cover womens ftays, alfo to ftiffen mens cloaths, and to make fome other of their wearing-apparel, *&c.*

CANVAS is alfo a very coarfe cloth made of hemp, unbleached, ferving to make towels, and anfwering other domeftic purpofes. It is alfo ufed to make fails for fhipping, *&c.*

CANVAS is ufed among the French, for the model and firft words, where an air or piece of mufic is compofed, and given to a poet to regulate and finifh.

CANATUS, in ornithology, the trivial name of a fpecies of tringa. See TRINGA.

CANZONE, in mufic, fignifies, in general, a fong where fome little figures are introduced: But it is fometimes ufed for a fort of Italian poem, ufually pretty long, to which mufic may be compofed in the ftyle of a cantata. If this term be added to a piece of inftrumental mufic, it fignifies much the fame as cantata: If placed in any part of a fonata, it implies the fame meaning as *allegro*, and only denotes that the part to which it is prefixed, is to be played or fung in a brifk and lively manner.

CANZONETTA, a diminutive of canzone, denoting a little fhort fong: The canzonette neapolitane have two ftrains, each whereof is fung twice over, as the vaudevilles of the French: The canzonette ficiliane are a fpecies of jigg, the meafure whereof is ufually twelve eights, and fix eights, and fometimes both, as rondeaus.

CAP, a part of drefs made to cover the head, much in the figure thereof.

The ufe of caps and hats is referred to the year 1449, the firft feen in thefe parts of the world being at the entry of Charles VII. into Rouen: from that time they began to take place of the hoods, or chaperoons, that had been ufed till then. When the cap was of velvet, they called it mortier; when of wool, fimply bonnet. None but kings, princes, and knights, were allowed the ufe of the mortier. The cap was the head-drefs of the clergy and graduates: Churchmen and members of univerfities, ftudents in law, phyfic, *&c.* as well as graduates, wear fquare caps in moft univerfities. Doctors are diftinguifhed by peculiar caps, given them in affuming the doctorate. Pafquier fays, that the giving the cap to ftudents in the univerfities, was to denote that they had acquired full liberty, and were no longer fubject to the rod of their fuperiors, in imitation of the ancient Romans, who gave a pileus or cap to their flaves, in the ceremony of making them free. The cap is alfo ufed as a mark of infamy in Italy. The Jews are diftinguifhed by a yellow cap at Lucca, and by an orange one in France.

CAP *of maintenance*, one of the regalia, or ornaments of ftate belonging to the kings of England, before whom it was carried at the coronation, and other great folemnities. Caps of maintenance are alfo carried before the mayors of the feveral cities in England.

CAPE, in geography, an high land running out with a point, into the fea, as Cape-Nord, Cape-Horn, the Cape of Good-Hope, *&c.*

CAPE *of Good-Hope*. See GOOD-HOPE.

CAPE-*coaft-caftle*, the principal Britifh fort and fettlement on the gold-coaft of Guinea, fituated under the meridian of London, in 5° N. lat.

CAPELLA, in aftronomy, a bright fixed ftar in the left fhoulder of the conftellation auriga.

CAPER, in botany. See CAPPARIS.

CAPERQUIN, a town of Ireland, in the county of Waterford, and province of Munfter, fituated on the river Blackwater: W. long. 7° 50′, and N. lat. 52° 5′.

CAPHAR, a duty which the Turks raife on the Chriftians, who carry or fend merchandifes from Aleppo to Jerufalem, and other places in Syria.

This duty of caphar was firft impofed by the Chriftians themfelves, when they were in poffeffion of the Holy land, for the maintenance of the troops, which were planted in difficult paffes, to obferve the Arabs, and prevent their incurfions. It is ftill continued, and much increafed by the Turks, under pretence of defending the Chriftians againft the Arabs, with whom, never-

neverthelefs, they keep a fecret intelligence, favouring their excurfions and plunders.

CAPI-AGA, or CAPOU-AGASSI, a Turkifh officer, who is, as it were, grand-mafter of the feraglio.

He is the firft in dignity and repute of all the white eunuchs, and is always near the Grand Signior's perfon. It is he who introduces embaffadors to audience; and all great affairs pafs through his hands before they come to that of the prince.

CAPIAS, in law, a writ of two forts, one before judgement in an action, and the other after: That before judgment is called *capias ad refpondendum*, where an original is fued out, *&c.* to take the defendant, and make him anfwer the plantiff; and that after judgement is the *capias ad fatisfaciendum*, &c.

CAPIGI, in the Turkifh affairs, the name of certain inferior officers belonging to the feraglio, to the number of five hundred, whofe bufinefs is to affift the janizaries in guarding the firft and fecond gate of that palace; whence alfo the name capighi, which fignifies a gate.

CAPILLAMENT, in a general fenfe, fignifies a hair, whence the word is applied to feveral things, which, on account of their length or their finenefs, refemble hairs: As,

CAPILLAMENTS *of the nerves*, in anatomy, the fine fibres, or filaments, whereof the nerves are compofed.

CAPILLARY, in a general fenfe, an appellation given to things on account of their extreme finenefs, or refembling hair.

CAPILLARY *tubes*, in phyfics, little pipes whofe canals are extremely narrow, their diameter being only a half, third, or fourth of a line. See HYDROSTATICS.

CAPILLUS *veneris*, in botany. See ADIANTUM.

CAPITAL, in geography, denotes the principal city of a kingdom, province, or ftate.

CAPITAL, among merchants, traders, and bankers, fignifies the fum of money which individuals bring to make up the common ftock of a partnerfhip.

CAPITAL *crime*, fuch a one as fubjects the criminal to capital punifhment, that is, the lofs of life.

CAPITAL, in architecture, the uppermoft part of a column or pilafter, ferving as the head, or crowning, and placed immediately over the fhaft, and under the entablature. See ARCHITECTURE.

CAPITANATE, a province of the kingdom of Naples, fituated on the gulf of Venice, and having the province of Molife on the north, and the Principate on the fouth.

CAPITANIA, in geography, an appellation given to the twelve governments eftablifhed by the Portuguefe in the Brafils.

CAPITATION, a tax or impofition raifed on each perfon in confideration of his labour, induftry, office, rank, *&c.* It is a very ancient kind of tribute. The Latins call it *tributum*, by which taxes on perfons are diftinguifhed from taxes on merchandife, which were called *vectigalia*.

Capitations are never practifed among us but in exigencies of ftate. In France, the capitation was introduced by Lewis XIV. in 1695, and is a tax very different from the taille, being levied from all perfons whether they be fubject to the taille or not. The clergy pay no capitation, but the princes of the blood are not exempted from it.

CAPITOL, in antiquity, a caftle on the Mons Capitolinus at Rome, where there was a temple dedicated to Jupiter, in which the fenate anciently affembled. The capitol confifted of three parts; a nave, facred to Jupiter; and two wings, the one confecrated to Juno, and the other to Minerva: It was afcended to by ftairs; the frontifpiece and fides were furrounded with galleries, in which thofe who were honoured with triumphs entertained the fenate at a magnificent banquet, after the facrifices had been offered to the gods.

Both the infide and outfide were enriched with infinite ornaments, the moft diftinguifhed of which was the ftatue of Jupiter, with his golden thunder-bolt, his fceptre, and crown. In the capitol alfo were a temple to Jupiter the guardian, and another to Juno, with the mint; and on the defcent of the hill was the temple of Concord.

This beautiful edifice contained the moft facred depofits of religion, fuch as the ancylia, the books of the fybils, *&c.*

CAPITOLINE *games*, annual games inftituted by Camillus, in honour of Jupiter Capitolinus, and in commemoration of the capitol's not being taken by the Gauls. Plutarch tells us, that a part of the ceremony confifted in the public crier's putting up the Hetrurians to fale by auction: They alfo took an old man, and, tying a golden bulla about his neck, expofed him to the public derifion. Feftus fays, they alfo dreffed him in a prætexta. There was another kind of capitoline games, inftituted by Domitian, wherein there were rewards and crowns beftowed on the poets, champions, orators, hiftorians, and muficians. Thefe laft capitoline games were celebrated every five years, and became fo famous, that inftead of calculating time by luftra, they began to count by capitoline games, as the Greeks did by olympiads. It appears, however, that this cuftom was not of long continuance.

CAPITOUL, an appellation given to the chief magiftrates of Tholoufe, on account of their meeting in a place called the Capitol: They are eight in number, are chofen annually, and have each the government of a capitoulate, or precinct, like the wards of London.

CAPITULATION, in military affairs, a treaty made between the garrifon or inhabitants of a place befieged, and the befiegers, for the delivering up the place on certain conditions.

The moft honourable and ordinary terms of capitulation are, to march out at the breach, with arms and baggage, drums beating, colours flying, a match lighted at both ends, and fome pieces of cannon, waggons and convoys for their baggage, and for the fick and wounded.

CAPITULATION, in the German polity, a contract which the emperor makes with the electors, in the name of all the princes and ftates of the empire, before he is declared emperor, and which he ratifies before

fore he is raifed to that fovereign dignity. The principal points which the emperor undertakes to obferve, are, 1. To defend the church and the empire. 2. To obferve the fundamental laws of the empire. And, 3. To maintain and preferve the rights, privileges, and immunities of the electors, princes, and other ftates of the empire, fpecified in the capitulation. Thefe articles and capitulations are prefented to the emperor by the electors only, without the concurrence of the other ftates, who have complained from time to time of fuch proceedings; and in the time of the Weftphalian treaty, in 1648, it was propofed to deliberate in the following diet, upon a way of making a perpetual capitulation; but the electors have always found means of eluding the execution of this article. In order however to give fome fatisfaction to their adverfaries, they have inferted in the capitulations of the emperors, and in that of Francis I. in particular, a promife to ufe all their influence to bring the affair of a perpetual capitulation to a conclufion. Some German authors own, that this capitulation limits the emperor's power; but maintain that it does not weaken his fovereignty: Though the moft part maintain, that he is not abfolute, becaufe he receives the empire under conditions which fet bounds to an abfolute authority.

CAPNOIDES, in botany, the trivial name of a fpecies of fumaria. See FUMARIA.

CAPON, a cock-chicken, gelded as foon as left by the dam, or as foon as he begins to crow. They are of ufe either to lead chickens, ducklings, pheafants, *&c.* and defend them from the kites and buzzards; or to feed for the table, they being reckoned more delicate than either a cock or a hen.

CAPPACIA, a town of the hither principate, in the kingdom of Naples. It is a bifhop's fee, and fituated about fifty-five miles fouth-eaft of the city of Naples: E. long. 15° 20′, and N. lat. 40° 40′.

CAPPARIS, in botany, a genus of the polyandria monogynia clafs. The calix confifts of four coriaceous leaves; the corolla has four petals; the ftamina are long; and the capfule is flefhy within, unilocular, and fupported by a pedunculus. There are ten fpecies, none of which are natives of Britain

CAPRA, or GOAT, a genus of quadrupeds belonging to the order of pecora. The horns are hollow, turned upwards, erect, and fcabrous. There are eight fore-teeth in the under jaw, and none in the upper; and they have no dog-teeth. This genus confifts of twelve fpecies, *viz.*

1. The hircus, or common goat, with arched carinated horns, and a long beard. The goat of Angora is only a variety of this fpecies; its hair is white, and hangs down to the feet; and the ears are plain and pendent. The common goat is a native of the eaftern mountains. See Plate LXIII.

The goat is an animal of more fagacity than the fheep. Inftead of having an antipathy at mankind, they voluntarily mingle with them, and are eafily tamed. Even in uninhabited countries, they betray no favage difpofitions. In the year 1698, an Englifh veffel having put in to the ifland of Bonovifta, two negroes came aboard, and offered gratis to the captain as many goats as he pleafed. The captain expreffed his aftonifhment at this offer. But the negroes replied, that there were only twelve perfons in the ifland; that the goats had multiplied to fuch a degree, that they were become extremely troublefome; and that, inftead of having any difficulty in catching them, they followed the men where-ever they went, and were fo obftinately officious, that they could not get quit of them upon any account whatever.

Goats are fenfible of careffes, and capable of a confiderable degree of friendfhip. They are ftronger, more agile, and lefs timid than fheep. They have a lively, capricious, and wandering difpofition; are fond of high and folitary places; and frequently fleep upon the very points of rocks. They are more eafily fupported than any other animal of the fame fize; for there is hardly an herb or the bark of a tree, which they will not eat with pleafure. Neither are they liable to fo many difeafes as fheep: They can bear heat and cold with lefs inconvenience. The actions and movements of animals depend more upon the force and variety of their fenfations, than the ftructure of their bodies: The natural inconftancy or fancifulnefs of goats is accordingly expreffed by the irregularity of their actions: They walk, ftop fhort, run, jump, fhew, and hide themfelves, as it were by mere caprice, and without any other caufe than what arifes from the natural vivacity of their temper.

The buck will copulate when he is a year old, and the female when fhe is feven months. But as this is rather premature, they are generally reftrained till they be eighteen months or two years. The buck is bald, beautiful, and vigorous; one is fufficient to ferve 150 females. A buck for propagation fhould be large, handfome, and about two years of age; his neck fhould be fhort, and flefhy; his head flender; his ears pendent; his thighs thick; his limbs firm; his hair black, thick, and foft; and his beard fhould be long, and bufhy. The females are generally in feafon from September to the end of November. The time of going with young is five months. They generally produce one kid, fometimes two, feldom three, and never more than four; and continue fruitful till they be feven years of age: But a buck is feldom kept after he is five.

Goat's flefh is not fo good as mutton: The rank fmell of the buck does not proceed from the flefh, but from the fkin.

The food of this animal cofts next to nothing, as it lives moftly upon fuch plants as are rejected by other cattle, and can fupport itfelf even upon the moft barren mountains. But their produce is valuable. Cheefe is made of their milk, which befides is reckoned good in confumptions, and other difeafes. Their flefh, tallow, hair, and hides, are all ufeful and faleable commodities.

2. The ibex, has large knotty horns reclined upon its back, is of a yellowifh colour, and its beard is black. This fpecies is a native of Crete; and is likewife to be met with in the mountains of fome of the northern parts of Europe.

3. The

Plate LXIII.

A. Bell Sculp.t

3. The mambrica, with reclined horns, about the length of the neck, pendent ears, and a beard. It is a native of India.

4. The rupicapra, or ſhamoy-goat, has erect and hooked horns. It inhabits the inacceſſible mountains of Switzerland. The body is of a duſky red colour; but the front, top of the head, gullet, and inſide of the ears are white; the under part of the tail is blackiſh; and the upper lip is a little divided. They ſeldom deſcend from the mountains but in hard winters, when they come down to feed upon the branches and barks of fir-trees, *&c.* On occaſions of this kind, one of the herd always keeps watch to give notice to the reſt of any approaching danger.

5. The depreſſa, is an American goat, with ſmall depreſſed horns, bent inwards and lying upon the head. It is about the ſize of a kid; and the hair is long and pendulous.

6. The reverſa, is likewiſe an American goat, with erect horns curved back at the points. It is about the ſize of a kid of a year old.

7. The gazella, is an Indian goat, with long, erect, cylindrical horns, annulated near the baſe.

8. The cervicapra, is likewiſe an Indian goat, with plaited, cylindrical horns. The hair near the horns is longer than in any other part of the body.

9. The Bezoartica, or Bezoar-goat, is bearded, and has cylindrical, arched, and wholly annulated horns. It is a native of Perſia. The bezoar is found in one of the ſtomachs called *abomaſus*. See BEZOAR.

10. The dorcas, or antelope, has cylindrical, annulated horns, bent backward, contorted, and ariſing from the front between they eyes. It is a native of Africa and Mexico.

11. The tartarica, has cylindrical, ſtrait, annulated horns, diaphonous at the points. It has no beard, and is found in the northern parts of Aſia.

12. The ammon, has ſemicircular, plain, white horns, and no beard. It is about the ſize of a ram, and is a native of Siberia.

CAPRAIA, an iſland on the coaſt of Tuſcany, about thirty miles ſouth-weſt of Leghorn: E. long. 11°, and N. lat. 43° 15′.

CAPRARIA, in botany, a genus of the didynamia angioſpermia claſs. The calix is divided into five ſegments; the corolla is bell ſhaped, and divided into five parts; the capſule has two valves, and contains many ſeeds. There are three ſpecies, none of them natives of Britain.

CAPRAROLA, a town of St Peter's patrimony in Italy, about twenty miles north of the city of Rome, and eight ſouth of Viterbo: E. long. 13°, and N. lat. 42° 30′.—It is a biſhop's ſee.

CAPRI, or CAPREA, a city and iſland at the entrance of the gulf of Naples, about twenty miles ſouth of that city: E. long. 14° 50′, and N. lat. 40° 45′.

The iſland is only four miles long, and one broad; the city is a biſhop's ſee, ſituated on a high rock, at the weſt end of the iſland.

CAPRICORN, in zoology. See MORDELLA.

CAPRICORN-*beetle*. See CERAMBYX.

CAPRICORN, in aſtronomy, one of the twelve ſigns of the zodiac.

Tropic of CAPRICORN, a leſſer circle of the ſphere, which is parallel to the equinoxial, and at 23° 30′ diſtance from it ſouthwards.

CAPRIFICATION, a method uſed in the Levant, for ripening the fruit of the domeſtic fig-tree, by means of inſects bred in that of the wild fig-tree.

It is ſaid, that theſe figs will never come to maturity, unleſs wounded by the inſects depoſiting their eggs. Poſſibly the reaſon of this effect, may be their lacerating the veſſels of the fruit, and thereby deriving thither a greater quantity of nutricious juice.

Plumbs and pears, wounded in the ſame manner, are found to ripen ſooneſt, and the pulp about the wound has a more exquiſite taſte than the reſt.

CAPRIFICUS, in botany. See FICUS.

CAPRIFOLIUM, in botany. See LONICERA.

CAPRIMULGUS, GOAT-SUCKER, or FERN-OWL, in ornithology, a genus of birds belonging to the order of paſſeres. The beak is incurvated, ſmall, tapering, and depreſſed at the baſe; the hairs at the mouth, which it opens very wide, are placed in a row. There are two ſpecies, *viz.* the Europæus, with the tubes of the noſtrils hardly viſible. It is a native of Europe, and feeds upon moths and nocturnal inſects. This bird is ſaid to ſuck goats in the night. 2. The Americacanus, has the tubes of the noſtrils very conſpicuous. This is a night-bird, and is found in America.

CAPRIOLES, in the menage, leaps that a horſe makes in the ſame place, without advancing, in ſuch a manner, that when he is at the height of the leap, he jerks out with his hinder legs even and near. It is the moſt difficult of all the high menage. It differs from a croupade in this, that in a croupade the horſe does not ſhew his ſhoes; and from a ballotade, becauſe in this he does not jerk out. To make a horſe work well at caprioles, he muſt be put between two pillars, and taught to raiſe firſt his fore-quarters, and then his hind-quarters, while his fore are yet in the air, for which end you muſt give the whip and the poinſon.

CAPSICUM, or GUINEA-PEPPER, a genus of the pentandria monogynia claſs. The corolla is rotated, and the berry wants juice. There are two ſpecies, both natives of the Indies. The ſeeds are uſed in ſauces and pickles.

CAPSQUARES, in gunnery, ſtrong plates of iron which come over the trunnions of a gun, and keep it in the carriage.

They are faſtened by a hinge to the prize-plate, that they may lift up and down, and form a part of an arch in the middle to receive a third part of the thickneſs of the trunnions; for two thirds are let into the carriage, and the other end is faſtened by two iron wedges, called the fore-locks and keys.

CAPSTAN, or MAIN CAPSTAN, in a ſhip, a great piece of timber in the nature of a windlaſs, placed next behind the main-maſt, its foot ſtanding in a ſtep on the lower deck, and its head between the upper decks; formed into ſeveral ſquares with holes in them. Its

ufe is to weigh the anchors, to hoife up or ftrike down top-mafts, to heave any weighty matter, or to ftrain any rope that requireth a main force.

Jear CAPSTAIN is placed between the main-maft and the mizen, and ferves to ftrain any rope, heave up on the jear rope or upon the viol, or hold off by at the weighing of an anchor.

CAPSTAN-*bars*, the pieces of wood that are put into the capftan-holes, to heave up any thing of weight into the fhip.

Pawl of a CAPSTAN, a fhort piece of iron made faft to the deck, and refting upon the whelps, to keep the capftan from recoiling, which is of dangerous confequence.

Whelps of a CAPSTAN are fhort pieces of wood, made faft to it, to keep the cable from coming too nigh, in turning it about.

Pawling the CAPSTAN, is ftopping it from turning by means of the pawl.

Come up CAPSTAN, or *launch out the* CAPSTAN, that is, flacken the cable which you heave by.

CAPSULE, in a general fenfe, denotes a receptacle, or cover in form of a bag.

CAPSULE, among botanifts, a fpecies of pericarpium, or feed-veffel, compofed of feveral dry elaftic valves, which ufually burft open at the points, when their feeds are ripe: It differs from a pod, in being roundifh and fhort. This kind of pericarpium fometimes contains one cell or cavity, fometimes more: In the firft cafe it is called unilocular, as it is bilocular, trilocular, *&c.* when it contains two, three, *&c.* cells or cavities.

CAPSULÆ *atrabiliariæ*, called alfo *glandulæ renales*, and *renes fuccenturiati*. See p. 269.

CAPTAIN, a military officer, whereof there are various kinds, according to their commands.

CAPTAIN *of a troop or company*, an inferior officer, who commands a troop of horfe, or company of foot, under a colonel. In the fame fenfe we fay, captain of dragoons, of grenadiers, of marines, of invalids, *&c.*

In the horfe and foot guards, the captains have the rank of colonels.

CAPTAIN *general*, he who commands in chief.

CAPTAIN *lieutenant*, he who with the rank of captain, but the pay of lieutenant, commands a troop or company in the name and place of fome other perfon who is difpenfed with on account of his quality from performing the functions of his poft.

Thus the colonel, being ufually captain of the firft company of his regiment; that company is commanded by his deputy, under the title of captain-lieutenant.

So in England, as well as in France, the king, queen, dauphin, princes, *&c.* have ufually the title of captains of the guards, *gens d' armes*, &c. the real duty of which offices is performed by captain-lieutenants.

CAPTAIN *reformed*, one who, upon the reduction of the forces, has his commiffion and company fuppreffed; yet is continued captain, either as fecond to another, or without any poft or command at all.

CAPTAIN *of militia*, he who commands a company of the militia, or trained bands. See MILITIA.

CAPTAIN *of a fhip of war*, the commanding officer of a fhip, galley, fire-fhip, or the like. This officer ranks with a colonel in the land-fervice.

CAPTAIN *of a merchant fhip*, he who has the direction of the fhip, her crew, and lading, *&c.* In fmall fhips and fhort voyages, he is more ordinarily called the mafter. In the mediterranean, he is called the patroon.

The proprietor of the veffel appoints the captain or mafter, and he is to form the crew, and chufe and hire the pilots, mates, and feamen; though, when the proprietor and mafter refide on the fame fpot, they generally act in concert together.

CAPTAIN BASHAW, or CAPONDAN BASHAW, in the polity of the Turks, fignifies the Turkifh high admiral. He poffeffes the third office of the empire, and is invefted with the fame power at fea that the vizir has on fhore. Soliman II. inftituted this office in favour of the famous Barbaroffa, with abfolute authority over the officers of the marine and arfenal, whom he may punifh, cafhier, or put to death, as foon as he is without the Dardanelles. He commands in chief in all the maritime countries, cities, caftles, *&c.* and, at Conftantinople, is the firft magiftrate of police in the villages on the fide of the Porte, and the canal of the Black-fea. The mark of his authority is a large Indian cane, which he carries in his hand, both in the arfenal and with the army.

The captain-bafhaw enjoys two forts of revenues; the one fixed, the other cafual. The firft arife from a capitation of the iflands in the Archipelago, and certain governments in Natolia and Galipoli. The latter confift in the pay of the men who die during a campaign; in a fifth of all prizes made by the begs; in the profits accruing from the labour of the flaves, whom he hires as rowers to the grand fignior; and in the contributions he exacts in all places where he paffes.

CAPTION, in Scots law, a writ iffuing under his majefty's fignet, in his majefty's name, obtained at the inftance of a creditor in a civil debt, commanding meffengers at arms and other officers of the law to apprehend and imprifon the perfon of the debtor until he pay the debt. See SCOTS LAW, title, *Sentences and their execution*.

CAPTIVITY, a punifhment which God inflicted upon his people for their vices and infidelities. The firft of thefe captivities is that of Egypt, from which Mofes delivered them; after which, are reckoned fix during the government of the judges; but the greateft and moft remarkable, were thofe of Judah and Ifrael, which happened under the kings of each of thefe kingdoms. It is generally believed, that the ten tribes of Ifrael never came back again after their difperfion; and Jofephus and St Jerom are of this opinion: neverthelefs, when we examine the writings of the prophets, we find the return of Ifrael from captivity pointed out in a manner almoft as clear as that of the tribes of Benjamin and Judah. See Hofea i. 10. xi. 12. Amos ix. 14. Ifaiah xi. 13, 14. Ezekiel xxxvii. 16, *&c.*

The captivities of Judah are generally reckoned four; the fourth and laſt of which fell in the year of the world 3416, under Zedekiah; and from this period begins the ſeventy years captivity, foretold by Jeremiah.

Since the deſtruction of the temple by the Romans, the Hebrews boaſt, that they have always had their heads, or particular princes, whom they call princes of the captivity, in the eaſt and weſt. The princes of the captivity in the eaſt governed the Jews who dwelt at Babylon, in Chaldea, Aſſyria, and Perſia; and the prince of the captivity in the weſt governed thoſe who dwelt in Judea, Egypt, Italy, and in other parts of the Roman empire. He who reſided in Judæa, took up his abode commonly at Tiberias, and aſſumed the title of Roſchabboth, head of the fathers or patriarchs. He preſided in aſſemblies, decided in caſes of conſcience, levied taxes for the expences of his viſits, and had officers under him, who were diſpatched through the provinces, for the execution of his orders. As to the princes of the captivity of Babylon, or the eaſt, we know neither the original nor ſucceſſion of them; it appears only, that they were not in being before the end of the ſecond century.

CAPTURE ſignifies, particularly, prizes taken by privateers in time of war.

CAPUA, a city of the province of Lavoro, in the kingdom of Naples, ſituated on the river Volturno, about fifteen miles north-weſt of the city of Naples: E. long. 15°, and N. lat. 41° 20′.

It is the ſee of an archbiſhop.

CAPUCHINS, in the church of Rome. See FRANCISCANS.

CAPUT *mortuum*, in chemiſtry, that thick dry matter which remains after diſtillation of any thing, but of minerals eſpecially.

CAPY-BARA, in zoology. See SUS.

CARABINE, a fire-arm, ſhorter than a muſket, carrying a ball of twenty-four in the pound, borne by the light-horſe, hanging at a belt over the left ſhoulder.

The barrel is two feet and a half long, and is ſometimes furrowed ſpirally within, which is ſaid to add to the range of the piece.

CARABINEERS, or CARABINIERS, regiments of light horſe, carrying longer carabines than the reſt, and uſed ſometimes on foot.

CARABUS, in zoology, a genus of inſects belonging to the order of inſecta coleoptera. The feelers are briſtly; the breaſt is ſhaped like a heart, and marginated; and the elytra are likewiſe marginated. There are 43 ſpecies of this genus, moſtly diſtinguiſhed by their colour.

CARACATY, a large country in the north of Aſia, extending from the wall of China to the ancient Mogoliſtan.

CARACOL, in the menage, the half turn which a horſeman makes, either to the right or left.

In the army, the horſe always make a caracol after each diſcharge, in order to paſs to the rear of the ſquadron.

CARACOL, in architecture, denotes a ſtair-caſe in a helix or ſpiral form.

CARACOLI, a kind of metal, of which the Caribbees, or natives of the Leſſer Antilles, make a ſort of ornament in the form of a creſcent, which they alſo call caracoli.

This metal comes from the main land; and the common opinion is, that it is a compound of ſilver, copper, and gold, ſomething like the Corinthian braſs among the ancients. Theſe metals are ſo perfectly mixed and incorporated together, that the compound which reſults from them, it is ſaid, has a colour that never alters, how long ſoever it remains in the ſea, or under ground. It is ſomething brittle, and they who work at it, are obliged to mix a large proportion of gold with it, to make the compound more tough and malleable.

CARACT, CARAT, or CARRAT, the name of that weight which expreſſes the degree of fineneſs that gold is of.

The mint-maſter, or cuſtom, have fixed the purity of gold at 24 caracts; though it is not poſſible ſo to purify and refine that metal, but it will want ſtill about one fourth part of a caract in abſolute purity and perfection. The caract is divided into $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, and $\frac{1}{32}$. Theſe degrees ſerve to diſtinguiſh the greater or leſſer quantity of alloy therein contained; for inſtance, gold of 22 caracts, is that which has two parts of ſilver, or of any other metal, and 22 of fine gold.

CARACT is alſo a certain weight which goldſmiths and jewelers uſe wherewith to weigh precious ſtones and pearls.

This caract weighs four grains, but ſomething lighter than the grains of other weights. Each of theſe grains is ſubdivided into $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, *&c.*

CARAGROUTH, in commerce, a ſilver-coin of the empire, weighing nine drachms. It goes at Conſtantinople for 120 aſpers. There are four ſorts of them, which are all equally current, and of the ſame value.

CARAGUATA, in botany. See TILLANDSIA.

CARAITES, in the eccleſiaſtical hiſtory of the Jews, a religious ſect among that people, who adhere cloſely to the text and letter of the ſcriptures, rejecting the rabbinical interpretations, and the cabbala. The Caraites paſs for the moſt learned of the Jewiſh doctors; they are chiefly to be met with in Poland, Muſcovy, and the eaſt: they are but few in compariſon of the bulk of the Jews, who are of the party of the rabbins: the latter have ſo great an averſion for the Caraites, that they will have no alliance, nor even converſation with them: they treat them as baſtards; and if a caraite would turn rabbiniſt, the other Jews would not receive him.

CARAMANIA, a province of Natolia, in Aſia, ſituated on the Mediterranean ſea, oppoſite to the iſland of Cyprus.

CARAMANICO, a large well-peopled town of the kingdom of Naples, in the hither Abruzzo.

CARAMANTA, the name of a province of South America, bordered on the north by the diſtrict of Carthagena;

thagena; on the east, by New Grenada; and on the south and west, by Popayan.

CARAMANTA is also the name of the capital of that province, situated in 5° 18′ N. lat.

CARANNA, a resinous substance brought from New Spain in little masses rolled up in leaves of flags. It is rarely kept in the shops, and is rejected by the catalogue of the London college, though it is still retained in the Edinburgh.

CARAPO, in ichthyology, the trivial name of a species of gymnotus. See GYMNOTUS.

CARAVAN, or CARAVANNE, in the east, signifies a company or assembly of travellers and pilgrims, and more particularly of merchants, who, for their greater security, and in order to assist each other, march in a body through the desarts, and other dangerous places, which are infested with Arabs or robbers.

There is a chief, or aga, who commands the caravan, and is attended by a certain number of janizaries, or other militia, according to the countries from whence the caravans set out; which number of soldiers must be sufficient to defend them and conduct them with safety to the places for which they are designed, and on a day appointed. The caravan encamps every evening near such wells or brooks, as their guides are acquainted with; and there is a strict discipline observed upon this occasion, as in armies in time of war. Their beasts of burden are partly horses, but most commonly camels, who are capable of undergoing a very great fatigue.

CARAVANSERA, or KARAVANSERA, a place appointed for receiving and loading the caravans.

It is commonly a large square building, in the middle of which there is a very spacious court; and under the arches or piazzas that surround it there runs a bank, raised some feet above the ground, where the merchants, and those who travel with them in any capacity, take up their lodgings as well as they can; the beasts of burden being tied to the foot of the bank. Over the gates, that lead into the court, there are sometimes little rooms, which the keepers of the caravanseras let out at a very high price to such as have a mind to be private.

The caravanseras in the east are something in the nature of the inns in Europe, only that you meet with little accommodation either for man or beast, but are obliged to carry almost every thing with you: there is never a caravansera without a well, or spring of water. These buildings are chiefly owing to the charity of the Mahometans; they are esteemed sacred dwellings, where it is not permitted to insult any person, or to pillage any of the effects that are deposited there. They even carry their precautions so far, as not to suffer any man who is not married to lodge there; because they are of opinion, that a man who has no wife is more dangerous than another.

CARAVANSERASKIER, the steward, or keeper of a caravansera.

He keeps an account of all the merchandises that are sold upon trust, and demands the payments of the sums due to the merchants for what has been sold in the caravansera, on the seller's paying two *per cent*.

CARAWAY, in botany. See CARUM.

CARBUNCLE, in natural history, a very elegant gem, whose colour is deep red, with an admixture of scarlet.

This gem was known among the ancients by the name of anthrax. It is usually found pure and faultless, and is of the same degree of hardness with the sapphire: it is naturally of an angular figure, and is found adhering, by its base, to a heavy and ferrugineous stone of the emery kind: its usual size is near a quarter of an inch in length, and two thirds of that in diameter in its thickest parts: when held up against the sun, its loses its deep tinge, and becomes exactly of the colour of a burning charcoal, whence the propriety of the name which the ancients gave it. It bears the fire unaltered, not parting with its colour, nor becoming at all the paler by it. It is only found in the East Indies, so far as is yet known, and there but very rarely.

CARBUNCLE, or ANTHRAX, in surgery, an inflammation which arises, in time of the plague, with a vesicle or blister almost like those produced by burning.

CARBUNCLE, in heraldry, a charge or bearing, consisting of eight radii, four whereof make a common cross, and the other four a saltier.

Some call these radii buttons, or staves, because round, and enriched with buttons, or pearled like pilgrims staves, and frequently tipped or terminated with flower-de-luces; others blazon them, royal sceptres, placed in saltier, pale and fesse.

CARCHARIAS, in ichthyology. See SQUALUS.

CARCASSE, or CARCUSS, in the art of war, an iron-case, or hollow capacity, about the bigness of a bomb, of an oval figure, made of ribs of iron, filled with combustible matters, as meal-powder, saltpetre, sulphur, broken glass, shavings of horns, turpentine, tallow, *&c.*; the design of it is to be thrown out of a mortar to set houses on fire, and do other execution. It has two or three apertures through which the fire is to blaze.

CARCASSONE, a town of Languedoc, in France, situated on the river Ande, about twenty-five miles west of Narbonne: E. long. 2°, and N. lat. 43° 20′. It is a bishop's see.

CARCERES, in the ancient Circensian games, were inclosures, in the circus, wherein the horses were restrained till the signal was given for starting, when, by an admirable contrivance, they all at once flew open.

CARCINOMA. See CANKER.

CARD, among artificers, an instrument consisting of a block of wood, beset with sharp teeth, serving to arrange the hairs of wool, flax, hemp, and the like: there are different kinds of them, as hand-cards, stock-cards, *&c.*

CARDS, among gamesters, little pieces of fine thin pasteboard of an oblong figure, of several sizes, but most commonly in England three inches and an half long, and two and an half broad, on which are painted several points and figures.

The

The moulds and blocks for making cards, are exactly like thofe that were ufed for the firft books: they lay a fheet of wet or moift paper on the block, which is firft flightly done over with a fort of ink made with lamp-black diluted in water, and mixed with fome ftarch to give it a body. They afterwards rub it off with a round lift. The court-cards are coloured by means of feveral patterns, ftyled *ftane-files*. Thefe confift of papers cut through with a pen-knife, and in thefe apertures they apply feverally the various colours, as red, black, &c. Thefe patterns are painted with oil-colours, that the brufhes may not wear them out; and when the pattern is laid on the pafteboard, they flightly pafs over it a brufh full of colour, which, leaving it within the openings, forms the face or figure of the card.

Cards, upon fufficient fecurity, may be exported without payment of the ftamp-duty; but for every pack fold without the label of the ftamp-office, in England, there is a penalty of 10 l.

CARDAMINDUM, in botany. See TROPÆOLUM.

CARDAMINE, LADY'S SMOCK, in botany, a genus of the tetradynamia filiquofa clafs. The pod opens with a fpring, and the valves are revoluted: The ftigma is entire; and the calix gapes a little. There are fifteen fpecies, feven of which are natives of Britain, *viz.* the bellidifolia, or daify-leaved lady's-fmock; the petræa, or mountain lady's-fmock; the pratenfis, or common lady's-fmock; the amara, bitter creffes, or lady's-fmock; the impatiens, or impatient lady's-fmock; the parviflora, or fmall-flowered lady's-fmock; and the hirfuta, or hairy lady's-fmock.

CARDAMOM, in materia medica, the feeds of a fpecies of amomum. They are diftinguifhed into the leffer and greater. The greater cardamom is a dried fruit or pod containing two rows of fmall triangular feeds of a warm aromatic flavour. The leffer is about half the fize of the former, and the feeds are confiderably ftronger both in fmell and tafte. Hence this fort is the only one now ufed as a medicine. The feeds are warm, grateful, pungent, aromatic, and frequently employed as fuch in practice.

CARDIAC, an appellation given to fuch medicines as are fuppofed to preferve or increafe the ftrength of the heart.

CARDIACA, in botany. See LEONURUS.

CARDIALGIA, the HEART-BURN, in medicine, a diforder of the ftomach attended with anxiety, a naufea, and often a reaching or actual vomiting. See MEDICINE.

CARDIFF, a borough-town of Glamorganfhire, in fouth Wales, fituated on the river Tave, about two miles fouth-eaft of Landaff: W. long. 3° 20′, N. lat. 51° 30′. It fends only one member to parliament.

CARDIGAN, the capital of Cardiganfhire, near the mouth of the river Tivy and the Irifh channel, about thirty miles north of Pembroke: W. long. 4° 40, N. lat. 52° 15′. It gives the title of earl to the noble family of Brudenel, and fends only one member to parliament.

CARDINAL, in a general fenfe, an appellation given to things on account of their preheminence: thus we fay, cardinal virtues, &c.

CARDINAL SIGNS in the zodiac, are Aries, Libra, Cancer, and Capricorn.

CARDINAL, more particularly fignifies an ecclefiaftical prince in the Romifh church, being one who has a voice in the conclave at the election of a pope. The cardinals were originally nothing more than deacons, to whom was intrufted the care of diftributing the alms to the poor of the feveral quarters of Rome; and as they held affemblies of the poor in certain churches of their feveral diftricts, they took the title of thefe churches. They began to be called cardinals in the year 300, during the pontificate of St Sylvefter, by which appellation was meant the chief priefts of a parifh, and next in dignity to a bifhop. This office grew more confiderable afterwards, and by fmall degrees arrived at its prefent height, in which it is the reward of fuch as have ferved his holinefs well, even princes thinking it no diminution of their honour to become members of the college of cardinals.

The cardinals compofe the pope's council, and till the time of Urban VIII. were ftyled *moft illuftrious*; but by a decree of that pope in 1630, they had the title of *eminence* conferred upon them.

At the creation of a new cardinal, the pope performs the ceremony of fhutting and opening his mouth, which is done in a private confiftory. The fhutting his mouth, implies the depriving him of the liberty of giving his opinion in congregations; and the opening his mouth, which is performed fifteen days after, fignifies the taking off this reftraint. However, if the pope happens to die during the time a cardinal's mouth is fhut, he can neither give his voice in the election of a new pope, nor be himfelf advanced to that dignity.

The cardinals are divided into fix claffes or orders, confifting of fix bifhops, fifty priefts, and fourteen deacons, making in all feventy; which conftitute the facred college. The number of cardinal-bifhops has very feldom been changed, but that of priefts and deacons have varied at different times.

The privileges of the cardinals are very great: They have an abfolute power in the church during the vacancy of the holy fee: They have a right to elect the new pope, and are the only perfons on whom the choice can fall: Moft of the grand offices in the court of Rome are filled by cardinals. The drefs of a cardinal is a red foutanne, a rochet, a fhort purple mantle, and the red hat. When they are fent to the courts of princes, it is in quality of legates *a latere*; and when they are appointed governors of towns, their government is called by the name of legation.

CARDINAL is alfo a title given to fome bifhops, as thofe of Mentz and Milan, to the archbifhop of Bourges; and the abbot of Vendome calls himfelf cardinalis natus.

CARDINAL'S FLOWER. See RAPUNTIUM.

CARDIOID, in the higher geometry, an algebraical curve, fo called from its refemblance to a heart.

CARDIOSPERMUM, in botany, a genus of the octandria trigynia clafs. The calix has four leaves; there are four petals; an unequal four-leaved nectarium; and there are three inflated capfules. There are two fpecies, both natives of the Indies.

CARDIUM, in zoology, a genus of infects belonging to the order of vermes teftacea. The fhell confifts of two equal valves, and the fides are equal. There are 21 fpecies of this genus.

CARDONNA, a city of Catalonia, in Spain, fituated on a river of the fame name, about forty miles northweft of Barcelona: E. long. 1° 20′, N. lat. 41° 35′.

CARDUEL, a province of Georgia, in Afia, lying between the Cafpian and Euxine feas, the capital whereof is Teflis. It belongs partly to the Turks, and partly to the Perfians.

CARDUELIS, in ornithology, a fynonime of a fpecies of fringilla. See FRINGILLA.

CARDUUS, in botany, a genus of the fyngenefia polygamia æqualis clafs. The calix is ovated, and imbricated with fpinous fcales; and the receptacle is hairy. There are 26 fpecies, ten of which are natives of Britain, *viz.* the lanceolatus, or fpear-thiftle; the nutans, or mufk-thiftle; the acanthoides, or welted-thiftle; the crifpus, or thiftle upon-thiftle; the paluftris, or marfh-thiftle; the diffectus, or Englifh foft thiftle; the helenioides, or melancholy thiftle; the marianus, or milk-thiftle; and the acaulos, or dwarf carline-thiftle.

CAREENING, in the fea-language, the bringing a fhip to lie down on one fide, in order to trim and caulk the other fide.

A fhip is faid to be brought to the careen, when the moft of her lading being taken out, fhe is halled down on one fide by a fmall veffel as low as neceffary; and there kept by the weight of the ballaft, ordnance, *&c.* as well as by ropes, left her mafts fhould be ftrained too much; in order that her fides and bottom may be trimmed, feams caulked, or any thing that is faulty under water mended. Hence when a fhip lies on one fide when fhe fails, fhe is faid to fail on the careen.

CARELIA, in geography, a province of Finland, bounded by the province of Savolaxia on the north, and by the gulph of Finland on the fouth. It is fubject to Ruffia.

CARELSCROON, a port-town of the province of Gothland, in Sweden, fituated on the coaft of the Baltic: E. long. 15°, and N. lat. 56° 20′.

It is an excellent harbour, where the Swedes lay up their royal navy.

CARENTAN, a town of Normandy, in France, fituated at the mouth of a river of the fame name: W. long. 1° 15′, and N. lat. 49° 20′.

CARET, among grammarians, a character marked thus ^, fignifying that fomething is added on the margin, or interlined, which ought to have come in where the caret ftands.

CARETTA, in zoology, the trivial name of a fpecies of teftudo. See TESTUDO.

CAREX, in botany, a genus of the monœcia triandria clafs. The amentum of the male is imbricated; it has no corolla; and the calix confifts of one leaf. The amentum of the female is likewife imbricated; the corolla is wanting; and the calix confifts of one leaf; the nectarium is inflated and three-teethed; there are three ftigmata; and the feeds are triangular and contained within the nectarium. There are 37 fpecies, 26 of which are natives of Britain.

CARGADORS, a name which the Dutch give to thofe brokers, whofe bufinefs is to find freight for fhips outward bound, and to give notice to the merchants, who have commodities to fend by fea, of the fhips that are ready to fail, and of the places for which they are bound.

CARGAPOL, or KARGAPOL, the capital of a territory of the fame name, in the province of Dwina, in Mufcovy: E. long. 36°, and N. lat. 63°.

CARGO denotes all the merchandifes and effects which are laden on board a fhip.

Super-CARGO, a perfon employed by merchants to go a voyage, and overfee the cargo, and difpofe of it to the beft advantage.

CARIAMA, in ornithology, a fynonime of the palamedea. See PALAMEDEA.

CARIBBE-ISLANDS, a clufter of iflands, fituated in the Atlantic ocean, between 59° and 63°, W. long. and between 11° and 18° N. lat. They belong partly to the Britifh, and partly to the French, Dutch, *&c.*

CARIBBIANA, or CARIBIANA, the north eaft coaft of Terra-firma, in fouth America, otherwife called New-Andalufia. See ANDALUSIA.

CARICA, in botany, a genus of the diœcia decandria clafs. The male has hardly any calix; the corolla is bell-fhaped, and divided into five fegments; the filaments are inferted into the tube of the corolla, and are alternately fhorter. The calix of the female has five teeth; the corolla confifts of five petals; there are five ftigmata; and the berry is unilocular, and contains many feeds.

CARICATURA, in painting, denotes the concealment of real beauties, and the exaggeration of blemifhes, but ftill fo as to preferve a refemblance of the object.

CARICOUS, an epithet given to fuch tumours as refemble the figure of a fig. They are frequently found in the piles.

CARIES, in furgery, the corruption or mortification of a bone. See SURGERY.

CARIGNAN, a fortified town of Piedmont, fituated on the river Po, about feven miles fouth of Turin: E. long. 7° 25′, and N. lat. 44° 30′.

CARIGUE, or CARIGUEYA, in zoology, a fynonime of a fpecies of didelphis. See DIDELPHIS.

CARINTHIA, a duchy in the circle of Auftria, in Germany, bounded by the archbifhopric of Saltzburg on the north, and by Carniola and the dominions of Venice on the fouth. It is fubject to the houfe of Auftria.

CARIONOLA, a city of the province of Lavoro, in the

the kingdom of Naples, about twenty miles north of the city of Naples: E. long. 15°, and N. lat. 41° 20′. It is a bifhop's fee.

CARIPI, a kind of cavalry in the Turkifh army.

The caripi, to the number of about one thoufand, are not flaves, nor bred up in the feraglio, like the reft, but are generally Moors, or renegado Chriftians, who, having followed adventures, and being poor, and having their fortune to feek by their dexterity and courage, have arrived to the rank of horfe-guards to the grand fignior.

CARISBROOK-CASTLE, a caftle fituated in the middle of the ifle of Wight, where king Charles I. was imprifoned: W. long. 1° 30′, and N. lat. 50° 40′.

CARKE denotes the thirtieth part of a farplar of wool. See SARPLAR.

CARLINA, or CARLINE THISTLE, in botany, a genus of the fyngenefia polygamia æqualis clafs. The calix is radiated, with long coloured fcales. There are feven fpecies, only one of which, *viz.* the vulgaris, is a native of Britain. The roots are faid to be diaphoritic and alexipharmic.

CARLINE, or CAROLINE, a filver coin, current in the Neapolitan dominions, and worth about four-pence of our money.

CARLINGFORD, a port-town of Ireland, in the county of Lowth, and province of Leinfter, about twenty-two miles north of Drogheda: W. long. 6° 23′, and N. lat. 54° 5′.

CARLINGS, or CARLINES, in a fhip, two pieces of timber, lying fore and aft, along from beam to beam, whereon the ledges reft on which the planks of the fhip are faftened. All the carlings have their ends let into the beams culvertail-wife: They are directly over the keel, and ferve as a foundation for the whole body of the fhip.

CARLISLE, the capital city of Cumberland, fituated near the mouth of the river Eden, and the Solway frith: W. long. 2° 30′, and N. lat. 54° 45′.

It is a bifhop's fee.

CARLOCK, in commerce, a fort of ifing-glafs made with the fturgeon's bladder, imported from Archangel. The chief ufe of it is for clarifying wine; but it is alfo ufed by dyers. The beft carlock comes from Aftracan, where a great quantity of fturgeon is caught.

CARLOWITZ, a town of Sclavonia, fituated on the weft fide of the Danube, about thirty-five miles north-weft of Belgrade: E. long. 20° 45′, and N. lat. 45° 25′.

CARLSTADT, the capital of Croatia, a frontier province of Chriftendom againft the Turks: E. long. 16°, and N. lat. 45° 5′. It is fubject to the houfe of Auftria.

CARLSTADT is alfo the name of a town in the bifhopric of Wurtfburg, in the circle of Franconia in Germany, fituated on the river Maine, about fourteen miles north of Wurtfburg: E. long. 9° 50′. and N. lat. 50°.

CARMAGNIOL, a fortified town of Piedmont, fituated on the river Po, about ten miles fouth of Turin: E. long. 7° 30′, and N. lat. 44° 45′.

CARMELITES, or WHITE FRIERS, are an order of our lady of Mount Carmel, making one of the four orders of mendicants. They pretend to derive their original from the prophets Elijah and Elifha. Their original rules contained fixteen articles, one of which confined them to their cells, and enjoined them to employ themfelves day and night in prayer; another prohibited the brethren having any property; another enjoined fafting, from the feaft of the exaltation of the holy crofs till Eafter, excepting on Sundays; abftinence at all times from flefh, was enjoined by another article; one obliged them to manual labour; another impofed a ftrict filence on them, from vefpers till the tierce the next day: However, thefe conftitutions have been in fome refpects altered.

This order is fo much increafed, that it has at prefent thirty-eight provinces, befides the congregation of Mantua (in which there are fifty-four monafteries, under a vicar-general) and the congregation of bare-footed Carmelites in Italy and Spain, which have their peculiar generals.

If a monk of this order lie with a woman, he is prohibited faying mafs for three or four years, is declared infamous, and obliged to difcipline himfelf publicly once a week: If he is again guilty of the fame offence, his penance is doubled: And if a third time, he is expelled to order.

CARMENTALIA, feafts celebrated by the Romans, in honour of the prophetefs Carmenta, the mother of Evander.

They were folemnized twice in the month of January, *viz.* on the 11th and 15th.

CARMINATIVES, in pharmacy, medicines ufed in colics, or other flatulent diforders, to difpel the wind.

The four carminative flowers are thofe of camomile, melilot, motherwort, and dill; befides, angelica, fennel, lovage, anife, caraway, coriander, cummin, &c. all agree in their carminative qualities, and are therefore ufed in compofitions of that intention.

CARMINE, a powder of a very beautiful red colour, bordering upon purple, and ufed by painters in miniature; though but rarely, becaufe of its great price.

It is extracted from cochineal, by means of water, wherein chouan and antour have been infufed; fome add rocou, but this gives it too much of the oval caft. Others make carmine with brafil-wood, fernambouc, and leaf-gold, beat in a mortar, and fteeped in white-wine vinegar; the fcum arifing from this mixture, upon boiling, when dried, makes carmine; but this kind is vaftly inferior to the former: There is another carmine, made of brafil-wood and fernambouc, by a different preparation.

CARMONA, a town of Andalufia in Spain, about feventeen miles eaft of Sevil: W. long. 5° 35′, N. lat. 37° 20′.

CARNARVON, a borough-town of Carnarvonfhire, in north Wales, about five miles fouth-weft of Bangor: W. long. 4° 25′, and N. lat. 53° 20′. It gives the title of earl to the noble family of Bridges; and fends one member to parliament.

CARNATION, in botany. See CARYOPHYLLUS.

CARNATION-*colour*, among painters, is underſtood of all the parts of a picture, in general, which repreſent fleſh, or which are naked and without drapery.

In colouring for fleſh, there is ſo great a variety, that it is hard to lay down any general rules for inſtruction therein; neither are there any regarded by thoſe who have acquired a ſkill this way: The various colouring for carnations, may be eaſily produced, by taking more or leſs red, blue, yellow, or biſtre, whether for the firſt colouring, or for the finiſhing: The colour for women ſhould be bluiſh, for children a little red, both freſh and gay; and for the men it ſhould incline to yellow, eſpecially if they are old.

CARNELIAN, in natural hiſtory, a precious ſtone, of which there are three kinds, diſtinguiſhed by three colours, a red, a yellow, and a white. The red is very well known among us, and is found in roundiſh or oval maſſes, much like our common pebbles; and is generally met with between an inch and two or three inches in diameter: It is of a fine, compact, and cloſs texture, of a gloſſy ſurface; and, in the ſeveral ſpecimens, is of all the degrees of red, from the paleſt fleſh-colour to the deepeſt blood-red. It is generally free from ſpots, clouds, or variegations; but ſometimes it is veined very beautifully with an extremely pale red, or with white; the veins forming concentric circles, or other leſs regular figures, about a nucleus, in the manner of thoſe of agates. The pieces of carnelian which are all of one colour, and perfectly free from veins, are thoſe which our jewellers generally make uſe of for ſeals, though the variegated ones are much more beautiful. The carnelian is tolerably hard, and capable of a very good poliſh: It is not at all affected by acid menſtruums: The fire diveſts it of a part of its colour, and leaves it of a pale red; and a ſtrong and long continued heat will reduce it to a pale dirty gray.

The fineſt carnelians are thoſe of the Eaſt-Indies; but there are very beautiful ones found in the rivers of Sileſia and Bohemia; and we have ſome not deſpicable ones in England.

Though the ancients have recommended the carnelian as aſtringent, and attributed a number of fanciful virtues to it, we know no other uſe of the ſtone, than the cutting ſeals on it, to which purpoſe it is excellently adapted, as being not too hard for cutting, and yet hard enough not to be liable to accidents, to take a good poliſh, and to ſeparate eaſily from the wax.

CARNERO, in geography, a name given to that part of the gulf of Venice, which extends from the weſtern coaſt of Iſtria to the iſland of Groſſa and the coaſt of Morlachia.

CARNERO is likewiſe the name of the cape to the weſt of the mouth of the bay of Gibraltar.

CARNIOLA, a territory of Auſtria, in Germany, bounded by Carinthia and Stiria on the north, and by the dominions of Venice on the ſouth.

CARNIVAL, or CARNAVAL, a time of rejoicing, a ſeaſon of mirth, obſerved with great ſolemnity by the Italians, particularly at Venice, holding from twelfth-day till lent.

Feaſts, balls, operas, concerts of muſic, intrigues, marriages, *&c.* are chiefly held in carnival-time. The carnival begins at Venice the ſecond holiday in Chriſtmas: Then it is they begin to wear maſks, and open their play-houſes and gaming-houſes; the Place of St Mark is filled with mountebanks, jack-puddings, pedlars, whores, and ſuch like mob, who flock thither from all parts: There have been no leſs than ſeven ſovereign princes, and thirty thouſand foreigners here, to partake of theſe diverſions.

CAROB-*tree*. See CERATONIA.

CAROLINA, a province of N. America, belonging to Great Britain: It is ſituated, comprehending Georgia, between 75° and 86° W. long. and between 31° and 36° N. lat. and bounded by Virginia on the north, by the Atlantic ocean on the eaſt, by Spaniſh Florida on the ſouth, and by the Apalachian mountains on the weſt; or rather extends weſtward, without any limits. It is divided into three diſtinct governments, *viz.* North and South Carolina, and Georgia.

CAROLINE-*books*, the name of four books, compoſed by order of Charlemagne, to refute the ſecond council of Nice. Theſe books are couched in very harſh and ſevere terms, containing one hundred and twenty heads of accuſation againſt the council of Nice, and condemning the worſhip of images.

CAROLSTAT, a town of Gothland in Sweden, ſituated at the north end of the Wener-lake, about one hundred and forty miles weſt of Stokholm: E. long. 13° 30′, and N. lat. 59° 40′.

CAROLUS, an ancient Engliſh broad piece of gold, ſtruck under Charles I. its value has of late been at twenty-three ſhillings ſterling, though at the time it was coined, it is ſaid to have been rated at twenty ſhillings.

CAROLUS, a ſmall copper coin, with a little ſilver mixed with it, ſtruck under Charles VIII. of France.

The carolus was worth twelve deniers, when it ceaſed to be current.

Thoſe which are ſtill current in trade, in Lorrain, or in ſome neighbouring provinces, go under the name of French ſols.

CAROTID *arteries*, in anatomy. See p. 226.

CARP, in ichthyology, the Engliſh name of a ſpecies of cyprinus. See CYPRINUS.

CARPENTRY, the art of cutting, framing, and joining large pieces of wood, for the uſes of building. It is one of the arts ſubſervient to architecture, and is divided into houſe-carpentry and ſhip-carpentry: The firſt is employed in raiſing roofing, flooring of houſes, *&c.* and the ſecond in the building of ſhips, barges, *&c.* The rules in carpentry are much the ſame with thoſe of joinery; the only difference is, that carpentry is uſed in the larger coarſer work, and joinery in the ſmaller and curious. See JOINERY.

CARPET, a ſort of covering of ſtuff, or other materials, wrought with the needle or on a loom, which is part of the furniture of a houſe, and commonly ſpread over tables, or laid upon the floor.

Perſian

Perfian and Turkey carpets are thofe moft efteemed; though at Paris there is a manufactory after the manner of Perfia, where they make them little inferior, not to fay finer, than the true Perfian carpets. They are velvety, and perfectly imitate the carpets which come from the Levant. There are alfo carpets of Germany, fome of which are made of woollen ftuffs, as ferges, *&c.* and called fquare carpets: Others are made of wool alfo, but wrought with the needle, and pretty often embellifhed with filk; and laftly, there are carpets made of dog's hair. We have likewife carpets made in England, which are ufed either as floor-carpets, or to make chairs and other houfehold furniture: It is true, we are not arrived at the like perfection in this manufacture with our neighbours the French; but may not this be owing to the want of the like public encouragement?

CARPI, a town of the Veronefe in Italy, fituated on the river Adige, twenty four miles fouth-eaft of Verona: E. long 11° 40′, and N. lat. 45° 10′.

CARPINUS, the HORN-BEAN, in botany, a genus of the monœcia polyandria clafs. The calix of the male is bell-fhaped, and divided into five fegments; it has no corolla; and the ftamina are ten. The calix of the female has four teeth; there is no corolla; the ftyli are three; and the capfule has four valves, containing two feeds. There are but two fpecies, both natives of America.

CARPIO, in ichthyology, the trivial name of a fpecies of falmo and cyprinus. See SALMO, and CYPRINUS.

CARPOBALSAM, in the materia medica, the fruit of the tree which yields the true oriental balfam.

The caprobalfam is ufed in Egypt, according to Profper Alpinus, in all the intentions for which the balfam itfelf is applied: But the only ufe the Europeans make of it is in venice-treacle and mithridate, and in thefe not a great deal; for cubebs and juniper-berries are generally fubftituted in its place.

CARPOBOLUS, in botany. See LYCOPERDON.

CARPUS, the WRIST, in anatomy. See p. 179, 180.

CARR, among the ancients, a kind of throne mounted on wheels, and ufed in triumphs and other folemn occafions.

CARRIAGE, a vehicle ferving to convey perfons, goods, merchandifes, and other things from one place to another.

For the conftruction and mechanical principles of wheel-carriages, fee MECHANICS.

CARRIAGE *of a cannon*, the frame or timber-work on which it is mounted, ferving to point it for fhooting, or to carry it from one place to another. It is made of two planks of wood, commonly one half the length of the gun, called the cheeks, and joined by three wooden tranfoms, ftrengthened with three bolts of iron. It is mounted on two wheels; but on a march has two fore-wheels, with limbers added. The principal parts of a carriage are the cheeks, tranfums, bolts, plates, train, bands, bridge, bed, hooks, trunion-holes, and capfquare.

Block-CARRIAGE, a cart made on purpofe for carrying mortars and their beds from place to place.

Truck-CARRIAGE, two fhort planks of wood fupported on two axle-trees, having four trucks of folid wood for carrying mortars or guns upon battery, where their own carriages cannot go. They are drawn by men.

CARRICK, the moft foutherly divifion of the fhire of Air in Scotland.

CARRICK *on the Sure*, a town of Ireland, in the county of Tipperary, and province of Munfter, about fourteen miles north-weft of Waterford: W. long. 7° 24′, and N. lat. 52° 16′.

CARRICK-FERGUS, a town in the county of Antrim, and province of Ulfter, in Ireland, about eighty-five miles north of Dublin: W. long. 6° 15′, and N. lat. 54° 45′.

CARROT, in botany. See DAUCUS.

Candy-CARROT. See MYRRHIS.

Deadly-CARROT. See THAPSIA.

Mountain CARROT. See FOENICULUM.

CARROUSAL, a courfe of horfes and chariots, or a magnificent entertainment exhibited by princes on fome public rejoicing. It confifts in a cavalcade of feveral gentlemen richly dreffed and equipped, after the manner of ancient cavaliers divided into fquadrons, meeting in fome public place, and practifing jufts, tournaments, *&c.* The laft carroufals were in the reign of Lewis XIV.

CARS, or KARS, a city of Turcomania, or the greater Armenia, fituated on a river of the fame name: E. long. 44°, and N. lat. 41° 30′. It is fubject to the Turks.

CARSE, or CARSE *of Gowry*, the name of a diftrict of Perthfhire in Scotland, lying eaftward of Perth, on the northern bank of the Tay.

CART, a land-carriage with two wheels, drawn commonly with horfes, to carry heavy goods, *&c.* from one place to another. See MECHANICS.

CARTAMA, a town of Granada, in Spain, about ten miles north-weft of Malaga: W. long, 4° 30′, and N lat. 36° 40′.

CARTEL, an agreement made between two ftates for the exchange of their prifoners of war.

CARTEL fignifies alfo a letter of defiance, or a challenge, to decide a controverfy, either in a tournament, or in fingle combat. See DUEL.

CARTERET, a county of South Carolina, in North America.

CARTESIANS, a fect of philofophers, who adhere to the fyftem of Des Cartes, and founded on the two following principles; the one metaphyfical, the other phyfical: the metaphyfical one is, *I think, therefore I am*; the phyfical principal is, *That nothing exifts but fubftance*. Subftance he makes of two kinds; the one a fubftance that thinks, the other a fubftance extended; whence actual thought and actual extenfion are the effence of fubftance.

The effence of matter being thus fixed in extenfion, the Cartefians conclude, that there is no vacuum, nor any poffibility thereof in nature, but that the world is abfolutely full: mere fpace is precluded by this prin-

ciple,

ciple, in regard, extenfion being implied in the idea of fpace, matter is fo too.

Upon thefe principles, the Cartefians explain mechanically, and according to the laws of motion, how the world was formed, and whence the prefent appearances of nature do rife. They fuppofe, that matter was created of an indefinite extenfion, and divided into little fquare maffes, full of angles; that the Creator impreffed two motions on this matter; one whereby each part revolved round its centre, another whereby an affemblage, or fyftem, turned round a common centre; whence arofe as many different vortices as there were different maffes of matter, thus moving round common centres.

The confequences of this hypothefis, according to the Cartefians, will be, that the parts of matter in each vortex could not revolve among each other, without having their angles gradually broken, and that this continual friction of parts and angles produced three elements; the firft, an infinitely fine duft, formed of the angles broken off; the fecond, the fpheres remaining, after all the angular irregularities are thus removed: thefe two make the matter of Des Cartes's firft and fecond element; and thofe particles not yet rendered fmooth and fpherical, and which ftill retain fome of their angles, make the third element.

Now, according to the laws of motion, the fubtileft element muft take up the centre of each fyftem, being that which conftitutes the fun, the fixed ftars above, and the fire below; the fecond element, compofed of fpheres, makes the atmófphere, and all the matter between the earth and the fixed ftars, in fuch a manner as that the largeft fpheres are always next the circumference of the vortex or fyftem, and the fmalleft next its centre; the third element, or the hooked particles, is the matter that compofes the earth, all terreftrial bodies, comets, fpots in the fun, *&c.* Though both philofophers and divines have a juft plea againft this romantic fyftem, yet it muft be owned, that Des Cartes, by introducing geometry into phyfics, and accounting for natural phœnomena by the laws of mechanics, did infinite fervice to philofophy.

CARTHAGE, or New Carthage, the capital of Coftarica, a province of Mexico, in North America: W. long. 86°, and N. lat. 9° 44′.

CARTHAGENA, a large city, with one of the beft harbours in Spain, fituated in the province of Murcia, about twenty miles fouth of that city: W. long. 1° 5′, and N. lat. 37° 40′. It is a bifhop's fee.

New Carthagena, the capital of a province of the fame name, in South America, fituated on a kind of peninfula: W. long. 77°, and N. lat. 11°. It is one of the largeft and beft fortified towns in South America.

CARTHAMUS, or Bastard-saffron, in botany, a genus of the fyngenefia polygamia æqualis clafs. The calix is ovated, and imbricated with foliaceous fcales of an oval fhape. There are nine fpecies, none of them natives of Britain. The feeds are purgative; but operate flowly, and diforder the bowels.

CARTHUSIANS, a religious order, founded in the year 1080, by one Bruno. Their rules are very fevere. They are not to go out of their cells, except to church, without leave of their fuperior; nor fpeak to any perfon without leave. They muft not keep any portion of their meat or drink till next day; their beds are of ftraw, covered with a felt; their cloathing two hair-cloths, two cowls, two pair of hofe, and a cloke, all coarfe. In the refectory, they are to keep their eyes on the difh, their hands on the table, their attention on the reader, and their hearts fixed on God. Women are not allowed to come into their churches.

CARTHUSIAN-powder, the fame with kermes mineral. See Kermes.

CARTILAGE, in anatomy, a body approaching much to the nature of bones; but lubricous, flexible, and elaftic.

CARTMEL, a market-town of Lancafhire, about ten miles north-weft of Lancafter: W. long. 2° 40′, and N. lat. 54° 15′,

CARTON, or Cartoon, in painting, a defign drawn on ftrong paper, to be afterwards calked through, and transferred on the frefh plafter of a wall to be painted in frefco.

Carton is alfo ufed for a defign coloured, for working in mofaic, tapeftry, *&c.* The cartons at Hampton-court are defigns of Raphael Urbin, intended for tapeftry

CARTOUCHE, in architecture and fculpture, an ornament reprefenting a fcroll of paper. It is ufually a flat member, with wavings, to reprefent fome infcription, device, cypher, or ornament of armoury. They are, in architecture, much the fame as modillions; only thefe are fet under the cornice in wainfcotting, and thofe under the cornice at the eaves of a houfe.

Cartouche, in the military art, a cafe of wood, about three inches thick at the bottom, girt with marlin, holding about four hundred mufket-balls, befides fix or eight balls of iron, of a pound weight, to be fired out of a hobit, for the defence of a pafs, *&c.*

A cartouche is fometimes made of a globular form, and filled with a ball of a pound weight; and fometimes it is made for the guns, being of ball of half or quarter pound weight, according to the nature of the gun, tied in form of a bunch of grapes, on a tompion of wood, and coated over. Thefe were made in the room of partridge-fhot.

CARTRIDGE, in the military art, a cafe of pafteboard or parchment. holding the exact charge of a fire-arm. Thofe for mufkets, carabines, and piftols, hold both the powder and ball for the charge; and thofe of cannon and mortars are ufually in cafes of pafteboard or tin, fometimes of wood, half a foot long, adapted to the calibre of the piece.

Cartridge-box, a cafe of wood or turned iron, covered with leather, holding a dozen mufquet-cartridges. It is wore upon a belt, and hangs a little lower than the right pocket-hole.

CARVA, in botany. See Laurus.

CARUI, or Carvi, in botany. See Carum.

CARVING. See Sculpture.

CARUM, Caraway, in botany, a genus of the pentandria

tandria digynia clafs. The fruit is oblong and ftriated; the involucrum confifts of but one leaf; and the petals are carinated and emarginated. There is but one fpecies, *viz.* the caroi, a native of Britain. The feeds have an aromatic fmell and pungent tafte; and are frequently employed as a ftomachic and carminative in flatulent cafes.

CARUNCULA, in anatomy, a term denoting a little piece of flefh, and applied to feveral parts of the body, thus:

CARUNCULÆ MYRTIFORMES. See p. 276.

CARUS, in medicine, a fudden deprivation of fenfe and motion, affecting the whole body.

CARWAR, a town on the coaft of Malabar, in the Hither India, fixty miles fouth of Goa: E. long. 73°, and N. lat. 15°. Here our Eaft-India company have a factory, from whence they import pepper.

CARYATIDES, or CARAITES, in architecture. See p. 353.

CARYOCATACTES, in ornithology, the trivial name of a fpecies of corvus. See CORVUS.

CARYOCOSTINUM, or ELECTORIUM ET SCAMMONIO, in pharmacy, is compofed of the following ingredients: An ounce and a half of fcammony; of cloves and ginger, each fix drams; half a pound of honey; half a dram of effential oil of caraway-feeds; the fpices muft be ground together and mixed with the honey; then add the powdered fcammony, and afterwards the oil. This electuary is a warm brifk purgative.

CARYOPHYLLATA, in botany. See GEUM.

CARYOPHYLLUS, the PINK, in botany. See DIANTHUS.

CARYOPHYLLUS, the CLOVE-TREE, in botany, a genus of the polyandria monogynia clafs. The corolla has four petals; the calix confifts of four duplicated leaves; and the berry contains one feed. There is but one fpecies, *viz.* the aromaticus, a native of the Molucca iflands. The cloves are the flower-cups, have a ftrong agreeable aromatic fmell, and a bitterifh pungent tafte. The effential oil of cloves is an ingredient in many of our officinal compofitions.

CARYOTA, in botany, a genus of plants ranged under the palmæ bipennatifoliæ. The calix of the male is common; the corolla is divided into three parts; and the ftamina are numerous. The calix and corolla of the male are the fame with thofe of the female; there is but one piftillum; and the berry contains two feeds. There is but one fpecies, *viz.* the urens, a native of India.

CASAL, the capital of the duchy of Montferrat, in Italy, fituated on the river Po, forty-five miles eaft of Turin: E. long. 8° 35′, and N. lat. 45°.

CASAN, or KASAN, a province of Ruffia, lying between the province of Mofcow on the weft, and Siberia on the eaft.

CASCADE, a fteep fall of water from a higher into a lower place.

They are either natural, as that at Tivoli, *&c.* or artificial, as thofe of Verfailles, *&c.* and either falling with gentle defcent, as thofe of Sceaux; or in form of a buffet, as at Trianon; or down fteps, in form of a perron, as at St Clou; or from bafon to bafon, *&c.*

CASCAIS, a town of Eftremadura, in Portugal, fituated at the mouth of the river Tagus, feventeen miles eaft of Lifbon: W. long. 10° 15′, and N. lat. 38° 40′.

CASCARILLA, in botany. See CINCHONA.

CASE, among grammarians, implies the different inflexions or terminations of nouns, ferving to exprefs the different relations they bear to each other, and to the things they reprefent.

CASE, among printers, denotes a floping frame, divided into feveral compartments, each containing a number of types or letters of the fame kind. See PRINTING.

CASE *of crown-glafs* contains ufually twenty-four tables, each table being nearly circular, and about three feet fix inches diameter.

CASE *of Newcaftle glafs* contains thirty-five tables; of Normandy glafs twenty-five.

CASE-HARDENING, a method of preparing iron, fo as to render its outer furface hard, and capable of refifting any edged tool.

This is a leffer degree of fteel-making, and is practifed by baking, calcination, or cementation in an oven or other clofe veffel, ftratified with charcoal and powdered hoofs and horns of animals, fo as to exclude the air. See STEEL.

CASE-SHOT, in the military art, mufket-ball, ftones, old iron, *&c.* put into cafes, and fhot out of great guns.

CASERTA, a city of the province of Lavoro, in the kingdom of Naples, about fixteen miles north of the city of Naples: E. long. 15° 5′, and N. lat. 41° 10′. It is a bifhop's fee.

CASH-BOOK. See BOOK-KEEPING, p. 618.

CASHELL, or CASHILL, a city of the county of Tipperary, in Ireland, about eighty miles fouth-weft of Dublin: W. long. 7° 40′, and N. lat. 52° 16′. It is a bifhop's fee.

CASHEW-NUT, in botany. See ANACARDIUM.

CASIA, in botany. See OSYRIS.

CASK, a veffel of capacity, for preferving liquors of divers kinds; and alfo fometimes dry goods, as fugar, almonds, *&c.*

A cafk of fugar is a barrel of that commodity, containing from eight to eleven hundred weight. A cafk of almonds is about three hundred weight.

CASPIAN-SEA, a large fea, or lake of Afia, bounded by the province of Aftracan on the north, and by part of Perfia on the eaft, fouth, and weft. It is upwards of four hundred miles long from fouth to north, and three hundred miles broad from eaft to weft.

CASSANDRA, the fame with the lyra, or harp-fhell, a fpecies of dolium.

CASSANO, a fortrefs, in the Milanefe, in Italy, fituated on the river Adda, about twelve miles north-eaft of Milan: E. long. 10°, and N. lat. 45° 20′.

CASSEL, the capital of the landgravate of Heffe-caffel, is

in the circle of the Upper Rhine, in Germany, ſituated on the river Fulde: E. long. 2° 20′, and N. lat. 51° 20′.

CASSEL is alſo the name of a town in French Flanders, about fifteen miles ſouth of Dunkirk: E. long. 2° 30′, and N. lat. 50° 5′.

CASSIA, in botany, a genus of the decandria monogynia claſs. The calix conſiſts of five leaves; the petals are five; and the antheræ are roſtrated and barren; the pod is a legumen. There are 30 ſpecies, all natives of warm climates. The caſſia fiſtula is a native of Egypt, and the Eaſt Indies. The fruit is a cylindrical pod, the pulp of which is a gentle laxative medicine.

CASSIDA, in botany. See SCUTELLARIA.

CASSIDA, in zoology, a genus of inſects belonging to the order of coleoptera. The feelers are like threads, but thicker on the outſide; the elytra are marginated; and the head is hid under the thorax. There are 31 ſpecies of this inſect, diſtinguiſhed principally by differences in their colour.

CASSIMERE, the capital city of a province of the ſame name in the Hither India: E. long. 75°, and N. lat. 35°. It was once the capital of a kingdom, and is ſtill ſometimes the reſidence of the Mogul.

CASSINE, in botany, a genus of the pentandria trigynia claſs. The calix conſiſts of five parts or ſegments; the petals are five, and the berry contains three ſeeds. There are only two ſpecies, both natives of Æthiopia.

CASSIOPEIA, in aſtronomy, a conſtellation of the northern hemiſphere, ſituated oppoſite to the great bear, on the other ſide of the pole.

CASSIS, the HELMET SHELL. See MUREX.

CASSITERIA, in the hiſtory of foſſils, a genus of cryſtals, the figures of which are influenced by an admixture of ſome particles of tin.

The caſſiteria are of two kinds: the whitiſh pellucid caſſiterion, and the brown caſſiterion; the firſt is a tolerably bright and pellucid cryſtal, and ſeldom ſubject to the common blemiſhes of cryſtal: It is of a perfect and regular form, in the figure of a quadrilateral pyramid, and is found in Devonſhire and Cornwall principally. The brown caſſiterion is like the former in figure: It is of a very ſmooth and gloſſy ſurface, and is alſo found in great plenty in Devonſhire and Cornwall.

CASSOCK, or CASSULA, a kind of robe or gown, wore over the reſt of the habit, particularly by the clergy. The word caſſock comes from the French *caſaque*, an horſeman's coat.

CASSOWARY, in ornithology. See STRUTHIO.

CASSUMBAZAR, a town of India, in Aſia, ſituated on the river Ganges, in the province of Bengal: E. long. 37°, and N. lat. 24°.

CASSUMUNAR, in the materia medica, a root approaching to that of zedoary.

It is cardiac and ſudorific, and famous in nervous caſes: It is alſo an ingredient in many compoſitions, and is preſcribed in powders, boluſſes, and infuſions. Its doſe is from five to fifteen grains.

CASTANEA, in botany. See FAGUS.

CASTANOVITZ, a town of Croatia, ſituated on the river Unna, which divides Chriſtendom from Turky: E. long. 17° 20′, and N. lat. 45° 40′. It is ſubject to the houſe of Auſtria.

CASTEL-ARAGONESE, a fortreſs of Sardinia, ſituated on the north-weſt coaſt of that iſland: E. long. 8° 45′, and N. lat. 41°.

CASTEL-BAR, a town of Ireland, in the county of Mayo, and province of Connaught, about thirty-eight miles north of Gallway: W. long. 9° 24′, N. lat. 53° 25′.

CASTEL-BRANCHO, a city of the province of Beira, in Portugal, about ninety five miles north-eaſt of Liſbon: W. long. 8°, N. lat. 39° 35′.

CASTEL DE VIDE, a town of Alentejo, in Portugal, about twelve miles eaſt of Portalegre, and thirty-five weſt of Alcantara: W. long. 7° 40, N. lat. 39°.

CASTELLA, a town of the Mantuan, in Italy, about five miles north-eaſt of the city of Mantua: E. long. 11° 15′, N. lat. 45° 30′.

CASTELLAN, the name of a dignity or charge in Poland: The caſtellans are ſenators of the kingdom, but ſenators only of the lower claſs, who, in diets, ſit on low ſeats, behind the palatines, or great ſenators. They are a kind of lieutenants of provinces, and command a part of the palatinate under the palatine.

CASTELLANY, the territory belonging to any city or town, chiefly uſed in France and Flanders: Thus we ſay, the caſtellany of Liſle, Ypres, *&c.*

CASTIGLIONE, a fortified town in the duchy of Mantua, about twenty miles north-weſt of the city of Mantua: E. long. 11°, N. lat 45° 15′.

CASTILE, the name of two inland provinces of Spain, ſituated almoſt in the middle of that kingdom: The moſt ſoutherly one is called New Caſtile, and the other, towards the north, Old Caſtile; Madrid being the capital of the former, and Burges of the latter.

CASTILLAN, or CASTILLANE, a gold-coin, current in Spain, and worth fourteen rials and ſixteen deniers.

CASTILLAN is alſo a weight uſed in Spain for weighing gold. It is the hundredth part of a pound Spaniſh weight.

What they commonly call a weight of gold in Spain, is always underſtood of the caſtillan.

CASTILLARA, a town of the Mantuan, in Italy, ſituated ſix miles north-eaſt of the city of Mantua: E. long. 11° 25′, N. lat. 45° 20′.

CASTILLON, a town of Perigort, in the province of Guienne, in France, ſituated on the river Dordonne, ſixteen miles eaſt of Bourdeaux: W. long. 2° 40, N. lat. 44° 50′.

CASTLE, a fortreſs or place rendered defenceable, either by nature or art.

A caſtle is a fort, or little citadel. See CITADEL.

It frequently ſignifies with us the principal manſion of noblemen.

In the time of Henry II. there were no leſs than 1115 caſtles in England, each of which contained a manor.

CASTLE, in the ſea-language, is a part of the ſhip, of which there are two, the fore-caſtle, being the elevation

tion at the prow, or the uppermoſt deck towards the mizen, the place where the kitchens are. Hind-caſtle is the elevation which reigns on the ſtern, over the laſt deck, where the officers cabins and places of aſſembly are.

CASTLE-CAREY, a market town of Somerſetſhire, ſituated ten miles ſouth-eaſt of Wells: W. long. 2° 40′, N. lat. 51° 15′.

CASTLE-RISING, a borough-town of Norfolk, ſituated near the ſea coaſt, about thirty miles weſt of Norwich, and ſeven north of Lynn: E. long. 40′, N. lat. 52°. 46′. It ſends two members to parliament.

CASTLE-WORK, ſervice or labour done by inferior tenants, for the building and upholding of caſtles of defence, towards which ſome gave their perſonal aſſiſtance, and others paid their contributions. This was one of the three neceſſary charges to which all lands among our Saxon anceſtors were expreſsly ſubject.

CASTON, a market town of Norfolk, about eight miles north-weſt of Norwich: E. long. 1° 20′, N. lat. 52° 45′.

CASTOR, or BEAVER, in zoology, a genus of quadrupeds belonging to the order of glires. The fore-teeth of the upper jaw are truncated, and hollowed in a tranſverſe angular direction. The tops of the fore-teeth of the lower-jaw lie in a tranſverſe direction; and the tail is depreſſed. There are three ſpecies of caſtor, *viz.* 1. The fiber, with a plane ovated tail, is found on the banks of rivers in Europe, Aſia, and America. It is from the inguinal glands of this animal that the caſtor is obtained; it is contained in cods or pouches which reſemble a dog's teſticles.

Several writers have taken notice of the ingenuity of American beavers in making their houſes, of which we ſhall here give ſome account. The firſt thing they do when they are about to build, is to aſſemble in companies, ſometimes of two or three hundred together; then they chuſe a place where plenty of proviſions are to be had, and where all neceſſaries are to be found proper for their uſe. Their houſes are always in the water, and when they can find neither lake nor pond, they endeavour to ſupply that defect by ſtopping the current of a brook or ſmall river, by means of a dam. To this end they firſt cut down trees in the following manner: Three or four beavers will go to work about a large tree, and by continually gnawing of it with their teeth, they at laſt throw it down, and ſo contrive matters that it always falls towards the water, that they may have the leſs way to carry it, when they have divided it into pieces. After they have done this, they take each piece by itſelf, and roll it towards the water, where they intend to place it.

Theſe pieces are more or leſs thick and long, according to the nature and ſituation of the places where they are required. Sometimes they make uſe of the large trunks of trees, which they lay down flat; ſometimes the dam only conſiſts of branches as thick as one's thigh, which are ſupported by ſtakes interwoven with the branches of trees; and all the vacant places are filled up with a ſort of clay, in ſuch a manner, that no water can paſs through them. They prepare the clay with their paws or hands; and their tails ſerve inſtead of a carriage, as well as a trowel to lay on their clay.

The foundation of the dams are generally ten or twelve feet thick, and they leſſen gradually till they come to two or three. They always obſerve an exact proportion, inſomuch, that the moſt curious architects are not capable of performing their work more regularly. That ſide towards the current of the water is always ſloping, but the other is perpendicular.

The conſtruction of the houſes is altogether as wonderful; for they are generally built upon piles in ſmall lakes, which are formed by making of the dams. Sometimes they are on the bank of a river, or on the extremity of a point of land, which advances into the water. They are of a round or oval form, and the top of them is like a dome.

This deſcription of one of their houſes which was examined and meaſured, will perhaps give the reader more ſatisfaction than an account in general. It was about three parts ſurrounded with water, and the other part was joined to the land. It was round, with an oval dome at the top, and the height above the ſurface of the water, was eight feet. It was about forty feet in diameter, and one hundred and twenty in circumference, which perhaps may ſeem ſtrange, becauſe the proportion is geometrical; this however is fact, for it was meaſured ſeveral times. The part that joined to the bank was not made out of it, but was of the ſame materials with the reſt.

The bottom of the houſe was of earth, or ſoil, with pieces of wood laid in it, above three inches in circumference; then a parcel of poplar ſticks laid with one end in the houſe, and another ſlanting a long way under water; then a layer of earth again, and then poplar ſticks, which were repeated to the height of eighteen inches. From thence to the top of the houſe there was a mixture of earth, ſtones, and ſticks, curiouſly put together; and the whole was covered with ſods, that had long graſs growing thereon. The largeſt pieces of wood made uſe of near the top, were about three inches in diameter, and all the reſt was ſmall ſtuff, not above two or three fingers thick.

The outermoſt part of this houſe did not ſtand farther out in the creek than the edge of the ſhore; but that which brought the water almoſt round the houſe were the trenches, which were made by taking out the earth; theſe were nine feet in the broadeſt part, and eighteen feet in length. The creek at the front of the houſe was ſix and thirty feet broad, and ſeemed to be pretty deep. The houſe was ſo contrived as to be very ſolid, for there was no breaking into it without an ax; and in the froſty ſeaſon it was quite impenetrable. From this houſe there were ſeveral paths into the wood, through which they drew the ſticks and trees, which they made uſe of for food or building.

The wall of the houſe was two feet thick, and it was covered with ſmooth clay on the inſide in ſuch a manner that it would not admit the leaſt breath of air. Two thirds of the ſtructure was out of the water; and in the upper part, each beaver had his particular

ticular place, whereon leaves were ſtrewed to lie upon.

There never was any filth ſeen in any of theſe houſes, which are made like an oven in the inſide, with a paſſage for theſe animals to go and bathe in the water. One of theſe will generally lodge about eight or ten beavers, though ſometimes they have held thirty; but this is very uncommon.

Theſe creatures are never ſurpriſed by the froſt and ſnow; for they finiſh their work towards the end of September; and then they lay in proviſions for the winter. In the ſummer-time they live upon fruits, and the barks and leaves of trees; and they likewiſe catch ſmall fiſh, and particularly crabs or craw-fiſh. However, their winter-proviſion is the tender branches of trees, particularly poplar, of which they ſeem to be very fond. It is uſually ſaid, and upon pretty good authority, that theſe beavers make the walls of their houſes of a thickneſs in proportion to the ſeverity of the ſucceeding winter; which if true, theſe animals muſt be furniſhed with uncommon foreſight.

When there are great floods cauſed by the melting of the ſnow, which damage the houſes of the beavers, they then leave them, and ſhift for themſelves as well as they can; however, the females return as ſoon as the waters are abated; but the males keep the field till July, when they aſſemble again to repair the damage that has been done by the flood, either to their houſes or dams. When any of their houſes are demoliſhed by the hunters, they never repair them again, but build others quite new. Some authors have ſaid, that the beavers make ſeveral rooms in their houſes; but this upon examination has been found to be falſe.

In hunting the beavers, the ſavages ſometimes ſhoot them, always getting on the contrary ſide of the wind; for they are very ſhy, quick in hearing, and of a very keen ſcent. This is generally done when the beavers are at work, or on ſhore feeding on poplar bark. If they hear any noiſe when at work, they immediately jump into the water, and continue there ſome time; and when they riſe, it is at a diſtance from the place where they went in.

They ſometimes are taken with traps: theſe are nothing but poplar ſticks laid in a path near the water; which when the beaver begins to feed upon, they cauſe a large log of wood to fall upon their necks, which is put in motion by their moving of the ſticks, and conſequently requires an ingenious contrivance. The ſavages generally prefer this way of taking them, becauſe it does not damage their ſkins.

In the winter-time they break the ice in two places at a diſtance from the houſe, the one behind the other. Then they take away the broken ice with a kind of a racket, the better to ſee where to place their ſtakes. They faſten their nets to theſe, which have large meſhes, and ſometimes are eighteen or twenty yards in length. When theſe are fixed, they proceed to demoliſh the houſe, and turn a dog therein; which terrifying the beaver, he immediately leaves it, and takes to the water; after which, he is ſoon entangled by the net.

Mr Lawſon who was general ſurveyor of North Carolina, affirms, that beavers are very plenty in that country. He confirms what has been ſaid about their ingenuity in building of their dams and houſes, and obſerves, that their food is chiefly the bark of trees and ſhrubs; ſuch as that of the ſaſſafras, aſh, ſweet gum, and ſeveral others. He adds, that if they are taken young, they will become very tame; but then they will do a great deal of miſchief in the orchards, by breaking the trees. They will likewiſe block up the doors of the houſes in the night, with the ſticks and wood which they bring thither. He farther informs us, that it is certain death for them to eat any thing that is ſalt. The fleſh is looked upon as very delicate food.

2. The moſchatus, with a long, compreſſed, lanceolated tail, and palmated feet. It is the exotic water-rat of Cluſius, and is a native of Ruſſia.

3. The zibethicus, or muſk-rat, with a long, compreſſed, and lanceolated tail, and the toes of the feet ſeparate from each other. The follicles of the tail are ſaid to baniſh moths and other inſects from cloaths, *&c.* For this reaſon the inhabitants of Ruſſia and Canada ſew them into the folds of their cloaths, to keep off vermin and contagious diſeaſes.

CASTOR is alſo the name of a market-town of Lincolnſhire, twenty miles north-eaſt of Lincoln: W. long. 12′, and N. lat. 53° 30′.

CASTOREA, in botany. See DURANTA.

CASTOREUM, in the materia medica, a ſubſtance obtained from the inguinal glands of the caſtor. See CASTOR.

CASTRATION, in ſurgery, the operation of gelding.

It was prohibited by a decree of the ſenate of Rome under Hadrian; and the Cornelian law ſubjected the perſon who performed the operation, to the ſame penalties as the perſon on whom it was performed, although it was done with his conſent.

Caſtration is much in uſe in Aſia and Turkey, where it is practiſed upon the ſlaves, to prevent any commerce with their women. In Italy, caſtration is frequent from another motive, namely, to preſerve the voice for ſinging. It is ſometimes found neceſſary in chirurgical caſes, as in a ſarcocele and cancer of the teſticles. For the method of performing this operation, ſee SURGERY.

CASTRES, a city of Languedoc, in France, about thirty-five miles eaſt of Thoulouſe: E. long. 2°, and N. lat. 43° 40′. It is a biſhop's ſee.

CASTRO, the capital of the iſland of Chiloe, on the coaſt of Chili, in ſouth America: W. long. 82°, S. lat. 43°.

CASTRO is alſo the capital of a duchy of the ſame name in the pope's territories, in Italy, ſituated on the confines of Tuſcany: E. long. 12° 35′, N. lat. 42° 30′.

CASTRO is likewiſe a town in the territory of Otranto, in the kingdom of Naples, about ſeven miles ſouth of Otranto: E. long. 19° 25′, N. lat. 40° 8′.

CASTRO *marino*, a town in the province of Algarva, in Portugal, ſituated near the mouth of the river Guadiana, on the confines of Andaluſa: W. long. 8° 15′. N. lat. 37°.

CASUALTIES *of ſuperiority*, in Scots law, thoſe duties and emoluments which a ſuperior has right to demand out of his vaſſal's eſtate, over and beſides the conſtant yearly duties eſtabliſhed by the *reddendo* of his charter, upon certain caſual events. See SCOTS LAW, title, *Of the caſualties due to the ſuperior*.

CASUS *amiſſionis*, in Scots law. In actions of proving the tenor of obligations extinguiſhable by the debtor's retiring or cancelling them, it is neceſſary for the purſuer, before he is allowed a proof of the tenor, to condeſcend upon ſuch a *caſus amiſſionis*, or accident, by which the writing was deſtroyed, as ſhews it was loſt while in the creditor's poſſeſſion. See SCOTS LAW, title, *Actions*.

CAT, in zoology. See FELIS.

CAT-*mint*, in botany. See MENTHA.

CAT, or CAT-*head*, on ſhipboard, a ſhort piece of timber in a ſhip, lying aloft right over the hawſe, having at one end two ſhivers, wherein is reeved a rope, with a great iron-hook faſtened to it, called

CAT-*hook*. Its uſe is to trice up the anchor, from the hawſe to the top of the fore-caſtle.

CAT-*holes*, in a ſhip, are over the parts as right with the capſtan as they can be: Their uſe is to heave the ſhip a-ſtern, upon occaſion, by a cable, or hawſe, called ſtern-faſt. See STERN-FAST.

CAT *of the mountain*. See FELIS.

CAT-*ſilver*, in natural hiſtory. See MICÆ.

CATACAUSTIC *curves*, in the higher geometry, that ſpecies of cauſtic curves which are formed by reflexion. See FLUXIONS.

CATACRHESIS, in rhetoric, a trope which borrows the name of one thing to expreſs another. Thus Milton deſcribing Raphael's deſcent from the empyreal heaven to paradiſe, ſays,

"Down thither prone in flight
"He ſpeeds, and thro' the vaſt etherial ſky
"Sails between worlds and worlds."

CATACOMB, a grotto or ſubterraneous place for the burial of the dead.

The term is particularly uſed in Italy, for a vaſt aſſemblage of ſubterraneous ſepulchres, three leagues from Rome, in the *via Appia*, ſuppoſed to be the ſepulchres of the ancients. Others imagine theſe catacombs to be the cells wherein the primitive Chriſtians hid themſelves. Each catacomb is three feet broad, and eight or ten high, running in form of an alley or gallery, and communicating with one another.

CATAGMATICS, in pharmacy, remedies proper for curing a catagma or fracture.

CATALEPSY, in medicine. See MEDICINE.

CATALONIA, a province of Spain, bounded by the Pyrenean mountains which divide it from France, on the north; by the Mediterranean, on the eaſt and ſouth; and by the provinces of Aragon and Valencia, on the weſt.

CATAMENIA, in medicine. See MENSES.

CATAMITE, a boy kept for ſodomitical practices.

CATANANCHE, in botany, a genus of plants belonging to the ſyngeneſia polygamia æqualis claſs. The receptacle is paleaceous; the calix is imbricated; and the pappus has an awn, with a kind of cetaceous calix. There are three ſpecies, none of which are natives of Britain.

CATAPASM, among ancient phyſicians, ſignifies any dry medicine reduced to powder, in order to be uſed by way of inſpiration in the whole body, or any part of it.

CATAPHONICS, the ſcience which conſiders the properties of reflected ſounds.

CATAPHORA, in medicine, the ſame as coma. See COMA.

CATAPHRACTA, in antiquity, a kind of coat of mail, which covered the ſoldier from head to foot.

Hence, cataphracti were horſemen armed with the cataphracta, whoſe horſes, as Salluſt ſays, were covered with linen full of iron plates diſpoſed like feathers.

CATAPLASM, an external topical medicine, prepared of ingredients of different virtues, according to the intention of the phyſician. Hence there are different ſorts of cataplaſms with reſpect to the matter of which they conſiſt, as emollient, reſolvent, diſcutient, ſuppurative, corroborative, anodyne, and antiſeptic cataplaſms. They are commonly applied hot, or lukewarm, rolled up in linen cloths, which by means of the oils which are added preſerve heat for a conſiderable time; for which end alſo ſome, upon theſe, apply a ſwine's or ox's bladder, and ſometimes on the top of all apply an earthen tile.

CATAPULTA, in antiquity, a military engine contrived for the throwing of arrows, darts, and ſtones, upon the enemy.

Some of theſe engines were of ſuch force, that they would throw ſtones of an hundred weight. Joſephus takes notice of the ſurpriſing effects of theſe engines, and ſays, that the ſtones thrown out of them beat down the battlements, knocked off the angles of the towers, and would level a whole file of men, from one end to the other, were the phalanx never ſo deep.

CATARACT, in hydrography, a precipice in the channel of a river, cauſed by rocks, or other obſtacles, ſtopping the courſe of the ſtream, from whence the water falls with a greater noiſe and impetuoſity: Such are the cataracts of the Nile, the Danube, Rhine, and the famous one of Niagara in America.

CATARACT, in medicine and ſurgery, a diſorder of the humours in the eye, by which the pupilla, that ought to appear tranſparent and black, looks opaque, grey, blue, brown, &c. by which viſion is variouſly impeded, or totally deſtroyed. See MEDICINE, and SURGERY.

CATARO, the capital of a territory of the ſame name, in the Venetian Dalmatia, about twenty-five miles ſouth-eaſt of Raguſa: E. long. 19° 20′, N. lat. 42° 25′.

CATARACTES, in ornithology, the trivial name of a ſpecies of larus. See LARUS.

CATARRH, in medicine, a diſtillation or defluxion from the head upon the mouth and aſpera arteria, and

and through them upon the lungs. See MEDICINE.

CATASTASIS, in poetry, the third part of the ancient drama, being that wherein the intrigue, or action, ſet forth in the epitaſis, is ſupported and carried on, and heightened, till it be ripe for the unravelling in the cataſtrophe. Scaliger defines it, the full growth of the fable, while things are at a ſtand in that confuſion to which the poet has brought them.

CATASTROPHE, in dramatic poetry, the fourth and laſt part of the ancient drama, or that immediately ſucceeding the cataſtaſis: Or, according to others, the third only; the whole drama being divided into protaſis, epitaſis, and cataſtrophe; or, in the terms of Ariſtotle, prologue, epilogue, and exode. See EPIC and DRAMATIC *compoſitions*.

CATCH-*fly*, in botany. See LYCHNIS.

CATCH-POLE, a term uſed by way of reproach, for the bailiff's follower, or aſſiſtant.

CATCH-*word*, among printers, that placed at the bottom of each page, being always the firſt word of the following page.

CATECHETIC. Catechetic ſchools were buildings appointed for the office of the catechiſt, adjoining to the church, and called *catechumena*: Such was that in which Origen, and many other famous men, read catechetical lectures at Alexandria. See CATECHUMEN.

CATECHISM, the name of a ſmall book, deſigned for inſtructing children in the principles of religion. The church of Rome, the church of England, the preſbyterian church, *&c.* have all catechiſms containing and enforcing their peculiar opinions.

CATECHU, in the materia medica, the name of a troch conſiſting of Japan earth and gum arabic, each two ounces, and of ſugar of roſes ſixteen ounces, beat together, with a little water. It is recommended as a mild reſtringent, *&c.*

CATECHUMEN, a candidate for baptiſm, or one who prepares himſelf for the receiving thereof.

The catechumens, in church-hiſtory, were the loweſt order of Chriſtians in the primitive church. They had ſome title to the common name of Chriſtian, being a degree above pagans and heretics, though not conſummated by baptiſm. They were admitted to the ſtate of catechumens, by the impoſition of hands, and the ſign of the croſs. The children of believing parents were admitted catechumens, as ſoon as ever they were capable of inſtruction: But at what age thoſe of heathen parents might be admitted, is not ſo clear. As to the time of their continuance in this ſtate, there were no general rules fixed about it; but the practice varied according to the difference of times and places, and the readineſs and proficiency of the catechumens themſelves.

There were four orders or degrees of catechumens; the firſt were thoſe inſtructed privately without the church, and kept at a diſtance, for ſome time, from the privilege of entering the church, to make them the more eager and deſirous of it. The next degree were the *audientes*, ſo called from their being admitted to hear ſermons and the ſcriptures read in the church, but were not allowed to partake of the prayers. The third ſort of catechumens were the *genu flectentes*, ſo called, becauſe they received impoſition of hands kneeling. The fourth order was the *competentes & electi*, denoting the immediate candidates for baptiſm, or ſuch as were appointed to be baptized the next approaching feſtival, before which, ſtrict examination was made into their proficiency under the ſeveral ſtages of catechetical exerciſes.

After examination, they were exerciſed for twenty days together, and were obliged to faſting and confeſſion: Some days before baptiſm they went veiled; and it was cuſtomary to touch their ears, ſaying, *Ephatha*, i. e. be opened; as alſo, to anoint their eyes with clay; both ceremonies being in imitation of our Saviour's practice, and intended to ſhadow out to the catechumens their condition both before and after their admiſſion into the Chriſtian church.

CATEGORY, in logic, a ſeries or order of all the predicates or attributes contained under any genus.

The ſchool-philoſophers diſtribute all the objects of our thoughts and ideas into certain *genera* or claſſes, not ſo much, ſay they, to learn what they do not know, as to communicate a diſtinct notion of what they do know; and theſe claſſes the Greeks called categories, and the Latins predicaments.

Ariſtotle made ten categories, *viz.* quantity, quality, relation, action, paſſion, time, place, ſituation, and habit, which are uſually expreſſed by the following technical diſtich:

Arbor, ſex, ſervos, ardore, refrigerat, uſtos,
Ruri cras ſtabo, nec tunicatus ero.

CATENARIA, in the higher geometry, the name of a curve line formed by a rope hanging freely from two points of ſuſpenſion, whether the points be horizontal or not. See FLUXIONS.

CATERGI, the name of the public carriers in the grand Signior's dominions. In Europe, the merchant or traveller gives earneſt to the carrier; but the catergi in Turky give earneſt to the merchant and others, as a ſecurity that they will certainly carry their goods, or not ſet out with them.

CATERPILLAR, in zoology, the name of all winged inſects when in their reptile or worm-ſtate. See NATURAL HISTORY, *Of inſects*.

CATESBÆA, in botany, a genus of the tetrandria monogynia claſs. The corolla is long, monopetalous, and ſhaped like a tunnel; the ſtamina are within the faux; and the berry contains but one ſeed. There is but one ſpecies, *viz.* the ſpinoſa, a native of Providence.

CATHÆRETICS, in pharmacy, medicines of a cauſtic nature, ſerving to eat off proud fleſh.

CATHARTICS, in medicine, remedies which promote evacuation by ſtool.

CATHEDRAL, a church wherein is a biſhop's ſee or ſeat.

CATHETER, in ſurgery, a fiſtulous inſtrument, uſually made of ſilver, to be introduced into the bladder, in order to ſearch for the ſtone, or diſcharge the urine when ſuppreſſed. See SURGERY.

CATHETUS, in geometry, a line or radius falling perpendicularly

pendicularly on another line or furface: thus the catheti of a right-angled triangle are the two fides that include the right angle.

CATHETUS *of incidence*, in catoptrics, a right line drawn from a point of the object, perpendicular to the reflecting line.

CATHETUS *of reflection*, or *of the eye*, a right line drawn from the eye, perpendicular to the reflecting line.

CATHETUS *of obliquation*, a right line drawn perpendicular to the fpeculum, in the point of incidence or reflection.

CATHETUS, in architecture, a perpendicular line, fuppofed to pafs through the middle of a cylindrical body, as a balufter, column, *&c.*

CATHNESS, the moft northerly county of Scotland, having the Caledonian ocean on the north, eaft, and fouth-eaft, and the fhire of Sutherland on the fouth and weft. Its capital is Wick.

CATHOLIC, in a general fenfe, denotes any thing that is univerfal or general.

CATHOLIC CHURCH. The rife of herefies induced the primitive Chriftian church to affume to itfelf the appellation of catholic, being a characteriftic to diftinguifh it from all fects, who, though they had party-names, fometimes fheltered themfelves under the name of Chriftians.

The Romifh church diftinguifhes itfelf now by the name of catholic, in oppofition to all thofe who have feparated from her communion, and whom fhe confiders as only heretics and fchifmatics, and herfelf only as the true and Chriftian church. In the ftrict fenfe of the word, there is no catholic church in being, that is, no univerfal Chriftian communion.

CATHOLIC KING, a title which hath been hereditary to the kings of Spain, ever fince Alphonfus, who, having gained feveral victories over the Saracens, and re-eftablifhed the Chriftian faith in Spain, was honoured with the title of Catholic. Some fay it was in the time of Ferdinand and Ifabella.

CATHOLICON, in pharmacy, a kind of foft purgative electuary, fo called, as being fuppofed an univerfal purger of all humours.

CATOCHE, or CATOCHUS, in medicine, a difeafe, by which the patient is rendered, in an inftant, as immoveable as a ftatue, without either fenfe or motion, and continues in the fame pofture he was in at the moment he was feized. See MEDICINE.

CATODON, in ichthyology, the trivial name of a fpecies of phyfeter. See PHYSETER.

CATOPSIS, in medicine. See MYOPIA.

CATOPTRICS, that part of optics that treats of reflex vifion, and explains the laws and properties of reflection. See OPTICS.

CATULUS, in ichthyology. See SQUALUS.

CATUS-PARDUS, in zoology. See FELIS.

CATUS ZIBETHICUS. See CASTOR.

CATZENELLIBOGEN, a city of Heffe, fituated upon the Upper Rhine, in Germany, about fixteen miles north of Mentz: E. long. 7° 40′, N. lat. 50° 20′. It is the capital of a county of the fame name.

CAVALIER, in fortification, an elevation of earth of different fhapes, fituated ordinarily in the gorge of a baftion, bordered with a parapet, and cut into more or lefs embrafures, according to the capacity of the cavalier.

Cavaliers are a double defence for the faces of the oppofite baftion: they defend the ditch, break the befiegers galleries, command the traverfes in dry moats, fcowr the failliant angle of the counterfcarpe where the befiegers have their counter-batteries, and infilade the enemies trenches, or oblige them to multiply their parallels: they are likewife very ferviceable in defending the breach, and the retrenchments of the befieged, and can very much incommode the entrenchments which the enemy make, being lodged in the baftion.

CAVALIER, in the menage, one that underftands horfes, and is practifed in the art of riding them.

CAVALRY, a body of foldiers that charge on horfeback. They are divided into fquadrons, and encamp on the wings of the army.

CAVAN, the capital of a county of the fame name, in the province of Ulfter, in Ireland, fituated about fixty miles north-weft of Dublin: W. long. 7° 35′, and N. lat. 54°.

CAUCALIS, in botany, a genus of the pentandria digynia clafs. The corolla is radiated; the fruit is hairy, and the involucra are entire. There are fix fpecies, three of which are natives of Britain, *viz.* the arvenfis, or fmall corn-parfley; the anthrifcus, or hedge-parfley; and the leptophylla, or fine-leaved baftard parfley.

CAUCASUS, a vaft ridge of mountains, running from the Leffer Afia through the north of Perfia to the Eaft Indies; thefe acquire different names in the feveral countries through which they pafs.

CAUDIVERBERA, in zoology, the trivial name of a fpecies of lacerta. See LACERTA.

CAVEAR, CAVEER, or CAVIARY, the fpawn, or hard roes of fturgeon, made into fmall cakes, an inch thick, and of an hand's-breadth, falted, and dried in the fun. This fort of food is in great repute throughout Mufcovy, becaufe of their three lents, which they keep with a fuperftitious exactnefs; wherefore the Italians fettled at Mufcow, drive a very great trade in this commodity throughout that empire, becaufe there is a prodigious quantity of fturgeon taken at the mouth of the Wolga and of the other rivers which fall into the Cafpian fea. There is a pretty large quantity of this commodity confumed in Italy, and they are very well acquainted with it in France and England, where it is reckoned no defpicable difh.

The French and Italians get the cavear from Archangel, but they feldom get it at the firft hand, for they commonly buy it of the Englifh and Dutch.

CAVEAT, in law, a kind of procefs in the fpiritual courts, to ftop the proving of a will, the granting letters of adminiftration, *&c.* to the prejudice of another. It is alfo ufed to ftop the inftitution of a clerk to a benefice.

CAVEATING, in fencing, is the fhifting the fword from one fide of that of your adverfary to the other.

CAVEDO, in commerce, a Portuguefe long meafure, equal to $27\frac{354}{1000}$ Englifh inches.

CAVETTO, in architecture, a hollow member, or round concave moulding, containing a quadrant of a circle, and having a quite contrary effect to that of a quarter round: it is ufed as an ornament in cornices.

CAVEZON, in the menage, a fort of nofe-band, either of iron, leather, or wood, fometimes flat, and at other times hollow or twifted, clapt upon the nofe of a horfe, to wring it, and fo forward the fuppling and breaking of the horfe.

CAVIA-COBAYA, a fynonime of the mus porcellinus, or Guinea-pig. See MUS.

CAVILLON, a town of Provence in France, fituated on the river Durance, about fifteen miles fouth of Avignon: E. long. 5°, and N. lat. 43° 50'. It is a bifhop's fee, and fubject to the pope.

CAUKING, or CAULKING *of a fhip*, is driving oakum, or the like, into all the feams of the planks of a fhip, to prevent leaking, and keep out the water.

CAULKING-IRONS, are iron chiffels for that purpofe. Some of thefe irons are broad, fome round, and others grooved. After the feams are ftopped with oakum, it is done over with a mixture of tallow, pitch, and tar, as low as the fhip draws water.

CAUL, in anatomy. See p. 266. col. 2.

CAULIFLOWERS, in gardening, a much efteemed fpecies of cabbage.

Cauliflowers have of late years been fo much improved in Britain, as to exceed in goodnefs and magnitude any produced in moft parts of Europe; and, by the fkill of the gardener, are continued for feveral months together, but the moft common feafon for them is in May, June, and July.

CAULIS, in botany. See p. 641. col. 2. and Plate LVII. fig. 148.

CAUSALTY, among metaphyficians, the action or power of a caufe in producing its effect.

CAUSALTY, among miners, denotes the lighter, fulphureous, earthy parts of ores, carried off in the operation of wafhing.

This, in the mines, they throw in heaps upon banks, which, in fix or feven years, they find it worth their while to work over again.

CAUSE, that from whence any thing proceeds, or by virtue of which any thing is done: it ftands oppofed to effect. We get the ideas of caufe and effect from our obfervation of the viciffitude of things, while we perceive fome qualities or fubftances begin to exift, and that they receive their exiftence from the due application and operation of other beings. That which produces, is the caufe; and that which is produced, the effect: thus, fluidity in wax is the effect of a certain degree of heat, which we obferve to be conftantly produced by the application of fuch heat.

Firft CAUSE, that which acts of itfelf, and of its own proper power or virtue: God is the only firft caufe in this fenfe.

Second CAUSES are thofe which derive the power and faculty of action from a firft caufe.

Efficient CAUSES are the agents employed in the production of any thing.

Material CAUSES, the fubjects whereon the agents work; or the materials whereof the thing is produced.

Final CAUSES are the motives inducing an agent to act; or the defign and purpofe for which the thing was done.

Phyfical CAUSE, that which produces a fenfible corporeal effect; as the fun is the phyfical caufe of light.

Moral CAUSE, that which produces a real effect, but in things immaterial; as repentance is the caufe of forgivenefs. A moral caufe is alfo defined, that which determines us, though not neceffarily, to do, or not to do, any thing; as advice, intreaties, commands, menaces, *&c.*

It is to be obferved, that, in this fenfe, a moral caufe is only applicable to a free intelligent agent: it is alfo obfervable, that the latter notion of a phyfical as well as a moral caufe is the moft juft, clear, and diftinct.

CAUSE, among civilians, the fame with action. See ACTION.

CAUSTICS, in phyfic, an appellation given to medicines of fo hot and fiery a nature, that, being applied, confume, and, as it were, burn the texture of the parts, like hot iron.

Cauftics are generally divided into four forts, the common ftronger cauftic, the common milder cauftic, the antimonial cauftic, and the lunar cauftic.

The ftronger cauftic is prepared by boiling to a fourth part any quantity of the lees of almond-foap, adding lime that has been kept in a veffel pretty clofe ftopt for feveral months; the lime is to be added till all the liquor is abforbed, and the whole reduced to a pafte, which is to be kept in a veffel well ftopt.

The common milder cauftic is prepared by taking equal parts of foft foap and frefh quick-lime, and mixing them at the time of ufing.

The antimonial cauftic is prepared thus: Take of antimony one pound, of corrofive fublimate two pounds; and being reduced feparately into powder, mix them well, and diftill them in a retort with a wide neck, in a gentle heat of fand; let what afcends into the neck of the retort be expofed to the air, that it may run into a liquor.

The method of preparing the lunar cauftic is as follows: Diffolve pure filver by a fand-heat, in about twice its weight of aqua-fortis; then dry away the humidity with a gentle fire, afterwards melt it in a crucible, that it may be poured into proper moulds, carefully avoiding over-much heat, left the matter fhould grow too thick.

CAUSTIC CURVE, in the higher geometry, a curve formed by the concourfe or coincidence of the rays of light reflected from fome other curve.

CAUSTIC GLASSES. See BURNING-GLASSES.

CAUSTICUM ANTIMONIALE, in the London Difpenfatory, the fame with the oil of antimony.

CAUSUS, or BURNING-FEVER, a fpecies of continual fever, accompanied with a remarkable inflammation of the blood.

CAUTERIZATION, the application of cauteries to any part of the body.

CAUTERY, in ſurgery, a medicine for burning, eating, or corroding any ſolid part of the body.

Cauteries are diſtinguiſhed into two claſſes, actual and potential: by actual cauteries, are meant red hot inſtruments, uſually of iron, and by potential cauteries are underſtood certain kinds of corroding medicines. See MEDICINE, and SURGERY.

CAUTION, in the civil and Scots law, denotes much the ſame with what, in the law of England, is called bail. See BAIL.

CAUTIONER, in Scots law, that perſon who becomes bound for another to the performance of any deed or obligation. As to the diifferent kinds and effects of cautionry, ſee SCOTS LAW, title, *Obligations ariſing from conſent.*

CAXA, a little coin made of lead, mixed with ſome ſcoria of copper, ſtruck in China, but current chiefly at Bantam in the iſland of Java, and ſome of the neighbouring iſlands.

The caxas are of two kinds, great and ſmall. Of the ſmall, 300,000 are equal to fifty-ſix livres five ſols French money; and of the great, 6000 are equal to four ſhillings and ſixpence ſterling.

CAXAMALCA, the name of a town and diſtrict of Peru, in South America, where there was a moſt ſumptuous palace belonging to the Yncas, and a magnificent temple dedicated to the ſun. It was at Caxamalca that Pizarro put to death Athualpha, their laſt king.

CAY, in zoology, a ſynonime of the ſimia midas. See SIMIA.

CAZEROM, or CAZERON, a city of Perſia, the capital of the province of Kurch Schabour, ſituated in 70° E. long. and 29° 15′ N. lat.

CAZIMIR, a town of Poland, in the palatinate of Lublin.

CEANOTHUS, in botany, a genus of the pentandria monogynia claſs. The petals are vaulted; and the berry is dry, having three cells, containing each one ſeed. There are three ſpecies, none of them natives of Britain.

CECROPIA, in botany, a genus of the diœcia diandria claſs. The ſpatha of the male is caducous; the amenta are imbricated with helmet-ſhaped ſcales; and the corolla is wanting. The germina of the female are imbricated; it has but one ſtylus; the ſtigma is lacerated; and the berry contains but one ſeed. There is one ſpecies, *viz.* the peltata, a native of Jamaica.

CEDAR, in botany, the Engliſh name of a ſpecies of juniperus. See JUNIPERUS.

CEDRELA, in botany, a genus of the pentandria monogynia claſs. The calix is bell-ſhaped, and divided into three ſegments; the corolla is ſhaped like a funnel, and has five petals inſerted into the baſe of the receptacle; the capſule is lignous, and has five cells and five valves; the ſeeds are imbricated on the back part, and have membranaceous edges. There is but one ſpecies, *viz.* the odorata, a native of America.

CEDRUS, in botany. See JUNIPERUS, and PINUS.

CELANDINE, in botany. See CHELIDONIUM.

CELASTRUS, in botany, a genus of the pentandria monogynia claſs. The corolla conſiſts of five open petals; the capſule is triangular, and has three cells; and the ſeeds have a calyptra. There are five ſpecies, none of them natives of Britain.

CELERES, in Roman antiquity, a regiment of body-guards, belonging to the Roman kings, eſtabliſhed by Romulus, and compoſed of 300 young men, choſen out of the moſt illuſtrious Roman families, and approved by the ſuffrages of the curiæ of the people, each of which furniſhed ten.

CELERI, in botany, the Engliſh name of the apium graveolens, or celery, which is cultivated in our gardens as a pot-herb.

CELERITY, in mechanics, the ſwiftneſs of any body in motion.

It is alſo defined to be an affection of motion, by which any moveable body runs through a given ſpace in a given time. See MECHANICS.

CELESTINS, in church-hiſtory, a religious order of Chriſtians, reformed from the Bernardins by pope Celeſtin V. Their rules are divided into three parts; the firſt, of the provincial chapters, and the elections of ſuperiors; the ſecond contains the regular obſervances; and the third, the viſitation and correction of the monks.

The Celeſtins riſe two hours after midnight to ſay matins: they eat no fleſh at any time, except when they are ſick: they faſt every Wedneſday and Friday to the feaſt of the exaltation of the holy croſs; and from that feaſt to Eaſter, every day.

CELIBACY, the ſtate of unmarried perſons, to which, according to the doctrine, or at leaſt the diſcipline, of the church of Rome, the clergy are obliged.

That celibacy has no pretence of divine or apoſtolical inſtitution, ſeems no difficult point to prove: whence it is, at firſt, hard to conceive from what motive the court of Rome perſiſted ſo very obſtinately to impoſe this inſtitution on the clergy. But we are to obſerve, that this was a leading ſtep to the execution of the project formed of making the clergy independent of princes, and rendering them a ſeparate body, to be governed by their own laws. In effect, while prieſts had children, it was very difficult to prevent their dependence upon princes, whoſe favours have ſuch an influence on private men; but having no family, they were more at liberty to adhere to the pope.

CELOSIA, in botany, a genus of the pentandria monogynia claſs. The calix has three leaves; the ſtamina are joined to the baſe of a plaited nectarium; and the capſule opens horizontally. There are eight ſpecies, none of them natives of Britain.

CELSIA, in botany, a genus of the didynamia angioſpermia claſs. The calix is divided into five ſegments; the corolla is rotated; the filaments are barbed; and the capſule is bilocular. There is but one ſpecies, *viz.* the orientalis, a native of Greece.

CELTIS, in botany, a genus of the polygamia monœcia claſs. The calix of the hermaphrodite is divided into five ſegments; it has no corolla; there are five ſtamina,

ſtamina, and two ſtyli; the drupa contains but one ſeed. The calix of the male is divided into ſix ſegments; it has no corolla; and the ſtamina are ſix. The ſpecies are three, none of them natives of Britain.

CEMENT, or CÆMENT. See CÆMENT.

CEMENTATION. See CÆMENTATION.

CEMETERY. See COEMETERY.

CENADA, a town of the Venetian territories in Italy, ſituated about thirty-two miles north of Padua: E. long. 12° 40′, and N. lat. 46° 5′.

CENCHRAMIDEA, in botany. See CLUSIA.

CENCHRIS, in zoology, a ſynonime of the boa conſtrictor. See BOA.

CENCHRUS, in botany, a genus of the polygamia monœcia claſs. The involucrum is laciniated, and incloſes two flowers; the calix is a two flowered gluma, one of the flowers being a male, and the other a female. The corolla of the hermaphrodite is a blunt gluma; the ſtamina are three; and the ſtylus is bifid; there is but one ſeed. The corolla of the male is likewiſe an obtuſe gluma; and there are three ſtamina. The ſpecies are ſix, none of them natives of Britain.

CENCONTLTAOLLI, in ornithology. See TURDUS.

CENOBITE, or COENOBITE. See COENOBITE.

CENOTAPH, in antiquity, a monument erected in honour of the dead, but not containing any of their remains. Of theſe there were two ſorts; one erected for ſuch perſons as had been honoured with funeral rites in another place; and the ſecond ſort, for thoſe that had never obtained a juſt funeral.

The ſign whereby honorary ſepulchres were diſtinguiſhed from others, was commonly the wreck of a ſhip, to denote the deceaſe of the perſon in ſome foreign country.

CENSER, a ſacred inſtrument made uſe of in the religious rites of the ancients. It was a vaſe, containing incenſe to be uſed in ſacrificing to the gods. Cenſers were likewiſe in uſe among the Jews, as we find in 1 Kings vii. 50. The cenſer is alſo uſed in Romiſh churches.

CENSOR, in Roman antiquity, a magiſtrate, whoſe buſineſs it was to reform the manners, and to value the eſtates of the people.

There were two cenſors firſt created in the 311th year of Rome, upon the ſenate's obſerving that the conſuls were generally ſo much taken up in military actions as to have no leiſure to attend to private affairs. At firſt they were choſen out of the ſenate, but after the plebeians had got the conſulate open to them, they ſoon arrived at the cenſorſhip.

After the cenſors were elected in the comitia centurialia, they proceeded to the capitol, where they took an oath not to manage either by favour or diſaffection, but to act equitably and impartially through the whole courſe of their adminiſtration: and, notwithſtanding their great authority, they were obliged to give an account of their management to the tribunes and *ædiles curules*. In proceſs of time, the dignity of this office dwindled very much; under the emperors it ſunk to nothing, as their majeſties engroſſed all the branches of that juriſdiction. The republic of Venice has at this day a cenſor of manners of their people, whoſe office laſts ſix months.

CENSORS *of books*, are a body of doctors or others eſtabliſhed in divers countries, to examine all books before they go to the preſs, and to ſee they contain nothing contrary to faith and good manners.

At Paris, the faculty of theology claim this privilege, as granted to them by the pope; but in 1624, new commiſſions of four doctors were created, by letters-patent, the ſole cenſors of all books, and anſwer able for every thing contained therein.

In England, we had formerly an officer of this kind, under the title of Licenſer of the preſs; but, ſince the revolution, our preſs has been laid under no ſuch reſtraint.

CENSURE, a judgment which condemns ſome book, perſon, or action, or more particularly a reprimand from a ſuperior. Eccleſiaſtical cenſures, are penalties by which, for ſome remarkable miſbehaviour, Chriſtians are deprived of the communion of the church, or prohibited to execute the ſacerdotal office.

CENSUS, in Roman antiquity, an authentic declaration made before the cenſors, by the ſeveral ſubjects of the empire, of their reſpective names and places of abode. This declaration was regiſtered by the cenſors, and contained an enumeration, in writing, of all the eſtates, lands, and inheritances they poſſeſſed; their quantity, quality, place, wives, children, domeſtics, tenants, ſlaves.

The cenſus was inſtituted by Servius Tullius, and was held every five years. It was of great ſervice to the republic, becauſe, by means of it, they diſcovered the number of citizens capable of bearing arms, and the money they could afford for the expence of a war. It went through all ranks of people, though under different names: that of the common people was called *cenſus*; that of the knights, *cenſus, recenſio, recognitio*; that of the ſenators, *lectio, relectio*.

The cenſus which intitled one to the dignity of a knight, was 400,000 ſeſterces: that of a ſenator, was double that ſum.

In the Voconian law, cenſus is uſed for a man, whoſe eſtate in the cenſor's books is valued at 100,000 ſeſterces.

CENTAUR, in ancient poetry, denotes a fabulous kind of animal, half man, half horſe.

The Theſſalians, who firſt taught the art of breaking horſes, appearing on horſeback to make only one body with the animal on which they rode, gave riſe to the fiction of the hippocentaur.

CENTAUREA, in botany, a genus of the ſyngeneſia polygamia fruſtranea claſs. The receptacle is briſtly; the pappus is ſimple; the rays of the corolla are tunnel-ſhaped, long, and irregular. There are 61 ſpecies, five of which are natives of Britain, *viz.* the cyanus, or blue-bottle; the ſcabioſa, or great knapweed; the jacea, or common knapweed; the calcitrapa, or ſtar-thiſtle; and the ſolſtitialis, or St Barnaby's thiſtle.

CENTAURY. See CHELIDONIUM.

CENTER *of gravity*, in mechanics, that point about which all the parts of a body do, in any ſituation, exactly balance each other. See MECHANICS.

CENTER *of motion*, that point which remains at reſt, while all the other parts of a body move about it. See MECHANICS.

CENTESIMATION, a milder kind of military puniſhment, in caſes of deſertion, mutiny, and the like, when only every hundredth man is executed.

CENTIPES, in zoology. See SCOLOPENDRA.

CENTONARII, in antiquity, certain officers of the Roman army, who provided tents and other ſtuff, called centones, made uſe of to quench the fire which the enemy's engines threw into the camp.

Theſe centonarii kept with the carpenters and other officers of the artillery.

CENTRAL FORCES, the powers which cauſe a moving body to tend towards, or recede from the centre of motion. See MECHANICS.

CENTRAL RULE, a rule diſcovered by Mr Thomas Baker, whereby to find the centre of a circle deſigned to cut the parabola in as many points, as an equation to be conſtructed hath real roots. Its principal uſe is in the conſtruction of equations, and he has applied it with good ſucceſs as far as biquadratics.

The central rule is chiefly founded on this property of the parabola, that if a line be inſcribed in that curve perpendicular to any diameter, a rectangle formed of the ſegments of the inſcript, is equal to the rectangle of the intercepted diameter and parameter of the axis.

The central rule has the advantage over Cartes and De Latere's methods of conſtructing equations, in that both theſe are ſubject to the trouble of preparing the equation, by taking away the ſecond term.

CENTRIFUGAL FORCE, that force by which all bodies that move round any other body in a curve, endeavour to fly off from the axis of their motion in a tangent to the periphery of the curve, and that in every point of it. See MECHANICS.

CENTRINA, in ichthyology, the trivial name of a ſpecies of ſqualus. See SQUALUS.

CENTRIPETAL FORCE, that force by which a body is every where impelled, or any how tends towards ſome point as a centre. See MECHANICS.

CENTRISCUS, in ichthyology, a genus belonging to the order of amphibia nantes. The head gradually ends in a narrow ſnout; the aperture is broad and flat; the belly is carinated; and the belly-fins are united. There are two ſpecies, *viz.* 1. The ſcutatus has its back covered with a ſmooth bony ſhell, which ends in a ſharp ſpine, under which is the tail; but the back-fins are between the tail and the ſpine. It is a native of the Eaſt Indies. 2. The ſcolopax has a rough ſcabrous body, and a ſtrait extended tail. It has two belly-fins, with four rays in each, and has no teeth. It is found in the Mediterranean.

CENTUMVIRI, in Roman antiquity, judges appointed to decide common cauſes among the people: they were choſen three out of each tribe; and though five more than an hundred, were nevertheleſs called centumviri, from the round number centum, an hundred.

CENTUNCULUS, in botany, a genus of the tetrandria monogynia claſs. The calix conſiſts of four ſegments; the corolla has four diviſions, and open; the ſtamina are ſhort; and the capſule has but one cell. There is only one ſpecies, *viz.* the minimus, or baſtard pimpernel, a native of Britain.

CENTURION, among the Romans, an officer in the infantry, who commanded a century, or an hundred men.

The centurions held the firſt rank in the firſt cohort of a legion, and two of them the place of the two firſt haſtati or pike-men: the firſt among the principes was alſo a centurion.

The centurion primipilus was the chief of the centurions: he was not under the command of any tribune, as all the reſt were; he had four centuries under his direction, and guarded the ſtandard and the eagle of the legion.

CENTURY, in a general ſenſe, any thing divided into or conſiſting of an hundred parts.

The Roman people, when they were aſſembled for the electing of magiſtrates, enacting of laws, or deliberating upon any public affair, were always divided into centuries, and voted by centuries, in order that their ſuffrages might be the more eaſily collected; whence theſe aſſemblies were called *comitia centuriata*. The Roman cohorts were alſo divided into centuries. See CENTURION and COHORT.

CENTURY, in chronology, the ſpace of one hundred years.

This method of computing by centuries is generally obſerved in church-hiſtory, commencing from the time of our Saviour's incarnation; in which ſenſe we ſay the firſt century, the ſecond century, *&c.*

CENTURIES *of Magdeburg*, a famous eccleſiaſtical hiſtory, ranged into thirteen centuries, carried down to the year 1298, compiled by ſeveral hundred Proteſtants of Magdeburg, the chief of whom was Matthias Flacius Illyricus.

CENTUSSIS, in Roman antiquity, a coin containing an hundred aſſes.

CEPA, in botany, the trivial name of a ſpecies of allium. See ALLIUM.

CEPÆA, in botany. See SEDUM.

CEPHALANTHUS, in botany, a genus of the tetrandria monogynia claſs. It has no common calix; the proper calix is tunnel-ſhaped; the receptacle is globular, and naked; and the ſeeds are downy. There is but one ſpecies, *viz.* the occidentalis, a native of America.

CEPHALIC, in a general meaning, ſignifies any thing belonging to the head.

CEPHALIC *medicines* are remedies for diſorders of the head.

CEPHALIC *vein*, in anatomy. See p. 241.

CEPHALONIA, the capital of an iſland of the ſame name, ſituated in the Mediterranean, near the coaſt of

of Epirus, and subject to the Venetians: E. long. 21°, and N. lat. 38° 30'.

CEPHALOPHARYNGÆI, in anatomy. See p. 302.

CEPHALUS, in ichthyology, the trivial name of a species of mugil. See MUGIL.

CEPHEUS, in astronomy, a constellation of the northern hemisphere.

CEPHUS, in ornithology, a synonime of a species of larus. See LARUS.

CERAM, an island in the Indian ocean, between the Molucca islands on the north, and those of Amboyna and Banda on the south, lying between 126° and 129° E. long. and in 3° S. lat.

It is about one hundred and fifty miles long, and sixty broad; and here the Dutch have a fortress, which keeps the natives in subjection.

CERAMBYX, in zoology, a genus of insects of the beetle kind, belonging to the order of insecta coleoptera. The antennæ are long and small; the breast is spinous or gibbous; and the elytra are linear. There are no less than 83 species enumerated by Linnæus, principally distinguished by the figure of the breast.

CERASTES, in zoology, the trivial name of a species of coluber; it is likewise the trivial name of a species of anguis. See ANGUIS, and COLUBER.

CERASTIUM, in botany, a genus of the decandria pentagynia class. The calix has five leaves; the petals are bifid; and the capsule is unilocular, and opens at the top. There are sixteen species, seven of which are natives of Britain, *viz.* the vulgatum, or narrow-leaved mouse-ear chickweed; the viscosum, or broad-leaved mouse-ear chickweed; the semidecandrium, or least mouse-ear chickweed; the arvense, or corn mouse-ear chickweed; the alpinum, or mountain mouse-ear chickweed; the tomentosum, or wooly mouse-ear chickweed; and the aquaticum, or marsh mouse-ear chickweed.

CERASUS, in botany, the trivial name of a species of prunus. See PRUNUS.

CERATE, in pharmacy, a kind of ointment applied to ulcerations, excoriations, *&c.* There are four kinds of cerate, *viz.* the *white cerate*, which is composed of a quarter of a pint of olive-oil, four ounces of white wax, and half an ounce of spermaceti, liquified together and sharred till the cerate be cold. The *yellow cerate* is composed of half a pound of yellow basilicum ointment, and an ounce of yellow wax, melted together. The *ceratum epuloticum*, is composed of one pint of olive-oil, and of yellow wax and calamine prepared each half a pound. Liquify the wax with the oil, and, as soon as the mixture begins to grow stiff, sprinkle in the calamine, keeping them constantly stirring till the cerate is quite cold. The *mercurial cerate* is composed of yellow wax, hogs lard dried, each half a pound; three ounces of quick-silver; and one dram of simple balsam of sulphur. Melt the wax with the lard, then gradually add this mixture to the quick-silver and balsam of sulphur previously ground together.

CERATION, the name given by the ancients to the small seeds of the ceratonia, used by the Arabian physicians, as a weight to adjust the doses of medicines; as the grain weight with us took its rise from a grain of barley.

CERATION, or CERATIUM, was also a silver coin, equal to one third of an obolus.

CERATOCARPUS, in botany, a genus of the monœcia monandria class. The calix of the male is divided into two parts; it has no corolla; and the filament is long: The calix of the female consists of two leaves connected to the germen; it has no corolla; the styli are two; and the seeds are bicorned and compressed. There is but one species, *viz.* the arenarius, a native of Tartary.

CERATOCEPHALOIDES, in botany. See VERBESINA.

CERATOCEPHALUS, in botany. See BIDENS.

CERATOIDES, in botany. See URTICA.

CERATONIA, in botany, a genus of the polygamia polyœcia class. It is a native of Sicily, Crete, and other eastern countries.

CERATOPHYLLUM, in botany, a genus of the monœcia polyandria class. The calix of the male is divided into many segments; it has no corolla; and the stamina are from 16 to 20. The calix and corolla of the female are the same with those of the male; it has one pistil, no stylus, and one naked seed. There are two species, one of which, *viz.* the demersum or horned pondweed, is a native of Britain.

CERATUM, in pharmacy. See CERATE.

CERBERA, in botany, a genus of the pentandria monogynia class. The fruit is a drupa containing one seed. There are three species, all of them natives of the Indies.

CERCELE, in heraldry. A cross cercele is a cross which opening at the ends, turns round both ways, like a ram's horn. See CROSS.

CERCIS, in botany, a genus of the decandria monogynia class. The calix is five-teethed, and gibbous below; the corolla is papilionaceous, with a short vexillum under the wings; the capsule is a legumen. There are two species, none of them natives of Britain.

CEREBELLUM, in anatomy. See p. 286.

CEREBRUM, in anatomy. See p. 285.

CEREMONY, an assemblage of several actions, forms, and circumstances, serving to render a thing more magnificent and solemn; particularly used to denote the external rites of religious worship, the formalities of introducing ambassadors to audiences, *&c.*

Master of the CEREMONIES, an officer instituted by king James I. for the more honourable reception of ambassadors and strangers of quality: he wears about his neck a chain of gold, with a medal under the crown of Great Britain, having on one side an emblem of peace, with this motto, *beati pacifici*; and on the other, an emblem of war, with *dieu et mon droit*: his salary is three hundred pounds *per annum.*

Assistant master of the CEREMONIES is to execute the employment in all points, whensoever the master of the

the ceremonies is abfent. His falary is one hundred and forty-one pounds thirteen fhillings and fourpence *per annum.*

Marfhal of the CEREMONIES is their officer, being fubordinate to them both. His falary is one hundred pounds *per annum.*

CEREUS, in botany. See CACTUS.

CERIGO, or CYTHEREA, in geography, an ifland of the Archipelago, on the eaftern coaft of the Morea, and fifty miles north of the ifland of Candia. It is a mountainous country, between forty and fifty miles in circumference, and fituated in E. long. 23° 40′, and N. lat. 36°.

CERINTHE, in botany, a genus of the pentandria monogynia clafs. The limbus of the corolla is tubular and ventricofe, opening at the faux; the feeds are often four, and fometimes two. There are only two fpecies, none of them natives of Britain.

CERINTHIANS, in church-hiftory, Chriftian heretics, followers of Cerinthus, who lived and publifhed his herefy in the time of the apoftles themfelves. They did not allow that God was the author of the creatures, but faid that the world was created by an inferior power: they attributed to this creator an only fon, but born in time, and different from the world: they admitted feveral angels and inferior powers: they maintained that the law and the prophets came not from God, but from the angels; and that the God of the Jews was only an angel: they diftinguifhed between Jefus and Chrift; and faid, that Jefus was a mere man, born, like other men, of Jofeph and Mary; but that he excelled all other men in prudence and wifdom; that Jefus being baptized, the Chrift of the fupreme God, that is, the Holy Ghoft, defcended upon him; and that by the affiftance of this Chrift, Jefus performed his miracles. It was partly to refute this fect that St John wrote his gofpel.

CERINTHOIDES, in botany. See CERINTHE.

CEROPEGIA, in botany, a genus of the pentandria monogynia clafs. The limbus of the corolla is connivent; and the feeds are plumofe. There are two fpecies, both natives of India.

CERRUS, in botany. See ÆGILOPS.

CERTHIA, in ornithology, a genus belonging to the order of picæ. The beak of this genus is arched, flender, fharp, and triangular; the tongue is fharp at the point; and the feet are of the walking kind, *i. e.* having the toes open and unconnected. There are 25 fpecies, *viz.* 1. The familiaris, or creeper, is grey above and white underneath, with brown wings, and ten white fpots on the ten prime feathers. It is a native of Europe, creeps up trees, lays about 20 eggs, and feeds upon caterpillars and the eggs of infects. 2. The muraria, or wall-creeper, is afh-coloured, with yellow fpots on the wings. It frequents towers and old walls, in the holes of which it builds its neft. 3. The pufilla, is grey above, and white below; the eye-brows are white; the prime feathers of the wings are brown, and white on the outer edge. It is a native of India. 4. The capenfis, is grey, with blackifh wings, the outermoft prime feathers of which are edged with white: It is a native of the Cape of Good-Hope. 5. The olivacea, is olive-coloured above, and grey below, with the orbits of the eyes white. It is found in Madagafcar. 6. The currucaria is likewife olive above, but yellowifh below; and the prime wing-feathers are equal. It is a native of Ceylon. 7. The jugularis is greyifh above, and yellowifh below; the throat is of a violet colour; and the two outmoft prime feathers of the wings are yellow at the points. It is found in the Philippine Ifles. 8. The cærulea has a blue belt round the eyes; and the throat, and prime wing and tail feathers are black: The bill is very long. It is a native of Surinam. 9. The cayana is of a green fhining colour above, and ftreaked with white below. It is a native of Cayenne. 10. The chalybeata is green and fhining above; the breaft is red, and on the fore-part of it there is an iron-coloured belt. 11. The afra is green above; the breaft is red; the belly is white; and it has a fhort blue tail. The above two fpecies are found at the Cape of Good-Hope. 12. The fpiza is green, with the head and prime wing-feathers black. It is a native of Brafil. 13. The fperata is purple above, and red below; the head, throat, and tail, are violet. It is found in the Philippine Ifles. 14. The fenegalenfis is of a blackifh violet colour; the top of the head and throat are greenifh, and the breaft is red. It is a native of Senegal. 15. The gutturalis is greenifh; the throat is a fhining green, and the breaft is purple. It is a native of Brafil. 16. The pinus is yellow below, and olive above; the wings are blue, with two white belts. It is a native of North America. 17. The cruenta is blackifh above, and white below; the top of the head, the neck, and tail, are red. It is a native of Bengal. 18. The flaveola is black above, and yellow below; the eye-brows, and the tops of the outermoft prime wing-feathers, are white. It is a native of America. 19. The pulchella has a green fhining body, and a red breaft; the two intermediate prime wing-feathers are very long. It is a native of Senegal. 20. The famofa has the two intermediate prime wing-feathers very long; the body is of a fhining green; and the axillæ of the wings are yellow. It is found at the Cape of Good-Hope. 21. The philippina has the two intermediate wing-feathers very long, a greenifh grey body, and yellowifh underneath. It is a native of the Philippine Ifles. 22. The violacea has the two intermediate prime wing-feathers very long, a fhining violet-coloured body, and the breaft and belly are yellow. 23. The zeylonica has a green head, an iron-coloured back, a yellow belly, and the throat and tail are azure. It is a native of Ceylon. 24. The cyanea is blue, with a black belt round the eyes; the fhoulders, wings, and tail are black, and the feet are red. It is a native of Brafil and Cayenne. 25. The lotentia is blue, with a red belt over the breaft. It is a native of Ceylon.

CERTIORARI, a writ which iffues out of the chancery, directed to an inferior court, to call up the records of a caufe there depending, in order that juftice may be done. And this writ is obtained upon complaint, that the

the party who feeks it has received hard ufage, or is not like to have an impartial trial in the inferior court. A certiorari is made returnable either in the king's bench, common pleas, or in chancery.

It is not only iffued out of the court of chancery, but likewife out of the king's bench, in which laft mentioned court it lies where the king would be certified of a record. Indictments from inferior courts, and proceedings of the quarter-feffions of the peace, may alfo be removed into the king's bench by a certiorari; and here the very record muft be returned, and not a tranfcript of it; though ufually in chancery, if a certiorari be returnable there, it removes only a tenor of the record.

CERTITUDE, confidered in the things or ideas which are the objects of our underftanding, is a neceffary agreement or difagreement of one part of our knowledge with another: as applied to the mind, it is the perception of fuch agreement or difagreement; or fuch a firm well-grounded affent, as excludes not only all manner of doubt, but all conceivable poffibility of a miftake.

There are three forts of certitude, or affurance, according to the different natures and circumftances of things.

1. A phyfical or natural certitude, which depends upon the evidence of fenfe; as that I fee fuch or fuch a colour, or hear fuch or fuch a found: no body queftions the truth of this, where the organs, the medium, and the object are rightly difpofed. 2. Mathematical certitude is that arifing from mathematical evidence; fuch is, that the three angles of a triangle are equal to two right ones. 3. Moral certitude is that founded on moral evidence, and is frequently equivalent to a mathematical one; as that there was formerly fuch an emperor as Julius Cæfar, and that he wrote the Commentaries which pafs under his name; becaufe the hiftorians of thefe times have recorded it, and no man has ever difproved it fince: this affords a moral certitude, in common fenfe fo great, that one would be thought a fool or a madman for denying it.

CERVIA, in geography, a city and port town of Romania, in Italy, fituated on the gulph of Venice, about ten miles fouth-eaft of Ravenna, and fubject to the pope: E. long. 13°, and N. lat. 44° 30′.

CERVICAL *nerves*, in anatomy. See p. 251.

CERVIX, in anatomy. See p. 166.

CERVIX *of the uterus*. See p. 274.

CERUMEN, EAR-WAX. See p. 296.

CERUSE, or CERUSS, *white lead*, a fort of calx of lead, made by expofing plates of that metal to the vapour of vinegar.

The beft way of preparing it is the following: A glafs-cucurbit is to be cut off in fuch a manner as to leave it a very long mouth; an alembic head of glafs is to be fitted to this; fome vinegar is to be put into the body, and a number of thin plates of lead are to be placed in the head in fuch a manner that they may ftand fomewhat erect: when the head is fitted on, the body is to be fet in a gentle fand-heat for twelve hours; then unluting the veffels, the receiver, which had been fitted to the nofe of the head, will contain a fweet and ftyptic liquor, naufeous and turbid, called the vinegar of lead, or the folution of lead; and the plates of lead, taken out of the head, will be found covered with a white dufty matter; this is cerufs; and if the operation be repeated, the whole lead will be in fine reduced to this ftate of cerufs.

Cerufs is ufed externally either mixed in ointments, or by fprinkling it on old gleeting and watery ulcers, and in many difeafes of the fkin. If, when it is reduced into a fine powder, it is received in with the breath in infpiration, and carried down into the lungs, it caufes terrible afthmas, that are almoft incurable, and at laft generally prove fatal: fad inftances of the very pernicious effects of this metal are too often feen among thofe perfons who work lead in any form, but particularly among the workers in white-lead.

The painters ufe it in great quantities, and, that it may be afforded cheap to them, it is generally adulterated with common whiting: the Englifh and Dutch cerufs are very bad in this refpect: the Venetian ought always to be ufed by apothecaries.

CERUSS *of antimony*, a medicine prepared by diftilling powdered regulus of antimony with fpirit of nitre, till no more fumes arife; what remains in the retort being pulverifed and wafhed, makes the cerufs of antimony, which is efteemed a powerful diuretic.

CERVUS, or DEER, in zoology, a genus of quadrupeds belonging to the order of pecora. The horns are folid, brittle, covered with a hairy fkin, and growing from the top; they likewife fall off, and are renewed annually. There are eight fore-teeth in the under jaw, and they have no dog-teeth. The fpecies of this genus are feven, *viz.* 1. The camelopardalis, with fimple or unbranched horns, and the fore-feet remarkably longer than the hind feet. This is an uncommon animal, few of them having ever been feen in Europe. It is a native of Æthiopia, and is very mild and gentle; The head is like that of a ftag; its horns are blunt and about fix inches long. The neck refembles that of a camel, but much longer, being fometimes feven feet in length. The body is fmall, covered with white hair, and fpotted with red. He is eighteen feet in length from the tail to the top of the head; and when he holds up his head, it is fixteen feet from the ground. He feeds principally on the leaves of trees.

2. The alces, or elk, has palmated horns, without any proper ftem, and a flefhy protuberance on the throat. This is the largeft animal of the deer kind. At the fair of St Germain at Paris, in the year 1752, a female elk was exhibited as a fhow. It was caught in the year 1749, in a foreft of Red Ruffia, belonging to a Khan of Tartary. The height was fix feet feven inches, the length ten feet, and the thicknefs eight. The hair was long, like that of a wild boar. The fkin is faid to refift the force of a gun bullet. The elk is a very fwift animal; and he feeds upon leaves of alder, birch, willow, &c. When tamed, he devours large quantities of hay or bread. This animal is found in the northern woods of Europe, Afia, and America.

3. The

3. The elaphus, is a kind of elk, with cylindrical ramified horns, bent backwards. It is a native of the northern parts of Europe and Afia.

4. The tarandus, or rein-deer, is a native of Lapland, and the northern parts of Europe, Afia, and America. The horns are large, cylindrical, branched, and palmated at the tops. Two of the branches hang over the face. He is about the fize of a buck, of a dirty whitifh colour; the hairs of his fkin are thick and ftrong. Thefe animals are of great ufe to the Laplanders; they feed upon their flefh; they employ their finews in fewing the boards of fledges together, and their milk affords them good cheefe: They likewife make garments of their fkins. The rein-deer are always employed in drawing fledges along the fnowy mountains, where horfes cannot travel. In a beaten track, they will drag a fledge twenty-five miles a day. When the animal is tired, his mafter loofes him from the fledge, and he immediately fcrapes the fnow from the ground with his feet, and feeds upon a fpecies of liver-wort, called rein-deer liverwort, which is very plentiful in thefe countries. This is the only nourifhment they require.

5. The dama, or buck and doe, a well known animal, kept tame in parks; the horns are branched, compreffed, and palmated at the top. It is a native of Europe. Their flefh, which goes by the name of venifon, is in high repute with the luxurious. See Plate LXIII.

6. The capreolus, has erect, cylindrical, branched horns, and forked at the top. It is called by fome authors the Brafilian goat, and is a native of Europe and Afia.

7. The Guineenfis, is of a greyifh colour, and black underneath. It is a native of Guinea, and the fize and figure of its horns have not been hitherto defcribed with any precifion.

CERVUS *volans*, in zoology, a fynonime of a fpecies of lucanus. See LUCANUS.

CESARE, among logicians, one of the modes of the fecond figure of fyllogifms; the minor propofition of which is an univerfal affirmative, and the other two univerfal negatives: Thus,

CE No immoral books ought to be read:
SA But every obfcene book is immoral:
RE Therefore no obfcene book ought to be read.

CESSIO *bonorum*, in Scots law. The name of that action by which an infolvent debtor may apply for liberation from prifon, upon making over his whole real and perfonal eftate to his creditors. See SCOTS LAW, title, *Sentences and their execution.*

CESTRUM, in botany, a genus of the pentandria monogynia clafs. The corolla is tunnel-fhaped; and the berry is unilocular. There are two fpecies, both natives of America.

CESTUS, among ancient poets, a fine embroidered girdle faid to be worn by Venus, to which Homer afcribes the faculty of charming and conciliating love.

CETACEOUS, an appellation given to fifhes of the whale kind.

CETE, the name of Linnæus's feventh order of mammalia, comprehending the MONODON, BALÆNA, PHYSETER, and DELPHINUS; fee thefe articles.

CETERACH, in botany, the trivial name of a fpecies of afplenium. See ASPLENIUM.

CETTE, a port-town of Languedoc, in France, fituated on a bay of the Mediterranean, in E. long. 3° 16′, and N. lat. 43° 25′.

CETUS, in aftronomy, a conftellation of the fouthern hemifphere, comprehending twenty-two ftars in Ptolemy's catalogue, twenty-one in Tycho's, and in the Britannic catalogue feventy-eight.

CEUTA, a city of the kingdom of Fez, in Africa, fituated on the fouth fide of the ftreights of Gibraltar, almoft oppofite to it: W. long. 6° 30′, and N. lat. 35° 50′. It is a ftrong fortrefs, in the poffeffion of the Spaniards.

CEYLON, an ifland in the Indian ocean, fituated between 78° and 82° E. long. and between 6° and 10° N. lat. It is about two hundred and fifty miles long, and two hundred broad. The Dutch, who are in poffeffion of all the fea-coaft, monopolize all the cinnamon produced in the ifland, the king being obliged to keep in the centre of the ifland, in his capital of Candy.

CHABLAIS, a country of Savoy, with the title of duchy.

CHACO, a large country of South America, fituated between 19° and 27° S. lat.

CHÆROPHYLLUM, or CHERVIL, in botany, a genus of the pentandria digynia clafs. The involucrum is concave and reflected; the petals are cordated; and the fruit is fmooth and oblong. The fpecies are feven, only two of which are natives of Britain, *viz.* the fylveftre, or wild cicely, or cow-weed; and the tumulum, or wild chervil. The leaves of the chervil are gently aperient and diuretic, and at the fame time grateful to the palate and ftomach.

CHÆTODON, in ichthyology, a genus of fifhes belonging to the order of thoraci. The teeth are very numerous, thick, fetaceous, and flexile: The rays of the gills are fix. The back-fin and the fin at the anus are flefhy and fquamous. There are twenty-three fpecies, diftinguifhed from each other principally by the figure of the tail, and the number of fpines in the back-fin.

CHAFF-FINCH, in ornithology, the Englifh name of a fpecies of fringilla. See FRINGILLA.

CHAGRE, a fort at the mouth of a river of the fame name, a little fouth of Porto Bello: W. long. 82°, and N. lat. 9° 50′.

CHAIN, a long piece of metal compofed of feveral links or rings, engaged the one in the other. They are made of divers metals, fome round, fome flat, others fquare; fome fingle, fome double; and ferve to fo many ufes, that it would be tedious to give a particular account of them all.

CHAIN is alfo a kind of meafure in France, in the trade of wood for fuel: There are chains for wood by tale, for wood by the rope, for faggots, for cleft wood, and for round fticks. There are alfo chains meafuring the fheaves of all forts of corn, particularly with regard to the payment of tythes; for meafuring pottles of hay,

nay, and for meafuring horfes. All thefe are divided into feet, inches, hands, *&c.* according to the ufe they are defigned for.

CHAIN-*fhot*, two bullets with a chain between them. They are ufed at fea to fhoot down yards or mafts, and to cut the fhrouds or rigging of a fhip.

CHAIN, in furveying, a meafure of length, made of a certain number of links of iron-wire, ferving to take the diftance between two or more places.

Gunter's chain of 100 fuch links, each meafuring $7\frac{92}{100}$ inches, and confequently equal to 66 feet, or four poles. See SURVEYING.

CHAISE, a fort of light, open chariot, or calafh. See CHARIOT.

CHALAZA, among naturalifts, a white knotty fort of ftring at each end of an egg, formed of a plexus of the fibres of the membranes, whereby the yolk and white are connected together. See EGG.

CHALCEDONY, in natural hiftory, a genus of femi-pellucid gems, of an even and regular not tabulated texture, of a femi-opaque cryftaline bafis, and variegated with different colours, difperfed in form of mifts and clouds, and, if nicely examined, found to be owing to an admixture of various kinds of earths, but imperfectly blended in the mafs, and often vifible in diftinct moleculæ.

Of this genus there are a great many fpecies, as the bluifh-white chalcedony; the brownifh-black chalcedony, or fmoaky jafper or capnitis of the ancients; and the yellow and red chalcedony.

All the chalcedonies give fire readily with fteel, and make no effervefcence with aqua-fortis.

CHALCIDES, in zoology, the trivial name of a fpecies lacerta. See LACERTA.

CHALDEA, or BABYLONIA, the ancient name of a country of Afia, now called Eyrac Arabic.

CHALDEE, or CHALDAIC *language*, that fpoken by the Chaldeans, or people of Chaldea: It is a dialect of the Hebrew. See HEBREW.

CHALDRON, a dry Englifh meafure, confifting of thirty-fix bufhels, heaped up according to the fealed bufhel kept at Guild-hall, London: but on fhip-board, twenty-one chaldron of coals are allowed to the fcore. The chaldron fhould weigh two thoufand pounds.

CHALK, in natural-hiftory, the Englifh name of the white, dry marle, with a dufty furface, found in hard maffes, and called by authors *creta*, and *terra creta.*

Chalk thrown into water, raifes a great number of bubbles, with a hiffing noife, and flowly diffufes itfelf into an impalpable powder. It ferments more ftrongly with acids than any other earth, and burns to lime.

As a medicine, chalk deferves, perhaps, the higheft place among the alkaline abforbents; nor is it lefs ufeful in many of the ordinary affairs of life. Its ufe in cleaning various utenfils is well known; and it is in no fmall repute as a manure, efpecially for cold four lands; in which intention the foft unctuous chalk is moft proper, as the dry, hard, and ftrong chalk is for lime. It is a great improver of lands, and will even change the very nature of them. However, it is moft advifeable to mix one load of chalk, with two or three of dung, mud, or frefh mould, whereby it will become a lafting advantage to the ground: The common allowance is fourteen loads of chalk to every acre.

Black CHALK, among painters, denotes a kind of ochreous earth, of a clofe ftructure, and fine black colour, ufed in drawing upon blue paper.

Red CHALK, an indurated clayey ochre, common in the colour-fhops, and much ufed by painters and artificers.

CHALLONS *on the Marne*, the capital of the Challonois, in the province of Champaign in France, fituated eighty-two miles eaft of Paris, and thirty fouth-eaft of Reims: E. long. 4° 35′, N. lat. 48° 55′. It is a bifhop's fee.

CHALLONS *on the Soan*, a city of Burgundy in France, thirty-two miles fouth of Dijon: E. long. 5°, N. lat. 46° 40′. It is the fee of a bifhop.

CHALYBEAT, in medicine, an appellation given to any liquid, as wine or water, impregnated with particles of iron or fteel.

Dr Monro, profeffor of anatomy at Edinburgh, by pouring a tincture of galls into common water, and diffolving therein a fmall quantity of fal martis, adding fome filings of iron, and oil of vitrol, procured a water exactly like the natural chalybeat water; and he is of opinion, that where thefe are not to be had, the artificial water may be made to anfwer all their intentions, according to its being more or lefs clofely kept, or expofed in the air or heat, *&c.*

CHAM, or KHAN, a word of much the fame import with *king* in Englifh: It is the title of the fovereign princes of Tartary, and is likewife applied to the principal noblemen in Perfia.

CHAM, in geography, a town of the Bavarian palatinate, fituated on a river of the fame name, about twenty-five miles north-eaft of Ratifbon; E. long. 13°, N. lat. 49° 15′.

CHAMA, in zoology, a genus of fhell-fifh belonging to the order of vermes teftacea. The fhell is thick, and has two valves; it is an animal of the oyfter kind. Linnæus enumerates 14 fpecies, principally diftinguifhed by the figure of their fhells.

CHAMÆBATOS, in botany. See RUBUS.

CHAMÆBUXUS, in botany. See POLYGALA.

CHAMÆCERASUS, in botany. See LONICERA.

CHAMÆCLEMA, in botany. See HEDERA.

CHAMÆCRISTA, in botany. See CASSIA.

CHAMÆDAPHNE, in botany. See KALMIA.

CHAMÆDRYS, in botany. See VERONICA.

CHAMÆLEA, in botany. See CENORUM.

CHAMÆLEON, in zoology, the trivial name of a fpecies of lacerta. See LACERTA.

CHAMÆLINUM, in botany. See LINUM.

CHAMÆMILUM, in botany. See MATRICARIA.

CHAMÆNERION, in botany. See EPILOBIUM.

CHAMÆPITYS, in botany. See TEUCRIUM.

CHAMÆRHODODENDROS, in botany. See AZALEA.

CHAMÆROPS, or HUMBLE-PALM, in botany, a genus ranged under the palmæ flabellifoliæ of Linnæus. It is a native of Spain.

Privy-CHAMBER. Gentlemen of the privy-chamber, are ſervants of the king, who are to wait and attend on him and the queen at court, in their diverſions, *&c.* Their number is forty-eight under the lord-chamberlain, twelve of whom are in quarterly waiting, and two of theſe lie in the privy-chamber.

In the abſence of the lord-chamberlain, or vice-chamberlain, they execute the king's orders: at coronations, two of them perſonate the dukes of Aquitain and Normandy: and ſix of them, appointed by the lord-chamberlain, attend ambaſſadors from crowned heads to their audiences, and in public entries. The gentlemen of the privy-chamber were inſtituted by Henry VII.

CHAMBER, in policy, the place where certain aſſemblies are held, alſo the aſſemblies themſelves. Of theſe, ſome are eſtabliſhed for the adminiſtration of juſtice, others for commercial affairs.

Of the firſt kind are, 1. Star-chamber, ſo called, becauſe the roof was painted with ſtars; the authority, power, and juriſdiction of which are abſolutely aboliſhed by the ſtatute 17 Car. I. 2. Imperial chamber of Spire, the ſupreme court of judicatory in the empire, erected by Maximilian I. This chamber has a right of judging by appeal, and is the laſt reſort of all civil affairs of the ſtates and ſubjects of the empire, in the ſame manner as the aulic council of Vienna. Neverthelefs it is reſtrained in ſeveral caſes; it takes no notice of matrimonial cauſes, theſe being left to the pope; nor of criminal cauſes, which either belong to particular princes or towns in their reſpective territories, or are cognizable by all the ſtates of the empire in a diet. By the treaty of Oſnaburg, in 1648, fifty aſſeſſors were appointed for this chamber, whereof twenty-four were to be Proteſtants, and twenty-ſix Catholics; beſides five preſidents, two of them Proteſtants, and the reſt Catholics. 3. Chamber of accounts, a ſovereign court in France, where accounts are rendered of all the king's revenues, inventories, and avowels thereof regiſtered; oaths of fidelity taken, and other things relating to the finances tranſacted. There are nine in France, that of Paris is the chief; it regiſters proclamations, treaties of peace, naturalizations, titles of nobility, *&c.* All the members wear long black gowns of velvet, of ſattin, or damaſk, according to their places. 4. Eccleſiaſtical chambers in France, which judge by appeal of differences about collecting the tythes. 5. Chamber of audience, or grand chamber, a juriſdiction in each parliament of France, the counſellors of which are called *jugeurs*, or judges, as thoſe of the chamber of inqueſts are called *rapporteurs*, reporters of proceſſes by writing. 6. Chamber of the edict, or miparty, a court eſtabliſhed by virtue of the edict of pacification, in favour of thoſe of the reformed religion. This chamber is now ſuppreſſed. 7. Apoſtolical chamber of Rome, that wherein affairs relating to the revenues of the church and the pope are tranſacted. This council conſiſts of the cardinal-camerlingo, the governor of the rota, a treaſurer, an auditor, a preſident, one advocate-general, a ſolicitor-general, a commiſſary, and twelve clerks. 8. Chamber of London, an apartment in Guildhall, where the city-money is depoſited.

Of the laſt ſort are, 1. The chambers of commerce. 2. The chambers of aſſurance. And, 3. The royal or ſyndical chamber of bookſellers in France.

The chamber of commerce is an aſſembly of merchants and traders, where the affairs relating to trade are treated of. There are ſeveral eſtabliſhed in moſt of the chief cities of France; and in our own country, we have lately ſeen chambers of this kind erected for carrying on the Britiſh herring-fiſhery. Chamber of aſſurance in France, denotes a ſociety of merchants and others for carrying on the buſineſs of inſuring; but in Holland, it ſignifies a court of juſtice, where cauſes relating to inſurances are tried. Chamber of bookſellers in Paris, an aſſembly conſiſting of a ſyndic and aſſiſtants, elected by four delegates from the printers, and twelve from the bookſellers, to viſit the books imported from abroad, and to ſearch the houſes of ſellers of marbled paper, printſellers, and dealers in printed paper for hangings, who are prohibited from keeping any letters proper for printing books. In the viſitation of books, which ought to be performed by three perſons at leaſt from among the ſyndic and aſſiſtants, all libels againſt the honour of God and the welfare of the ſtate, and all books printed either within or without the kingdom in breach of their regulations and privileges, are ſtopt, even with the merchandiſes that may happen to be in the bales with ſuch libels, or other prohibited books. The days appointed for this chamber to meet, are Tueſdays and Fridays, at two o'clock in the afternoon.

CHAMBERLAIN, an officer charged with the management and direction of a chamber. See CHAMBER, *in policy*.

There are almoſt as many kinds of chamberlains as chambers, the principal whereof are as follows.

Lord CHAMBERLAIN *of Great Britain*, the ſixth great officer of the crown; to whom belongs livery and lodging in the king's court; and there are certain fees due to him from each archbiſhop or biſhop, when they perform their homage to the king; and from all peers at their creation, or doing their homage. At the coronation of every king, he is to have forty ells of crimſon velvet for his own robes. This officer, on the coronation-day, is to bring the king his ſhirt, coif, and wearing cloaths; and after the king is dreſſed, he claims his bed, and all the furniture of his chamber for his fees: he alſo carries at the coronation, the coif, gloves, and linen to be uſed by the king on that occaſion; alſo the ſword and ſcabbard, the gold to be offered by the king, and the robes-royal and crown: he dreſſes and undreſſes the king on that day, waits on him before and after dinner, *&c.*

To this officer belongs the care of providing all things in the houſe of lords, in the time of parliament; to him alſo belongs the government of the palace of Weſtminſter: he diſpoſes likewiſe of the ſword of ſtate, to be carried before the king, to what lord he pleaſes.

Lord CHAMBERLAIN *of the houfehold*, an officer who has the overfight and direction of all officers belonging to the king's chambers, except the precinct of the king's bed-chamber.

He has the overfight of the officers of the wardrobe at all his majefty's houfes, and of the removing wardrobes, or of beds, tents, revels, mufic, comedians, hunting, meffengers, *&c.* retained in the king's fer vice. He moreover has the overfight and direction of the ferjeants at arms, of all phyficians, apothecaries, furgeons, barbers, the king's chaplain, *&c* and adminifters the oath to all officers above ftairs.

Other chamberlains, are thofe of the king's court of exchequer, of North Wales, of Chefter, of the city of London, *&c.* in which cafes this officer is generally the receiver of all rents and revenucs belonging to the place whereof he is chamberlain.

In the exchequer there are two chamberlains, who keep a controulment of the pells of receipts and exitus, and have certain keys of the treafury, records, *&c.*

CHAMBERLAIN *of London* keeps the city-money, which is laid up in the chamber of London: he alfo prefides over the affairs of mafters and apprentices, and makes free of the city, *&c.*

His office lafts only a year, but the cuftom ufually obtains to re-chufe the fame perfon, unlefs charged with any mifdemeanor in his office.

CHAMBERRY, the capital of the duchy of Savoy, in Italy, fituated ninety miles north-weft of Turin, and forty-five fouth of Geneva: E. long. 5° 45′, N. lat. 45° 40′.

CHAMOIS, or CHAMOIS-GOAT, in zoology. See CAPRA.

CHAMPAIGN, a province of France, bounded by Picardy on the north, by Lorrain on the eaft, by Burgundy on the fouth, and by the ifle of France on the weft. Its capital is Troyes.

CHAMPAIN, or *point* CHAMPAIN, in heraldry, a mark of difhonour in the coat of arms of him who kills a prifoner of war after he has cried quarter.

CHAMPION, a perfon who undertakes a combat in the place or quarrel of another; and fometimes the word is ufed for him who fights in his own caufe.

It appears that champions, in the juft fenfe of the word, were perfons who fought inftead of thofe that, by cuftom, were obliged to accept the duel, but had a juft excufe for difpenfing with it, as being too old, infirm, or being ecclefiaftics, and the like. Such caufes as could not be decided by the courfe of common law, were often tried by fingle combat; and he who had the good fortune to conquer, was always reputed to have juftice on his fide. Champions who fought for intereft only, were held infamous; thefe hired themfelves to the nobility, to fight for them in cafe of need, and did homage for their penfion

CHAMPION *of the king*, a perfon whofe office it is, at the coronation of our kings, to ride armed into Weftminfter-hall, while the king is at dinner there, and, by the proclamation of a herald, make challenge to this effect, *viz.* "That if any man fhall deny the king's "title to the crown, he is there ready to defend it in "fingle combat, *&c.*" Which done, the king drinks to him, and fends him a gilt cup, with a cover, full of wine, which the champion drinks, and has the cup for his fee.

CHANCE, in a general fenfe, a term applied to events not neceffarily produced as the natural effects of any proper foreknown caufe. For the doctrine of chance and its application to games, *&c.* fee GAMING.

CHANCE-*medley*, in law, is the accidental killing of a man, not altogether without the killer's fault, though without any evil intention; and is where one is doing a lawful act, and a perfon is killed thereby: For, if the act be unlawful, it is felony.

CHANCEL, a particular part of the fabric of a Chriftian church; or that part of the choir between the altar and the baluftrade that inclofes it, where the minifter is placed at the celebration of the communion.

CHANCELLOR, an officer fuppofed originally to have been a notary or fcribe under the emperors, and named *cancellarius*, becaufe he fat behind a lattice, called in Latin *cancellus*, to avoid being crowded by the people.

According to a late treatife, the chancellor originally prefided over a political college of fecretaries, for the writing of treaties, and other public bufinefs; and the court of equity, under the old conftitution, was held before the king and his council, in the palace, where one fupreme court for bufinefs of every kind was kept. At firft the chancellor became a judge, to hear and determine petitions to the king, which were preferred to him; and in the end, as bufinefs increafed, the people addreffed their fuit to the chancellor, and not to the king; and thus the chancellor's equitable power, by degrees, commenced by prefcription.

Lord high CHANCELLOR *of Great Britain*, or *Lord keeper of the great feal*, is the higheft honour of the long robe, being made fo *per traditionem magni figilli, per dominum regem*, and by taking the oaths: He is the firft perfon of the realm next after the king, and princes of the blood, in all civil affairs; and is the chief adminiftrator of juftice, next the fovereign, being the judge of the court of chancery.

All other juftices are tied to the ftrict rules of the law in their judgment: But the chancellor is invefted with the king's abfolute power, to moderate the written law, governing his judgment purely by the law of nature and confcience, and ordering all things according to equity and juftice. In this refpect Staundford fays, the chancellor has two powers, one abfolute, the other ordinary: Meaning, that although by his ordinary power, in fome cafes, he muft obferve the forms of proceedings, as other inferior judges; yet in his abfolute power, he is not limited by the law, but by confcience and equity.

The lord chancellor not only keeps the king's great feal; but alfo all patents, commiffions, warrants, *&c.* from the king, are, before they are figned, perufed by him: He has the difpofition of all ecclefiaftical benefices

nefices in the gift of the crown under 20l. a year, in the king's books; and he is ſpeaker of the houſe of lords. See PARLIAMENT.

CHANCELLOR *of a cathedral*, an officer that hears leſſons and lectures read in the church, either by himſelf or his vicar; to correct and ſet right the reader when he reads amiſs; to inſpect ſchools; to hear cauſes; apply the ſeal; write and diſpatch the letters of the chapter; keep the books; take care that there be frequent preachings, both in the church and out of it; and aſſign the office of preaching to whom he pleaſes.

CHANCELLOR *of the dutchy of Lancaſter*, an officer appointed chiefly to determine controverſies between the king and his tenants of the dutchy-land, and otherwiſe to direct all the king's affairs belonging to that court. See DUTCHY-*court*.

CHANCELLOR *of the exchequer*, an officer who preſides in that court, and takes care of the intereſt of the crown.

He is always in commiſſion with the lord-treaſurer, for the letting of crown-lands, *&c.* and has power, with others, to compound for forfeitures of lands, upon penal ſtatutes: He has alſo great authority in managing the royal revenues, and in matters relating to the firſt-fruits.

CHANCELLOR *of the order of the garter, and other military orders*, is an officer who ſeals the commiſſions and mandates of the chapter and aſſembly of the knights, keeps the regiſter of their proceedings, and delivers acts thereof under the ſeal of their order.

CHANCELLOR *of an univerſity*, is he who ſeals the diplomas, or letters of degrees, proviſion, *&c.* given in the univerſity.

The chancellor of Oxford is uſually one of the prime nobility, choſen by the ſtudents themſelves in convocation. He is their chief magiſtrate; his office is, *durante vita*, to govern the univerſity, preſerve and defend its rights and privileges, convoke aſſemblies, and do juſtice among the members under his juriſdiction.

Under the chancellor is the vice-chancellor, who is choſen annually, being nominated by the chancellor, and elected by the univerſity in convocation: He is always the head of ſome college, and in holy orders. His proper office is to execute the chancellor's power, to govern the univerſity according to her ſtatutes, to ſee that officers and ſtudents do their duty, that courts be duly called, *&c.* When he enters upon his office, he chuſes four pro-vice-chancellors out of the heads of the colleges, to execute his power in his abſence.

The chancellor of Cambridge is alſo uſually one of the prime nobility, and in moſt reſpects the ſame as that in Oxford; only he does not hold his office *durante vita*, but may be elected every three years. Under the chancellor there is a commiſſary, who holds a court of record for all privileged perſons and ſcholars under the degree of maſter of arts, where all cauſes are tried and determined by the civil and ſtatute law, and by the cuſtom of the univerſity.

The vice-chancellor of Cambridge is choſen annually, by the ſenate, out of two perſons nominated by the heads of the ſeveral colleges and hall.

CHANCERY, the grand court of equity and conſcience, inſtituted to moderate the rigour of the other courts that are bound to the ſtrict letter of the law.

The juriſdiction of this court is of two kinds, ordinary or legal, and extraordinary or abſolute. The ordinary juriſdiction is that wherein the lord-chancellor, who is judge of this court, in his proceeding and judgment, is bound to obſerve the order and method of the common law; in ſuch caſes the proceedings, which were formerly in Latin, but now in Engliſh, are filed or enrolled in the petty-bag-office; and the extraordinary, or unlimited power is that juriſdiction which the court exerciſes in caſes of equity, wherein relief is to be had by bill and anſwer.

The ordinary court holds plea of recognizances acknowledged in the chancery, writs of *ſcire facias* for repeal of the king's letters-patent. *&c.* alſo of all perſonal actions by or againſt any officer of the court, and of ſeveral offences and cauſes by act of parliament; all original writs, commiſſions of bankrupts, of charitable uſes, of ideots, lunacy, *&c.* are iſſued hence.

The extraordinary court gives relief for and againſt infants, notwithſtanding their minority; for and againſt married women, notwithſtanding their overture. All frauds and deceits, for which there is no redreſs at common law; all breaches of truſt, confidances and accidents, as to relieve obligors, mortgagors, *&c.* againſt penalties and forfeitures, where the intention was to pay the debt, are here remedied. But in all caſes where the plantiff can have his remedy at law, he ought not to be relieved in chancery; and a thing which may be tried by a jury, is not triable in this court.

The court of chancery will not retain a ſuit for any thing under ten pounds value, except in caſes of charity, nor for lands, *&c.* under forty ſhillings *per ann.* In this court all patents, moſt ſorts of commiſſions, deeds between parties touching lands and eſtates, treaties with foreign princes, *&c.* are ſealed and enrolled. Out of it are iſſued writs to convene the parliament and convocation, proclamations and charters, *&c.* For the ſeveral officers belonging to the court of chancery, ſee the articles MASTER *of the rolls*, MASTERS *in chancery*, CLERK, *&c.*

CHANDELIER, in fortification, a kind of moveable parapet, conſiſting of a wooden frame, made of two upright ſtakes, about ſix feet high, with croſs planks between them; ſerving to ſupport faſcines to cover the pioniers.

CHANNEL, in geography, an arm of the ſea, or a narrow ſea between two continents, or between a continent and an iſland. Such are the Britiſh channel, St George's channel, the channel of Conſtantinople, *&c.*

CHANTILLY, a village in France, about ſeven leagues from Paris, where there is a magnificent palace and fine foreſt belonging to the duke of Bourbon.

CHANTOR, a ſinger in the choir of a cathedral. The word is almoſt grown obſolete, *choriſter* or *ſinging-man* being commonly uſed inſtead of it. All great chapters

chapters have chantors and chaplains to affift the canons, and officiate in their abfence.

CHANTOR is ufed by way of excellence for the præcentor or mafter of the choir, which is one of the firft dignities of the chapter. At St David's in Wales, where there is no dean, he is next in dignity to the bifhop. The ancients called the chantor *primicerius cantorum*. To him belonged the direction of the deacons and other inferior officers.

Chantors in the temple of Jerufalem, were a number of Levites employed in finging the praifes of God, and playing upon inftruments before his altar. They had no habits diftinct from the reft of the people; yet in the ceremony of removing the ark to Solomon's temple, the chantors appeared dreffed in tunics of byffus or fine linen. 2 Chron. v. 12.

CHANTRY, or CHAUNTRY, a church or chappel, endowed with lands, *&c.* for the maintenance of one or more priefts to fay mafs for the fouls of the donors. Hence,

CHANTRY-*rents*, are rents ftill paid to the crown by the purchafers of thofe lands.

CHAOS, that confufion in which matter lay when newly produced out of nothing at the beginning of the world, before God, by his almighty word, had put it into the order and condition wherein it was after the fix days creation.

CHAOS, in zoology, a genus of infects belonging to the order of vermes zoophyta. The body has no fhell or covering, and is capable of reviving after being dead to appearance for a long time: It has no joints or external organs of fenfation. There are five fpecies, moftly obtained by infufions of different vegetables in water, and only difcoverable by the microfcope.

CHAPEAU, in heraldry, an ancient cap of dignity worn by dukes, being fcartlet-coloured velvet on the outfide, and lined with a fur. It is frequently borne above an helmet inftead of a wreath, under gentlemen's crefts.

CHAPEL, or CHAPPEL, a place of divine worfhip, ferved by an incumbent under the denomination of a chaplain.

CHAPEL is alfo a name given to a printer's work-houfe; in which fenfe they fay, the laws of the chapel, the fecrets of the chapel.

Knights of the CHAPEL, called alfo poor knights of Windfor, were inftituted by Henry VIII. in his teftament. Their number was at firft thirteen, but has been fince augmented to twenty-fix. They affift in the funeral fervices of the kings of England: They are fubject to the office of the canons of Windfor, and live on penfions affigned them by the order of the garter. They bear a blue or red cloke, with the arms of St George on the left fhoulder.

CHAPELET, in the menage, a couple of ftirrup leathers, mounted each of them with a ftirrup, and joined at top in a fort of leather buckle, called the head of the chapelet, by which they are made faft to the pummel of the faddle, after being adjufted to the rider's length and bore. They are ufed both to avoid the trouble of taking up or letting down the ftirrups, every time that the gentleman mounts on a different horfe and faddle, and to fupply the place of the academy faddles, which have no ftirrups to them.

CHAPITERS, in architecture, the fame with capitals.

CHAPITERS, in law, formerly fignified a fummary of fuch matters as were inquired of, or prefented before juftices in eyre, juftices of affize or of the peace, in their feffions.

Chapiters, at this time, denote fuch articles as are delivered by the mouth of the juftice in his charge to the inqueft.

CHAPLAIN, an ecclefiaftic who officiates in a chapel. See CHAPEL.

The king of Great Britain hath forty-eight chaplains in ordinary, ufually eminent doctors in divinity, who wait four each month, preach in the chapel, read the fervice to the family, and to the king in his private oratory, and fay grace in the abfence of the clerk of the clofet. Befides, there are twenty-four chaplains at Whitehall, fellows of Oxford or Cambridge, who preach in their turns, and are allowed 30 l. *per annum* each. According to a ftatute of Henry VIII. the perfons vefted with a power of retaining chaplains, together with the number each is allowed to qualify, is as follows: An archbifhop, eight; a duke or bifhop, fix; marquefs or earl, five; vifcount, four; baron, knight of the garter, or lord-chancellor, three; a dutchefs, marchionefs, countefs, baronefs, the treafurer and comptroller of the king's houfe, clerk of the clofet, the king's fecretary, dean of the chapel, almoner, and mafter of the rolls, each of them two; chief juftice of the king's bench, and warden of the cinque-ports, each one. All thefe chaplains may purchafe a licence or difpenfation, and take two benefices with cure of fouls. A chaplain muft be retained by letters teftimonial under hand and feal; for it is not fufficient that he ferve as chaplain in the family.

CHAPLAIN *of the order of Malta*, otherwife called diaco, and clerk conventual, the fecond clafs of the order of Malta. The knights make the firft rank.

CHAPLET, a ftring of beads ufed by the Roman Catholics, to count the number of their prayers. The invention of it is afcribed to Peter the hermit, who probably learned it of the Turks, as they owe it to the Eaft-Indians.

Chaplets are fometimes called pater-nofters, and are made of coral, of diamonds, of wood, *&c.* The common chaplet contains fifty ave-marias, and five pater-nofters. There is alfo a chaplet of our Saviour, confifting of thirty-three beads, in honour of his thirty-three years living on earth, inftituted by father Michael the Camaldulian.

CHAPPE', in heraldry, the dividing an efcutcheon by lines drawn from the centre of the upper edge to the angles below, into three parts, the fections on the fides being of a different metal or colour from the reft.

CHAPPEL *in frith*, a market town of Derbyfhire, about twenty-fix miles north-weft of Derby; W. long. 1° 50′, N. lat. 53° 22′.

CHAPTER, in eccleſiaſtical polity, a ſociety or community of clergymen belonging to the cathedrals and collegiate-churches.

It was in the eighth century that the body of canons began to be called a chapter. The chapter of the canons of a cathedral were a ſtanding council to the biſhop, and, during the vacancy of the ſee, had the juriſdiction of the dioceſe. In the earlier ages, the biſhop was head of the chapter; afterwards abbots and other dignitaries, as deans, provoſts, treaſurers, *&c.* were preferred to this diſtinction. The deans and chapters had the privilege of chuſing the biſhops in England; but Henry VIII. got this power veſted in the crown: and as the ſame prince expelled the monks from the cathedrals, and placed ſecular canons in their room, thoſe he thus regulated were called deans and chapters of the new foundation; ſuch are Canterbury, Wincheſter, Ely, Carliſle, *&c.*

CHAPTER, in matters of literature, a diviſion in a book for keeping the ſubject treated of more clear and diſtinct.

CHARA, in botany, a genus of the cryptogamia algæ claſs. The calix conſiſts of two leaves; the antheræ are globular and ſeſſile; there are three ſtigmata, and one round ſeed The ſpecies are four, three of which are natives of Britain, *viz.* the tomentoſa, or brittle chara; the vulgaris, or common chara; the hiſpida, or rough chara; and the flexilis, or ſmooth chara.

CHARABON, a ſea-port town on the northern coaſt of the iſland of Java, in the Indian ocean, ſituated 130 miles eaſt of Batavia; E. long. 108°, ſouth lat. 6°.

CHARACTER, in a general ſenſe, denotes any mark whatever, ſerving to repreſent either things or ideas: thus letters are characters, types, or marks of certain ſounds; words, of ideas, *&c.*

Literal characters may be divided, with reſpect to the nations among whom they have been invented, into Greek characters, Roman characters, Hebrew characters, *&c* The Latin character now uſed through all Europe was formed from the Greek, as the Greek was from the Phœnician; and the Phœnician, as well as the Chaldee, Syriac, and Arabic characters, were formed from the ancient Hebrew, which ſubſiſted till the Babyloniſh captivity; for, after that event, the character of the Aſſyrians, which is the ſquare Hebrew now in uſe, prevailed, the ancient being only found on ſome Hebrew medals, commonly called Samaritan medals It was in 1091 that the Gothic characters, invented by Ulfilas, were aboliſhed, and the Latin ones eſtabliſhed in their room.

Medalliſts obſerve, that the Greek character, conſiſting only of majuſcule letters, has preſerved its uniformity on all medals, as low as the time of Gallienus; from that time it appears ſomewhat weaker and rounder: from the time of Conſtantine to Michael we find only Latin characters; and after Michael the Greek characters recommence; but from that time they begin to alter with the language, which was a mixture of Greek and Latin. The Latin medals preſerve both their character and language as low as the tranſlation of the ſeat of the empire to Conſtantinople: towards the time of Decius the character began to loſe its roundneſs and beauty; ſome time after, it retrieved, and ſubſiſted tolerably till the time of Juſtin, when it degenerated gradually into the Gothic. The rounder, then, and better formed a character is upon a medal, the fairer pretence it has to antiquity.

CHARACTER is alſo uſed, in ſeveral of the arts, for a ſymbol, contrived for the more conciſe and immediate conveyance of the knowledge of things. For the

CHARACTERS *uſed in algebra*, ſee p. 79, 80.

CHARACTERS *uſed in aſtronomy*, viz.

Of the planets. See plate XXXIX.

Of the ſigns. See plate XXXIX.

Of the aſpects.

☌ or S Conjunction	△ Trine
SS Semiſextile	Bq Biquintile
⚹ Sextile	Vc Quincunx
Q Quintile	☍ Oppoſition
□ Quartile	☊ Dragon's head
Td Tredecile	☋ Dragon's tail

Of time.

A. M. *ante meridiem*, before the ſun comes upon the meridian.

O. or N. noon.

P. M. *poſt meridiem*, when the ſun is paſt the meridian.

CHARACTERS *in commerce.*

D° *ditto*, the ſame	R° *recto*, V° *verso* } *folio*
N° *numero*, or number	£. or *l.* pounds ſterling
F° *folio*, or page	
C or ⊕ hundred weight, or 112 pounds	℔, *per*, or by, as ℔ *ann.* by the year, ℔ *cent.*
q^{rs} quarters	R^x rixdollar
S or *ſ* ſhillings	D^t ducat
d pence or deniers	P. S. poſtſcript, *&c.*
℔ pound weight.	

CHARACTERS *in chemiſtry.* See CHEMISTRY.

CHARACTERS *in geometry and trigonometry.*

∥ the character of parallelism	$\stackrel{V}{=}$ equiangulr, or ſimilar
△ triangle	$\stackrel{\perp}{=}$ equilateral
□ ſquare	∠ an angle
▯ ▭ rectangle	∟ right angle
⊙ circle	⊥ perpendicular

° denotes a degree; thus 45° implies 45 degrees. ′ a minute; thus, 50′, is 50 minutes. ″, ‴, ⁗, denote ſeconds, thirds, and fourths: and the ſame characters are uſed where the progreſſions are by tens, as it is here by ſixties.

CHARACTERS *in grammar, rhetoric, poetry*, &c.

( ) parentheſis	SS. T. D. doctor in divinity
[ ] crotchet	V. D. M. miniſter of the word of God
- hyphen	
’ apoſtrophe	
′ emphaſis or accent	
˘ breve	LL. D. doctor of laws
¨ dialyſis	J. V. D. doctor of civil and canon law
‸ caret and circumflex	“ quotation

" quotation	M. D. doctor in phyſic
† ‡ and * references	A. M. maſter of arts
§ ſection or diviſion	A. B. bachelor of arts
¶ paragraph	

F. R. S. fellow of the royal ſociety.

For the other characters uſed in grammar, ſee COMMA, COLON, SEMICOLON, *&c.*

CHARACTERS *among the ancient lawyers, and in ancient inſcriptions.*

§ paragraphs	P. P. pater patriæ
ff digeſts	C. code
Scto. ſenatus conſulto	C. C. conſules
	T. titulus
E. extra	P. P. D. D. propria pecunia dedicavit
S. P. Q. R. ſenatus populuſque Romanus	D. D. M. dono dedit monumentum

CHARACTERS *in medicine and pharmacy.*

℞ recipe	M. manipulus, a handful
á, *áá*, or ana, of each alike	P. a pugil
℔ a pound or a pint	P. Æ. equal quantities
℥ an ounce	S. A. according to art
ʒ a drachm	q. s. a ſufficient quantity
℈ a ſcruple	q. pl. as much as you pleaſe
gr. grains	P. P. pulvis patrum, the Jeſuit's bark.
ß or *ſs*, half of any thing	
cong. congius, a gallon	
coch. cochleare, a ſpoonful	

CHARACTERS *uſed in muſic.* See MUSIC.

Numeral CHARACTERS uſed to expreſs numbers, are either letters or figures. The Arabic character, called alſo the common one, becauſe it is uſed almoſt throughout Europe in all ſorts of calculations, conſiſts of theſe ten digits, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

The Roman numeral character conſiſts of ſeven majuſcule letters of the Roman alphabet, *viz.* I, V, X, L, C, D, M. The I denotes one, V five, X ten, L fifty, C a hundred, D five hundred, and M a thouſand.

The I repeated twice makes two, II; thrice, three, III; four is expreſſed thus IV, as I before V or X takes an unit from the number expreſſed by theſe letters. To expreſs ſix, an I is added to a V, VI; for ſeven, two, VII: and for eight, three, VIII: nine is expreſſed by an I before X, thus IX.

The ſame remark may be made of the X before L or C, except that the diminution is by tens; thus, XL denotes forty, XC ninety, and LX ſixty. The C before D or M diminiſhes each by a hundred.

The number five hundred is ſometimes expreſſed by an I before a C inverted, thus, IƆ; and inſtead of M, which ſignifies a thouſand, an I is ſometimes uſed between two C's, the one direct, and the other inverted, thus CIƆ. The addition of C and Ɔ before or after, raiſes CIƆ by tens, thus, CCIƆƆ expreſſes ten thouſand, CCCIƆƆƆ, a hundred thouſand.

The Romans alſo expreſſed any number of thouſands by a line drawn over any numeral leſs than a thouſand; thus, $\overline{\text{V}}$ denotes five thouſand, $\overline{\text{LX}}$ ſixty thouſand: ſo likewiſe $\overline{\text{M}}$ is one million, $\overline{\text{MM}}$ is two millions, *&c.*

Some modern writers have admitted variations in this method of notation; thus we find IIX expreſſing eight, IICIX eighty-nine, Λ or V denoting IƆƆ, and ∞ or ⳩ ſtanding for CIƆ; whence ⳩ ten thouſand, Ψ Ψ twenty thouſand.

The Greeks had three ways of expreſſing numbers: firſt, every letter, according to its place in the alphabet, denoted a number, from α, one, to ω, twenty-four. 2. The alphabet was divided into eight units, α one, β two, γ three, *&c.* into eight tens, ι ten, κ twenty, λ thirty, *&c.* and eight hundreds, ρ one hundred, σ two hundred, τ three hundred, *&c.* 3. I ſtood for one, Π five, Δ ten, H a hundred, X a thouſand, M ten thouſand; and when the letter Π incloſed any of theſe, except I, it ſhewed the incloſed letter to be five times its value; as [Δ] fifty, [H] five hundred, [X] five thouſand, [M] fifty thouſand.

French CHARACTERS, uſed in the chamber of accounts, and by perſons concerned in the management of the revenue, is, properly ſpeaking, nothing elſe than the Roman numerals, in letters that are not majuſcule: thus, inſtead of expreſſing fifty-ſix by LVI, they denote it by ſmaller characters lvj.

CHARACTERS *upon tomb-ſtones.*

S. V. Siſte viator, *i. e.* Stop traveller.

M. S. Memoriæ ſacrum, *i. e.* Sacred to the memory.

D. M. Diis manibus.

I H S. Jeſus.

X. P. a character found in the catacombs, about the meaning of which authors are not agreed.

CHARACTER, in epic and dramatic poetry, that which is peculiar in the manners of any perſon, and diſtinguiſhes him from all others. See EPIC, *and dramatic compoſitions.*

CHARADRIUS, in ornithology, a genus belonging to the order of grallæ. The beak is cylindrical and blunt; the noſtrils are linear, and the feet have three toes. There are 12 ſpecies, *viz.* 1. The hiaticula, or ſea-lark of Ray, has a black breaſt, a white ſtreak along the front; the top of the head is brown; and the legs and beak are reddiſh. It is found on the ſhores of Europe and America. 2. The alexandrinus, or oriental dotterell, is of a browniſh colour, with the fore-head, collar, and belly white; the prime tail-feathers on both ſides are white; and the legs are black. It is a native of Egypt, and is much valued for its ſinging. It is about the ſize of a crow, and lives upon mice, rats, *&c.* 3. The vociferus, or noiſy plover of Cateſby, has black ſtreaks on the breaſt, neck, fore-head, and cheeks; and the feet are yellow. It is a native of North America. 4. The ægyptius, has a black ſtreak on the breaſt, white eye-brows, the prime tail-feathers ſtreaked with black at the points, and bluiſh legs. It is found in the plains of Egypt, and feeds on inſects. 5. The morinellus has an iron coloured breaſt, a ſmall white ſtreak on the breaſt and eye-brows, and black legs. It is the dotterell of Ray, and a native of Europe. 6. The apricarius has a black belly; the body is brown,

brown, and variegated with white and yellow ſpots; and the legs are aſh-coloured. It is the ſpotted plover of Edwards, and a native of Canada. 7. The pluvialis, is black above, with green ſpots, white underneath, and the feet are aſh-coloured. It is the green plover of Ray, and is a native of Europe. 8. The torquatus, has a black breaſt, and a white front; the top of the head and the collar is black; and the beak and feet are bluiſh. It is a native of St Domingo. 9. The calidris, has black feet and a black bill; the rump is greyiſh; and the body is pure white below. It frequents the ſhores of Europe. 10. The œdicnemus, or ſtone curlew of Ray, is of a grey colour, with two of the prime wing-feathers black, but white in the middle; it has a ſharp bill, and aſh-coloured feet. It is a native of Britain. 11. The luinantopus, is white below, with a black back, and a long black bill; the feet are red and very long. It is the autumnal dotterell of Engliſh authors, and frequents the ſea-ſhores of Europe. 12. Spinoſus, armed dotterell, or lap-wing, has a black breaſt, legs, and wings; it has a creſt on the hinder part of the head. It is of the ſize of a pidgeon; the French call it dominicanus, from the reſemblance it has to the dreſs of a dominican monk: It is a native of Egypt.

CHARANTIA, in botany. See MOMORDICA.

CHARAX, in ichthyology. See SALMO.

CHARBON, in the menage, that little black ſpot o mark which remains after a large ſpot in the cavity of the corner teeth of a horſe: about the ſeventh or eighth year, when the cavity fills up, the tooth being ſmooth and equal, it is ſaid to be raſed.

CHARCAS, the ſouthern diviſion of Peru, in South America, remarkable for the ſilver-mines of Potoſi.

CHARCOAL, a kind of fuel, conſiſting of half-burnt wood, much uſed by artificers of different profeſſions; and that not only as fuel, but for poliſhing braſs or copper-plates, *&c.*

The beſt charcoal for common uſes is that made of oak; but in the manufacture of gunpowder they commonly uſe charcoal made of alder.

CHARENTE, a river of France, which ariſing in the Limoſin, runs weſtward by Angouleſme and Saintes, falling into the bay of Biſcay, oppoſite to the iſle of Oleron.

CHARENTON, the name of two towns in France, the one upon the Marmaude, in the Bourbonois; the other in the iſle of France, near the confluence of the Marne with the Seine, about three miles ſouth-eaſt of Paris: E. long. 2° 30'; and N. lat. 48° 45'.

CHARGE, in heraldry, is applied to the figures repreſented on the eſcutcheon, by which the bearers are diſtinguiſhed from one another; and it is to be obſerved, that too many charges are not ſo honourable as fewer.

CHARGE *of lead* denotes a quantity of thirty-ſix pigs. See PIG.

CHARGE *to enter heir*, in Scots law, a writing paſſing under the ſignet, obtained at the inſtance of a creditor, either againſt the heir of his debitor, for fixing upon him the debt as repreſenting the debitor, which is called a general charge: Or, againſt the debitor himſelf, or his heir, for the purpoſe of veſting him in the right of any heritable ſubject to which he has made up no title, in order the creditor may attach that ſubject for payment of his debt, in the ſame manner as if his debitor or his heir were legally veſted in it by ſervice or otherwiſe. This laſt kind is called a ſpecial charge. See SCOTS LAW, title, *Appriſings and adjudications*.

CHARGED, in heraldry, a ſhield carrying ſome impreſs or figure, is ſaid to be charged therewith; ſo alſo when one bearing, or charge, has another figure added upon it, it is properly ſaid to be charged.

CHARIOT, a half coach, having only a ſeat behind, with a ſtool, at moſt, before. See COACH.

The chariots of the ancients, chiefly uſed in war, were called by the ſeveral names *bigæ*, *trigæ*, &c. according to the number of horſes applied to draw them. Every chariot carried two men, who were probably the warrior and the charioteer; and we read of ſeveral men of note and valour employed in driving the chariot. When the warriors came to encounter in cloſe fight, they alighted out of the chariot, and fought on foot; but when they were weary, which often happened, by reaſon of their armour, they retired into their chariot, and thence annoyed their enemies with darts and miſſive weapons. Theſe chariots were made ſo ſtrong, that they laſted for ſeveral generations.

Beſides this ſort, we find frequent mention of the *currus falcati*, or thoſe chariots armed with hooks, or ſcythes, with which whole ranks of ſoldiers were cut off together, if they had not the art of avoiding the danger; theſe were not only uſed by the Perſians, Syrians. Egyptians, *&c.* but we find them among our Britiſh anceſtors.

Triumphal CHARIOT was one of the principal ornaments of the Roman celebration of a victory.

The Roman triumphal chariot was generally made of ivory, round like a tower, or rather of a cylindrical figure; it was ſometimes gilt at the top, and ornamented with crowns; and, to repreſent a victory more naturally, they uſed to ſtain it with blood. It was uſually drawn by four white horſes, but oftentimes by lions, elephants, tygers, bears, leopards, dogs, *&c.*

CHARISTIA, a feſtival of the ancient Romans, celebrated in the month of February, wherein the relations by blood and marriage met, in order to preſerve a good correſpondence; and that, if there happened to be any difference among them, it might be the more eaſily accommodated, by the good humour and mirth of the entertainment.

CHARITY, among divines, one of the three grand theological virtues, conſiſting in the love of God and of our neighbour, or the habit and diſpoſition of loving God with all our heart, and our neighbour as ourſelves.

CHARITY *of St Hippolitus*, a religious congregation founded, about the end of the XIVth century, by one Bernardin Alvarez, a Mexican, in honour of St Hippolitus

Hippolitus the martyr, patron of the city of Mexico; and approved by pope Gregory XIII.

CHARLEMONT, a town of the province of Namur, in the Auftrian Netherlands, about eighteen miles fouth of Namur: E. long. 4° 40′, and N. lat. 50° 10′.

CHARLEMONT is alfo the name of a town of Ireland, fituated on the river Blackwater, in the county of Armagh, and province of Ulfter, about fix miles fouth-eaft of Dungannon: W. long. 6° 50′, and N. lat. 50° 16′.

CHARLEROY, a ftrong town in the province of Namur, in the Auftrian Netherlands, fituated on the river Sambre, about nineteen miles weft of Namur: E. long. 4° 20′, and N. lat. 50. 30′.

CHARLES's CAPE, a promontory of Virginia, in North America, forming the northern head-land of the ftreight that enters the bay of Cheafepeak.

CHARLES's-FORT, a fortrefs in the county of Cork, and province of Munfter in Ireland, fituated at the mouth of Kinfale harbour: W. long. 8° 20′, and N. lat. 51° 21′.

CHARLES's-TOWN, the capital of South Carolina, in North America, fituated on a peninfula formed by Afhley and Cooper rivers, the former of which is navigable for fhips twenty miles above the town: W. long. 79°, and N. lat. 32° 30′.

CHARLES's-WAIN, in aftronomy, feven ftars in the conftellation called *urfa major*. or the great bear.

CHARLETON, an ifland at the bottom of Hudfon's-bay, in North America, fubject to Great Britain: W. long. 80°, and N. lat. 52° 30′.

CHARLOCK, the Englifh name of the raphanus. See RAPHANUS.

CHARM, a term derived from the Latin *carmen*, a verfe; and ufed to denote a magic power, or fpell, by which, with the affiftance of the devil, forcerers and witches were fuppofed to do wonderful things, far furpaffing the power of nature.

CHARNEL, or CHARNEL-HOUSE, a kind of portico, or gallery, ufually in or near a church-yard, over which were anciently laid the bones of the dead, after the flefh was wholly confumed.

Charnel-houfes are now ufually adjoining to the church.

CHARNUB, in botany. See CERATONIA.

CHART, or SEA-CHART, an hydrographical map, or a projection of fome parts of the earth's fuperficies *in plano*, for the ufe of navigators. See NAVIGATION.

CHARTA-*magna*. See MAGNA *charta*.

CHARTER, in law, a written inftrument or evidence of things acted between one perfon and another.

Charters of private perfons, are deeds and inftruments for the conveyance of lands, *&c.* Here the purchafer of land fhall have all the charters and deeds, as incident to the fame, and for the maintenance of his title. But this is underftood where the feoffer is not bound to a general-warranty of the land.

CHARTER, in Scots law, that writing which contains the grant of a feudal fubject to the vaffal. See SCOTS LAW, tit. *Of the conftitution of heritable rights*.

CHARTOPHYLAX, the name of an officer of the church of Conftantinople, who attends at the door of the rails when the facrament is adminiftered, and gives notice to the priefts to come to the holy table. He reprefents the patriarch upon the bench, tries all ecclefiaftical caufes, keeps all the marriage regifters, affifts at the confecration of bifhops, and prefents the bifhop elect at the folemnity, and likewife all other fubordinate clergy. This office refembles in fome fhape that of the bibliothecarius at Rome.

CHARTRES, a large city of France, in the province of Orleanois, fituated on the river Eure, about forty-two miles fouth-weft of Paris: E. long. 1° 32′, N. lat. 48° 27′. It is a bifhop's fee.

CHARTREUSE, or CHARTREUSE-GRAND, a celebrated monaftery, the capital of all the convents of the Carthufian monks, fituated on a fteep rock in the middle of a large foreft of fir-trees, about feven miles north-eaft of Grenoble, in the province of Dauphine in France: E. long. 5° 5′, N. lat. 45° 20′. See CARTHUSIANS.

From this mother-convent, all the others of the fame order take their name; among which was the Chartreufe of London, corruptly called the charter-houfe, now converted into an hofpital, endowed with a revenue of 600 l. *per ann.*

Here are maintained eighty decayed gentlemen, not under fifty years of age: Alfo forty boys are educated and fitted either for the univerfity or trades. Thofe fent to the univerfity, have an exhibition of 20 l. a year for eight years; and have an immediate title to nine church-livings in the gift of the governors of the hofpital, who are fixteen in number, all perfons of the firft diftinction, and take their turns in the nomination of penfioners and fcholars.

CHARYBDIS, a rock in the ftrait of Meffina, between Italy and Sicily, much celebrated in the writings of ancient poets.

CHARYBDIS is alfo an appellation given by Dr Plot to certain openings in the bottom of the fea, whereby the water is conveyed to the origin or fources of fprings, rivers, *&c.* fuch is Maelftroom, on the coaft of Norway, fuppofed to be. See MAELSTROOM.

CHASING *of gold, filver*, &c. See ENCHASING.

CHASTE-*tree*. See VITEX.

CHATELET, the name of certain courts of juftice eftablifhed in feveral cities in France. The grand chatelet at Paris, is the place where the prefidial or ordinary court of juftice of the provoft of Paris is kept; confifting of a prefidial, a civil chamber, a criminal chamber, and a chamber of policy. The little chatelet is an old fort, now ferving as a prifon.

CHATHAM, a port-town of Kent, adjoining to Rochefter, fituated on the river Medway, thirty miles fouth-eaft of London: E. long. 40′, N. lat. 51° 20′.

It is the principal ftation of the royal navy, furnifhed with timber, rope-yards, and all manner of naval ftores, fufficient for the building and fitting out the largeft fleet.

CHATTEAU-CAMBRESIS, a town of the Cambrefis, in the French Netherlands, fituated on the river Selle,

Selle, thirteen miles fouth-eaft of Cambray, E. long. 3° 25′, N. lat. 50° 6′.

CHATTEAU DAUPHINE, a fortrefs fituated on the frontiers of Piedmont, in the province of Dauphine, but yielded to the king of Sardinia: E. long. 6° 40′, N. lat. 44° 30′.

CHATTELS, in law, all forts of goods moveable and immoveable, except fuch as are in the nature of freehold.

CHATTIGAN, a port-town of India, in the province of Bengal, fituated at the mouth of the moft eafterly branch of the Ganges, fubject to the Mogul: E. long. 91°, N. lat. 23°.

CHATTILLON, a town of Burgundy in France, about fixteen miles fouth-weft of Geneva: E. long. 5° 40′, N. lat. 46° 16′.

CHATTILLON is likewife the name of feveral other towns of France, fituated upon the Indre, the Loing, the Loire, the Marne, the Saone, *&c.*

CHAUMONT, the name of two towns in France; the one fituated in the ifle of France, thirty miles north-weft of Paris, E. long. 2°, N. lat. 49° 18′; the other fituated on the river Marne, in the province of Champaign, E. long. 5° 15′, N. lat. 48° 12′.

CHAUSE-TRAPE. See CALTROP.

CHEADLE, a market-town of Staffordfhire, ten miles north-eaft of Stafford: W. long. 2°, N. lat. 53°.

CHEASPEAK-BAY, a large frith or arm of the fea, which runs up about three hundred miles into the country between Virginia and Maryland, in North America: It is navigable almoft all the way for large fhips; being about twenty miles broad at the entrance between Charles-cape and Cape Henry, and between twenty and thirty miles broad afterwards. See CHARLES-CAPE.

CHECAYA, in Turkifh affairs, the fecond officer of the janizaries, who commands them under the aga, and is otherwife called *protogero.*

There is alfo a checaya of the treafury, ftables, kitchen, *&c.* the word fignifying as much as lieutenant, or the fecond in any office.

CHECK, or CHECK-ROLL, a roll or book, wherein is contained the names of fuch perfons as are attendants and in pay to the king, or other great perfonages, as their houfehold fervants.

Clerk of the CHECK, in the king's houfehold, has the check and controulment of the yeomen of the guard, and all the ufhers belonging to the royal family, allowing their abfence or defects in attendance, or diminifhing their wages for the fame, *&c.* He alfo, by himfelf or deputy, takes the view of thofe that are to watch in the court, and has the fetting of the watch, *&c.*

Clerk of the CHECK, in the king's navy at Plymouth, is alfo the name of an officer invefted with the like power.

CHECK, in falconry, a term ufed of a hawk when fhe forfakes her proper game, to flie at pyes, crows, rooks, or the like, that crofs her in her flight.

CHECKY, in heraldry, is when the fhield, or a part thereof, as a bordure, *&c.* is chequered, or divided into chequers or fquares, in the manner of a chefs-board.

This is one of the moft noble and moft ancient figures ufed in armory; and a certain author faith, that it ought to be given to none but great warriors, in token of their bravery: For the chefs-board reprefents a field of battle; and the pawns of men, placed on both fides, reprefent the foldiers of the two armies, which move, attack, advance, or retire, according to the will of the gamefters, who are the generals.

This figure is always compofed of metal and colour: But fome authors would have it reckoned among the feveral forts of furs.

CHEEK, in anatomy, that part of the face fituated below the eyes, on each fide. See p. 305.

CHEESE, a fort of food, prepared of curdled milk, purged from the ferum or whey, and afterwards dried for ufe.

Phyficians condemn the too free ufe of cheefe, by reafon it loads the ftomach when new, and heats and inflames when old.

Every country has its places noted for this commodity: Thus Chefter and Gloucefter-cheefe are famous in England; and the Parmefan cheefe is in no lefs repute abroad, efpecially in France. This fort of cheefe is entirely made of fweet cow's milk: But at Rochfort in Languedoc, they make cheefe of ewe's milk; and in other places, it is ufual to add goat or ewe's milk, in a certain proportion, to that of cow's.

There is likewife a kind of medicated cheefe, made by intimately mixing the expreffed juice of certain herbs, as fage, baum, mint, *&c.* with the curd, before it is fafhioned into a cheefe. The 100 weight of cheefe pays on importation, 1 s. $3\frac{4}{10}$ d. and draws back, on exportation, 1 s. $1\frac{1}{2}$ d. at the rate of 6 s. 8 d. The cheefe of Ireland is prohibited to be imported.

CHEESE-RUNNET, in botany. See GALLIUM.

CHEGFORD, a market-town of Devonfhire, about thirteen miles weft of Exeter: W. long. 4°, N. lat. 50° 40′.

CHEIRANTHUS, in botany, a genus of the tetradynamia filiquofa clafs. The germen has teeth-like glands on each fide; the calix is clofe, and confifts of two fmall leaves, gibbous at the bafe; and the feeds are plain. There are thirteen fpecies, only two of which are natives of Britain, *viz.* the cheiri, wall-flower, or wild cheir; and the tricufpidatus, or fea ftock-gilly-flower. The leaves of the wall-flower are faid to be cordial, anodyne, aperient, and emmenagogue; but are wholly neglected in practice.

CHEKAO, a kind of pafte prepared by calcination and trituration from a hard ftony fubftance, and afterwards wafhing the powder in large quantities of fair water.

The Chinefe ufe the chekao in drawing the elegant figures we fee in the wholly white china-ware, which they afterwards varnifh in the common way. See CHINA-WARE.

CHEKAIM, a province of China, bounded by that of Nankin on the north and by the ocean on the eaft.

CHELÆCANCRORUM, in the materia medica. See CRAB's CLAWS.

CHELIDONIUM, in botany, a genus of the polyandria monogynia clafs. The corolla has four petals;

the calix consists of two leaves; and the pod is linear and unilocular. There are four species, three of which are natives of Britain, *viz.* the majus, or celandine; the glaucium, or yellow horned poppy; and the hybridum, or violet-coloured horned poppy. The leaves and root of the majus, or celandine, are stimulating, aperient, diuretic, and sudorific: It is peculiarly recommended in the slow kind of jaundice, where there are no symptoms of inflammation, and in dropsies.

CHELIDONIUS *lapis*, in natural-history, a stone said by the ancients to be found in the stomachs of young swallows, and greatly cried up for its virtues in the falling-sickness; but from their description, it appears to be only a species of lycodontes, or bufonitæ. See LYCODONTES, and BUFONITÆ.

CHELM, a town of Poland, capital of a palatinate of the same name: It is situated in the province of Red Russia, 110 miles south-east of Warsaw: E. long. 23° 30′, N. lat. 51° 25′.

CHELMSFORD, the county town of Essex, situated on the river Chelmer, twenty five miles north-east of London: E. long. 30′, N. lat. 51° 40′. It sends two members to parliament.

CHELONE, in botany, a genus of the didynamia angiospermia class. The calix is divided into five parts; there are the rudiments of a fifth filament betwixt the two higher stamina; and the capsule is bilocular. There are three species, none of them natives of Britain.

CHELSEA, a fine village situated on the northern bank of the river Thames, a mile westward of Westminster, remarkable for a magnificent hospital of invalids and old decrepit soldiers; and a pleasure-house, called Ranelagh, to which a great deal of fine company resort in summer.

CHELTENHAM, or CHILTHENHAM, a market-town of Gloucestershire, seven miles north-east of Gloucester: W. long. 2° 10′, N. lat. 51° 50′. It is chiefly remarkable for its mineral waters, of the same kind with those of Scarborough. See SCARBOROUGH.

CHEMISE, in fortification, the wall with which a bastion, or any other bulwark of earth, is lined for its greater support and strength: Or it is the solidity of the wall from the talus to the stone-row.

Fire-CHEMISE, a piece of linen cloth, steeped in a composition of oil of petrol, camphor, and other combustible matters, used at sea, to set fire to an enemy's vessel.

C H E M I S T R Y.

THE object and chief end of chemistry is to separate the different substances that enter into the composition of bodies; to examine each of them apart; to discover their properties and relations; to decompose those very substances, if possible; to compare them together, and combine them with others; to reunite them again into one body, so as to reproduce the original compound with all its properties; or even to produce new compounds that never existed among the works of nature, from mixtures of other matters differently combined.

But this analysis, or decomposition, of bodies is finite; for we are unable to carry it beyond a certain limit. In whatever way we attempt to go further, we are always stopped by substances in which we can produce no change, and which are incapable of being resolved into others.

To these substances we may give the title of *principles* or *elements*. Of this kind the principal are earth, water, air, and fire. For though there be reason to think, that these are not the first component parts, or the most simple elements, of matter; yet, as we know by experience, that our senses cannot possibly discover the principles of which they are themselves composed, it seems more reasonable to fix upon them, and consider them as simple homogeneous bodies, and the principles of the rest, than to tire our minds with vain conjectures about the parts or elements of which they may consist.

Before entering upon the examination of compound substances, it is necessary to consider the most simple ones, or the four first principles, with some attention.

PART I. THEORY OF CHEMISTRY.

Of the Principles of Bodies.

Of AIR.

AIR is that fluid which we constantly breathe, and which encompasses the whole surface of the terrestrial globe. Being heavy, like other bodies, it penetrates into all places that are not either absolutely inaccessible, or filled with some other body heavier than itself. Its principal property is, to be susceptible of condensation and rarefaction; so that the very same quantity of air may occupy a much greater, or a much smaller space, according to the different state it is in. Heat and cold are the most usual causes of its condensation and rarefaction: For if a certain quantity of air be heated, its bulk enlarges

larges in proportion to the degree of heat applied to it; the consequence whereof is, that the same space now contains fewer particles of air than it did before. Cold again produces just the contrary effect.

On this property which air has of being condensed and dilated by heat, its elasticity chiefly depends. For if air were forced by condensation into a less compass than it took up before, and then exposed to a very considerable degree of cold, it would remain quite inactive, without exerting such an effort as it usually makes against the depressing body. On the other hand, the elasticity of heated air arises only from hence, that being rarefied by the action of fire, it requires much more room than it occupied before.

Air enters into the composition of many substances, especially vegetable and animal bodies: For by analysing most of them such a considerable quantity thereof is extricated, that some naturalists have suspected it to be altogether destitute of elasticity when thus combined with the other principles in the composition of bodies. According to them, the efficacy of the elastic power of the air is so prodigious, and its force when compressed so excessive, that it is not possible the other component parts of bodies should be able to confine so much of it in that state of compression which it must needs undergo, if retaining its elasticity when pent up among them.

However that be, this elastic property of the air produces the most singular and important phenomena observable in the resolution and composition of bodies.

Of WATER.

WATER is a thing so well known, that it is almost needless to attempt giving a general idea of it here. Every one knows that it is a transparent, insipid substance, and usually fluid. We say it is usually so; for being exposed to a certain degree of cold, it becomes solid: Solidity therefore seems to be its most natural state.

Water exposed to the fire grows hot; but only to a limited degree, beyond which its heat never rises, be the force of fire applied to it ever so violent: It is known to have acquired this degree of heat by its boiling up with great tumult. Water cannot be made hotter, because it is volatile, and incapable of enduring the heat without being evaporated and entirely dissipated.

If such a violent and sudden heat be applied to water as will not allow it time to exhale gently in vapours, as when, for instance, a small quantity thereof is thrown upon a metal in fusion, it is dissipated at once with vast impetuosity, producing a most terrible and dangerous explosion. This surprising effect may be deduced from the instantaneous dilatation of the parts of the water itself, or rather of the air contained in it. Moreover, water enters into the texture of many bodies, both compound and secondary principles; but, like air, it seems to be excluded from the composition of all metals, and most minerals. For although an immense quantity of water exists in the bowels of the earth, moistening all its contents, it does not therefore follow, that it is one of the principles of minerals. It is only interposed between their parts; for they may be entirely robbed of it, without any sort of decomposition: Indeed it is not capable of an intimate connection with them.

Of EARTH.

WE observed, that the two principles above treated of are volatile; that is, the action of fire separates them from the bodies they help to compose. But earth is fixed, and, when absolutely pure, resists the utmost force of fire. So that, whatever remains of a body, after it hath been exposed to the power of the fiercest fire, must be considered as containing nearly all its earthy principle, and consisting chiefly thereof.

Earth therefore is a fixed principle which is permanent in the fire. There is reason to think it very difficult, if not impossible, to obtain the terrene principle wholly free from every other substance: For after our utmost endeavours to purify them, the earths we obtain from different compounds are found to have different properties, according to the different bodies from which they are procured; or else, if those earths be pure, we must allow them to be essentially different, seeing they have different properties.

Earth, in general, with regard to its properties, may be distributed into *fusible* and *unfusible*; that is, into earth that is capable of melting or becoming fluid in the fire, and earth that constantly remains in a solid form, never melting in the strongest degree of heat to which we can expose it.

The former is also called *vitrifiable*, and the latter *unvitrifiable* earth; because, when earth is melted by the force of fire, it becomes what we call *glass*, which is nothing but the parts of earth brought into nearer contact, and more closely united by the means of fusion. Perhaps the earth, which we look upon as uncapable of vitrification, might be fused if we could apply to it a sufficient degree of heat. It is at least certain, that some earths, or stones, which separately resist the force of fire, so that they cannot be melted, become fusible when mixed together. Experience convinced Mr du Hamel, that lime-stone and slate are of this kind. It is however undoubtedly true, that one earth differs from another in its degree of fusibility: And this gives ground to believe, that there may be a species of earth absolutely unvitrifiable in its nature, which, being mixed in different proportions with fusible earths, renders them difficult to melt.

Whatever may be in this, as there are earths which we are absolutely unable to vitrify, that is a sufficient reason of our division of them. Unvitrifiable earths seem to be porous, for they imbibe water; whence they have also got the name of *absorbent earths*.

Of FIRE.

THE matter of the sun, or of light, the phlogiston, fire, the sulphureous principle, the inflammable matter, are all of them names by which the element of fire is usually denoted. But it should seem, that an accurate distinction hath not yet been made between the different states in which it exists; that is, between the phenomena of

of fire actually exiſting as a principle in the compoſition of bodies, and thoſe which it exhibits when exiſting ſeparately and in its natural ſtate: nor have proper diſtinct appellations been deſigned to it in thoſe different circumſtances. In the latter ſtate we may properly give it the names of fire, matter of the ſun, of light, and of heat; and may conſider it as a ſubſtance compoſed of infinitely ſmall particles, continually agitated by a moſt rapid motion, and of conſequence eſſentially fluid.

This ſubſtance, of which the ſun may be called the general reſervoir, ſeems to flow inceſſantly from that ſource, diffuſing itſelf over the world, and through all the bodies we know; but not as a principle, or eſſential part of them, ſince they may be deprived thereof, at leaſt in a great meaſure, without ſuffering any decompoſition. The greateſt change produced on them, by its preſence or its abſence, is the rendering them fluid or ſolid: ſo that all other bodies may be deemed naturally ſolid; fire alone eſſentially fluid, and the principle of fluidity in others. This being preſuppoſed, air itſelf might become ſolid, if it could be entirely deprived of the fire it contains; as bodies of moſt difficult fuſion become fluid, when penetrated by a ſufficient quantity of the particles of fire.

One of the chief properties of this pure fire is to penetrate eaſily into all bodies, and to diffuſe itſelf among them with a ſort of uniformity and equality: for if a heated body be contiguous to a cold one, the former communicates to the latter all its exceſs of heat, cooling in exact proportion as the other warms, till both come to have the very ſame degree of heat. Heat, however, is naturally communicable ſooneſt to the upper parts of a body; and conſequently, when a body cools, the under parts become ſooneſt cold. It hath been obſerved, for inſtance, that the lower extremity of a heated body, freely ſuſpended in the air, grows cold ſooner than the upper; and that when a bar of iron is red-hot at one end, and cold at the other, the cold end is much ſooner heated by placing the bar ſo that the hot end may be undermoſt, than when that end is turned uppermoſt. The levity of the matter of fire, and the vicinity of the earth, may poſſibly be the cauſes of this phenomenon.

Another property of fire is to dilate all bodies into which it penetrates. This hath already been ſhewn with regard to air and water; and it produces the ſame effect on earth.

Fire is the moſt powerful agent we can employ to decompoſe bodies; and the greateſt degree of heat producible by man, is that excited by the rays of the ſun collected in the focus of a large burning-glaſs.

Of the PHLOGISTON.

FROM what hath been ſaid concerning the nature of fire, it is evidently impoſſible for us to fix and confine it in any body. Yet the phenomena attending the combuſtion of inflammable bodies ſhew that they really contain the matter of fire as a conſtituent principle. By what mechaniſm then is this fluid, ſo ſubtile, ſo active, ſo difficult to confine, ſo capable of penetrating into every other ſubſtance in nature, ſo fixed as to make a component part of the moſt ſolid bodies? It is no eaſy matter to give a ſatisfactory anſwer to this queſtion. But without pretending to gueſs the cauſe of the phenomenon, let us reſt contented with the certainty of the fact, the knowledge of which will undoubtedly procure us conſiderable advantages. Let us therefore examine the properties of fire thus fixed and become a principle of bodies. To this ſubſtance, in order to diſtinguiſh it from pure and unfixed fire, the chemiſts have aſſigned the peculiar title of the *Phlogiſton*, which is indeed no other than a Greek word for the inflammable matter; by which latter name, as well as by that of the ſulphureous principle, it is alſo ſometimes called. It differs from elementary fire in the following particulars. 1. When united to a body, it communicates to it neither heat nor light. 2. It produces no change in its ſtate, whether of ſolidity or fluidity; ſo that a ſolid body does not become fluid by the acceſſion of the phlogiſton, and *vice verſa*; the ſolid bodies to which it is joined being only rendered thereby more apt to be fuſed by the force of the culinary fire. 3. We can convey it from the body with which it is joined into another body, ſo that it ſhall enter into the compoſition thereof, and remain fixed in it.

On this occaſion both theſe bodies, that which is deprived of the phlogiſton and that which receives it, undergo very conſiderable alterations; and it is this laſt circumſtance in particular that obliges us to diſtinguiſh the phlogiſton from pure fire, and to conſider it as the element of fire combined with ſome other ſubſtance, which ſerves it as a baſis for conſtituting a kind of ſecondary principle. For if there were no difference between them, we ſhould be able to introduce and fix pure fire itſelf where-ever we can introduce and fix the phlogiſton: yet this is what we can by no means do, as will appear from experiments to be afterwards produced.

Hitherto chemiſts have never been able to obtain the phlogiſton quite pure, and free from every other ſubſtance: for there are but two ways of ſeparating it from a body of which it makes a part; to wit, either by applying ſome other body with which it may unite the moment it quits the former; or elſe by calcining and burning the compound from which you deſire to ſever it. In the former caſe, it is evident that we do not get the phlogiſton by itſelf, becauſe it only paſſes from one combination into another; and in the latter, it is entirely diſſipated in the decompoſition, ſo that no part of it can poſſibly be ſecured.

The inflammability of a body is an infallible ſign that it contains a phlogiſton; but from a body's not being inflammable, it cannot be inferred that it contains none; for experiments have demonſtrated, that certain metals abound with it, which yet are by no means inflammable.

We have now delivered what is moſt neceſſary to be known concerning the principles of bodies in general. They have many other properties beſides thoſe abovementioned; but we cannot properly take notice of them here, becauſe they preſuppoſe an acquaintance with ſome other things relating to bodies, of which we have hitherto ſaid nothing, intending to treat of them in the ſequel as occaſion ſhall offer. We ſhall only obſerve in this place, that

that when animal and vegetable matters are burnt in ſuch a manner as to hinder them from flaming, ſome part of the phlogiſton contained in them unites intimately with their moſt fixed earthy parts, and with them forms a compound that can be conſumed only by making it red-hot in the open air, where it ſparkles and waſtes away, without emitting any flame. This compound is called a *coal*. We ſhall inquire into the properties of this coal under the head of oils: at preſent it ſuffices that we know in general what it is, and that it readily communicates to other bodies the phlogiſton it contains.

A general View of the Affinities or elective Attractions that ſubſiſt between Bodies.

Before we can reduce compound bodies to the firſt principles above pointed out, we obtain, by analyſing them, certain ſubſtances which are indeed more ſimple than the bodies they helped to compoſe, yet are themſelves compoſed of our primary principles. They are therefore at one and the ſame time both principles and compounds; for which reaſon we ſhall call them by the name of ſecondary principles. Saline and oily matters chiefly conſtitute this claſs. But before we enter upon an examination of their properties, it is fit we lay before the reader a general view of what chemiſts underſtand by the relations or affinities of bodies; becauſe it is neceſſary to know theſe, in order to a diſtinct conception of the different combinations we are to treat of.

All the experiments hitherto made concur in proving, that different bodies, whether principles or compounds, have ſuch a mutual conformity, relation, affinity, or attraction, as diſpoſes ſome of them to join and unite together, while they are incapable of contracting any union with others. This effect, whatever be its cauſe, will enable us to account for, and connect together, all the phenomena that chemiſtry produces. The nature of this univerſal affection of matter is laid down in the following propoſitions.

Firſt, If one ſubſtance has any affinity or conformity with another, the two will unite together, and form one compound.

Secondly, All ſimilar ſubſtances have an affinity with each other, and are conſequently diſpoſed to unite; as water with water, earth with earth, *&c.*

Thirdly, Subſtances that unite together loſe ſome of their ſeparate properties; and the compounds reſulting from their union partake of the properties of thoſe ſubſtances which ſerve as their principles.

Fourthly, The ſimpler any ſubſtances are, the more perceptible and conſiderable are their affinities: whence it follows, that the leſs bodies are compounded, the more difficult it is to analyſe them; that is, to ſeparate from each other the principles of which they conſiſt.

Fifthly, If a body conſiſt of two ſubſtances, and to this compound be preſented a third ſubſtance that has no affinity at all with one of the two primary ſubſtances aforeſaid, but has a greater affinity with the other than thoſe two ſubſtances have with each other, there will enſue a decompoſition, and a new union; that is, the third ſubſtance will ſeparate the two compounding ſubſtances from each other, coaleſce with that which has an affinity with it, form therewith a new combination, and diſengage the other, which will then be left at liberty, and ſuch as it was before it had contracted any union.

Sixthly, It happens ſometimes that when a third ſubſtance is preſented to a body conſiſting of two ſubſtances, no decompoſition follows; but the two compounding ſubſtances, without quitting each other, unite with the ſubſtance preſented to them, and form a combination of three principles: and this happens when that third ſubſtance has an equal, or nearly equal, affinity with each of the compounding ſubſtances. The ſame thing may alſo happen even when the third ſubſtance hath no affinity but with one of the compounding ſubſtances only. To produce ſuch an effect, it is ſufficient that one of the two compounding ſubſtances have to the third body a relation equal, or nearly equal, to that which it has to the other compounding ſubſtance with which it is already combined. Hence it follows, that two ſubſtances, which, when apart from all others, are incapable of contracting any union, may be rendered capable of incorporating together in ſome meaſure, and becoming parts of the ſame compound, by combining with a third ſubſtance with which each of them has an equal affinity.

Seventhly, A body, which of itſelf cannot decompoſe a compound conſiſting of two ſubſtances, becauſe they have a greater affinity with each other than it has with either of them, becomes nevertheleſs capable of ſeparating the two by uniting with one of them, when it is itſelf combined with another body having a degree of affinity with that one ſufficient to compenſate its own want thereof. In that caſe there are two affinities, and thence enſues a double decompoſition, and a double combination.

Theſe fundamental truths, from which we ſhall deduce an explanation of all the phenomena in chemiſtry, will be confirmed and illuſtrated by applying them to the ſeveral caſes, of which our deſign in this treatiſe obliges us to give a circumſtantial account.

Of Saline Subſtances in general.

If a particle of water be intimately united with a particle of earth, the reſult will be a new compound, which, according to our third propoſition of affinities, will partake of the properties of earth and of water; and this combination principally forms what is called a *ſaline ſubſtance*. Conſequently every ſaline ſubſtance muſt have an affinity with earth and with water, and be capable of uniting with both or either of them, whether they be ſeparate or mixed together: and accordingly this property characteriſes all ſalts or ſaline ſubſtances in general.

Water being volatile, and earth fixed, ſalts in general are leſs volatile than the former, and leſs fixed than the latter; that is, fire, which cannot volatilize and carry off pure earth, is capable of rarefying and volatilizing a ſaline ſubſtance; but then this requires a greater degree of heat than is neceſſary for producing the ſame effects on pure water.

There are ſeveral ſorts of ſalts, differing from one another in reſpect either of the quantity or the quality of the earth

earth in their compofition; or, laftly, they differ on account of fome additional principles, which not being combined with them in fufficient quantity to hinder their faline properties from appearing, permit them to retain the name of falts, though they render them very different from the fimpleft faline fubftances.

It is eafy to infer from what has been faid of falts in general, that fome of them muft be more, fome lefs, fixed or volatile than others, and fome more, fome lefs, difpofed to unite with water, with earth, or with particular forts of earth, according to the nature or the proportion of their principles.

Before we proceed further, it is proper juft to mention the principal reafons which induce us to think that every faline fubftance is actually a combination of earth and water, as we fuppofed at our entering on this fubject. The firft is, the conformity falts have with earth and water, or the properties they poffefs in common with both. Of thefe properties we fhall treat fully, as occafion offers to confider them, in examining the feveral forts of falts. The fecond is, that all falts may be actually refolved into earth and water by fundry proceffes; particularly by repeated diffolution in water, evaporation, deficcation, and calcination. Indeed the chemifts have not yet been able to produce a faline fubftance by combining earth and water together. This favours a fufpicion, that befides thefe two there is fome other principle in the compofition of falts which efcapes our refearches, becaufe we cannot preferve it when we decompofe them: but it is fufficient to our purpofe, that water and earth are demonftrably amongft the real principles of faline fubftances, and that no experiment hath ever fhewn us any other.

Of ACIDS.

THE fimpleft faline fubftance is that called an *acid*, on account of its tafte, which is like that of verjuice, forrel, vinegar, and other four things, which for the fame reafon are alfo called acids. By this peculiar tafte are acids chiefly known. They have moreover the property of turning all the blue and violet colours of vegetables red, which diftinguifhes them from all other falts.

The form under which acids moft commonly appear, is that of a tranfparent liquor; though folidity is rather their natural ftate. This is owing to their affinity with water; which is fo great, that, when they contain but juft as much of it as is neceffary to conftitute them falts, and confequently have a folid form, they rapidly unite therewith the moment they come into contact with it: and as the air is always loaded with moifture and aqueous vapours, its contact alone is fufficient to liquify them; becaufe they unite with its humidity, imbibe it greedily, and by that means become fluid. We therefore fay, they attract the moifture of the air. This change of a falt from a folid to a fluid ftate, by the fole contact of the air, is alfo called *deliquium;* fo that when a falt changes in this manner from a folid into a fluid form, it is faid to run *per deliquium*. Acids being the fimpleft fpecies of faline bodies, their affinities with different fubftances are ftronger than thofe of any other fort of falt with the fame fubftances; which is agreeable to our fourth propofition concerning affinities.

Acids in general have a great affinity with earths: that with which they moft readily unite is the unvitrifiable earth to which we gave the name of abforbent earth. They feem not to act at all upon vitrifiable earths, fuch as fand; nor yet upon fome other kinds of earths, at leaft while they are in their natural ftate. Yet the nature of thefe earths may be in fome meafure changed, by making them red hot in the fire, and then quenching them fuddenly in cold water: for by repeating this often they are brought nearer to the nature of abforbent earths, and rendered capable of uniting with acids.

When an acid liquor is mixed with an abforbent earth, for inftance with chalk, thefe two fubftances inftantly rufh into union with fo much impetuofity, that a great ebullition is immediately produced, attended with confiderable hiffing, heat, and vapours, which rife the very inftant of their conjunction.

From the combination of an acid with an abforbent earth there arifes a new compound, which fome chemifts have called *fal falfum;* becaufe the acid by uniting with the earth lofes its four tafte, and acquires another not unlike that of the common fea-falt ufed in our kitchens; yet varying according to the different forts of acids and earths combined together. The acid at the fame time lofes its property of turning blue or violet vegetables red.

If we inquire what is become of its propenfity to unite with water, we fhall find that the earth, which of itfelf is not foluble in water, hath by its union with the acid acquired a facility of diffolving therein; fo that our *fal falfum* is foluble in water. But, on the other hand, the acid hath, by its union with the earth, loft part of the affinity it had with water; fo that if a *fal falfum* be dried, and freed of all fuperfluous humidity, it will remain in that dry folid form, inftead of attracting the moifture of the air and running *per deliquium*, as the acid would do if it were pure and unmixed with earth.

Acids have likewife a great affinity with the phlogifton. When we come to treat of each acid in particular, we fhall examine the combinations of each with the phlogifton: they differ fo widely from one another, and many of them are fo little known, that we cannot at prefent give any general idea of them.

Of ALKALIS.

ALKALIS are faline combinations in which there is a greater proportion of earth than in acids. The principal arguments that may be adduced to prove this fact are thefe: Firft, if they be treated in the manner propofed above for analyfing faline fubftances, we obtain from them a much greater quantity of earth than we do from acids. Secondly; by combining certain acids with certain earths we can produce alkalis; or at leaft fuch faline compounds as greatly refemble ahem. Our third and laft argument is drawn from the properties of thofe alkalis which, when pure and unadulterated with any other principle, have lefs affinity with water than acids have, and are alfo more fixed, refifting the utmoft force of fire. On this account it is that they have obtained the title of *fixed*, as well as to diftinguifh them from another fpecies of alkali, to be confidered hereafter, which is impure and volatile.

Though

Though fixed alkalis, when dry, ſuſtain the utmoſt violence of fire without flying off in vapours, it is remarkable that, being boiled with water in an open veſſel, conſiderable quantities of them riſe with the ſteam; an effect which muſt be attributed to the great affinity between theſe two ſubſtances, by means whereof water communicates ſome part of its volatility to the fixed ſalt.

Alkalis freed of their ſuperfluous humidity by calcination attract the moiſture of the air, but not ſo ſtrongly as acids: ſo that it is eaſier to procure and preſerve them in a ſolid form.

They flow in the fire, and are then capable of uniting with vitrifiable earths, and of forming therewith true glaſs; which, however, will partake of their properties, if they be uſed in ſufficient quantity.

As they melt more readily than vitrifiable earth, they facilitate its fuſion; ſo that a weaker fire will reduce it to glaſs when a fixed alkali is joined with it, than will melt it without that addition.

Alkalis are known by their taſte, which is acrid and fiery; and by the properties they poſſeſs of turning blue or violet vegetables green; particularly ſyrup of violets.

Their affinity with acids is greater than that of abſorbent earths; hence, if an alkali be preſented to a combination of an acid wirh an abſorbent earth, the earth will be ſeparated from the acid by the alkali, and a new union between the acid and the alkali will take place. This is both an inſtance and a proof of our fifth propoſition concerning affinities.

If a pure alkali be preſented to a pure acid, they ruſh together with violence, and produce the ſame phenomena as were obſerved in the union of an abſorbent earth with an acid, but in a greater and more remarkable degree.

Fixed alkalis may in general be divided into two ſorts: one of theſe hath all the above recited properties; but the other poſſeſſes ſome that are peculiar to itſelf. We ſhall conſider this latter ſort more particularly under the head of ſea-ſalt.

Of Neutral Salts.

The acid and the alkali thus uniting, mutually rob each other of their characteriſtic properties; ſo that the compound reſulting from their union produces no change in the blue colours of vegetables, and has a taſte which is neither ſour nor acrid, but ſaltiſh. A ſaline combination of this kind is for that reaſon named *ſal ſalſum, ſal medium*, or a *neutral ſalt*.

It muſt be obſerved, that in order to make theſe ſalts perfectly neutral, it is neceſſary that neither of the two ſaline principles of which they are compounded be predominant over the other; for in that caſe they will have the properties of the prevailing principle. The reaſon is this: neither of theſe ſaline ſubſtances can unite with the other but in a limited proportion, beyond which there can be no further coalition between them. The action by which this perfect union is accompliſhed is termed *ſaturation;* and the inſtant when ſuch proportions of the two ſaline ſubſtances are mixed together, that the one is incorporated with as much of the other as it can poſſibly take up, is called the *point of ſaturation*.

The point of ſaturation is known to be obtained, when, after repeated affuſions of an acid in ſmall quantities to an alkali, or an abſorbent earth, we find thoſe phenomena ceaſe, which in ſuch caſes conſtantly attend the conflict of union, namely, ebullition, hiſſing, *&c.* and we may be aſſured the ſaturation is complete when the new compound hath neither an acid nor an acrid taſte, nor in the leaſt changes the blue colours of vegetables.

Neutral ſalts have not ſo great an affinity with water as either acids or alkalis have, becauſe they are more compounded; for we obſerved before, that the affinities of the moſt compounded bodies are generally weaker than thoſe of the moſt ſimple. In conſequence hereof few natural ſalts, when dried, attract the moiſture of the air; and thoſe that do, attract it more ſlowly and in leſs quantity than either acids or alkalis do.

All neutral ſalts are ſoluble it water; but more or leſs readily, and in a greater or ſmaller quantity, according to the nature of their component principles.

Water made boiling hot diſſolves a greater quantity of thoſe ſalts which do not attract the moiſture of the air, than when it is cold; and indeed it muſt be boiling hot to take up as much of them as it is capable of diſſolving: but as for thoſe which run in the air, the difference is imperceptible.

Some neutral ſalts have the property of ſhooting into cryſtals, and others have it not.

The nature of cryſtallization is this: Water cannot diſſolve, nor keep in ſolution, more than a determinate quantity of any particular ſalt; when therefore ſuch a quantity of water is evaporated from the ſolution of a ſalt capable of cryſtallization, that the remainder contains juſt as much ſalt as it can diſſolve, then by continuing the evaporation the ſalt gradually recovers its ſolid form, and concretes into ſeveral little tranſparent maſſes called cryſtals. Theſe cryſtals have regular figures, all differing from one another according to the ſpecies of ſalt of which they are formed. Different methods of evaporating ſaline ſolutions have different effects on the figure and regularity of the cryſtals; and each particular ſort of ſalt requires a peculiar method of evaporation to make its cryſtals perfectly regular.

A ſolution of ſalt deſigned for cryſtallization is uſually evaporated by means of fire to a pellicle; that is, till the ſalt begin to concrete; which is perceived by a kind of thin dark ſkin that gathers on the ſurface of the liquor, and is formed of the cryſtallized particles of ſalt. When this pellicle appears, the ſolution is ſuffered to cool, and the cryſtals form therein faſter or ſlower according to the ſort of ſalt in hand. If the evaporation be carried on briſkly to perfect drineſs, no cryſtals will be formed, and only an irregular maſs of ſalt will be obtained.

The reaſons why no cryſtals appear when the evaporation is haſtily performed, and carried on to drineſs, are, firſt, that the particles of ſalt, being always in motion while the ſolution is hot, have not time to exert their mutual affinities, and to unite together as cryſtallization requires: ſecondly, that a certain quantity of water enters into the very compoſition of cryſtals; which is therefore abſolutely neceſſary to their formation, and in a

greater

greater or fmaller proportion according to the nature of the falt.

If thefe cryftalized falts be expofed to the fire, they firft part with that moifture which is not neceffary to a faline concretion, and which they retained only by means of their cryftallization: afterwards they begin to flow, but with different degrees of fufibility.

It muft be obferved, that certain falts melt as foon as they are expofed to the fire; namely, thofe which retain a great deal of water in cryftallizing. But this fluor which they fo readily acquire muft be carefully diftinguifhed from actual fufion; for it is owing only to their fuperfluous humidity, which heat renders capable of diffolving and liquifying them; fo that when it is evaporated, the falt ceafes to be fluid, and requires a much greater degree of fire to bring it into real fufion.

The neutral falts that do not cryftallize may indeed be dried by evaporating the water which keeps them fluid; but by becoming folid they acquire no regular form; they again attract the moifture of the air, and are thereby melted into a liquor. Thefe may be called *liquefcent falts*.

Moft of the neutral falts, that confift of an acid joined with a fixed alkali, or with an abforbent earth, are themfelves fixed and refift the force of fire; yet feveral of them, if they be diffolved in water, and the folution boiled and evaporated, flie off along with the fteams.

Of the feveral Sorts of Saline Subftances.

1. *Of the* Universal, *or* Vitriolic Acid.

The univerfal acid is fo called, becaufe it is in fact the acid which is moft univerfally diffufed through all nature, in waters, in the atmofphere, and in the bowels of the earth. But it is feldom pure; being almoft always combined with fome other fubftance. That from which we obtain it, with moft eafe, and in the greateft quantity, is vitriol; and this is the reafon why it is called the *vitriolic acid*; the name by which it is beft known.

When the vitriolic acid contains but little phlegm, yet enough to give it a fluid form, it is called *oil of vitriol;* on account of a certain unctuofity belonging to it.

If the vitriolic acid contain much water, it is then called *fpirit of vitriol.* When it does not contain enough to render it fluid, and fo is in a folid form, it is named the *icy oil of vitriol.*

When oil of vitriol, highly concentrated, is mixed with water, they rufh into union with fuch an impetuofity, that, the moment they touch each other, there arifes a hiffing noife, like that of red-hot iron plunged in cold water, together with a very confiderable degree of heat proportioned to the degree in which the acid was concentrated.

If inftead of mixing this concentrated acid with water, you only leave it expofed to the air for fome time, it attracts the moifture thereof, and imbibes it moft greedily. Both its bulk and its weight are increafed by this acceffion; and if it be under an icy form, that is, if it be concreted, the phlegm thus acquired will foon refolve it into fluid.

The addition of water renders the vitriolic acid, and indeed all other acids, weaker in one fenfe; which is, that when they are very aqueous, they leave on the tongue a much fainter tafte of acidity, and are lefs active in the folution of fome particular bodies: But that occafions no change in the ftrength of their affinities, but in fome cafes rather enables them to diffolve feveral fubftances which, when well dephlegmated, they are not capable of attacking.

The vitriolic acid combined to the point of faturation with a particular abforbent earth, well known, forms a neutral falt that cryftallizes. This falt is called *alum*, and the figure of its cryftals is that of an octahedron or folid of eight fides. Thefe octahedra are triangular pyramids, the angles of which are fo cut off that four of the furfaces are hexagons, and the other four triangles.

There are feveral forts of alum, which differ according to the earths combined with the vitriolic acid. Alum diffolves eafily in water, and in cryftallization retains a confiderable quantity of it; which is the reafon that being expofed to the fire it readily melts, fwelling and puffing up as its fuperfluous moifture exhales. When that is quite evaporated, the remainder is called *burnt alum*, and is very difficult to fufe. The acid of the alum is partly diffipated by this calcination. Its tafte is faltifh, with a degree of roughnefs and aftringency.

The vitriolic acid combined with certain earths forms a kind of neutral falt called *felenites*, which cryftallizes in different forms according to the nature of its earth. There are numberlefs fprings of water infected with diffolved felenites; but when this falt is once cryftallized, it is exceeding difficult to diffolve it in water a fecond time. For that purpofe a very great quantity of water is neceffary, and moreover it muft boil; for, as it cools, moft of the diffolved felenites takes a folid form, and falls in a powder to the bottom of the veffel.

If an alkali be prefented to the felenites, or to alum, thefe falts will be thereby decompofed; that is, the acid will quit the earths, and join the alkali, with which it hath a greater affinity. And from this conjunction of the vitriolic acid with a fixed alkali there refults another fort of neutral falt, which is called *arcanum duplicatum*, *fal de duobus*, and *vitriolated tartar*, becaufe one of the fixed alcalis moft in ufe is called *falt of tartar*.

Vitriolated tartar is almoft as hard to diffolve in water as the felenites. It fhoots into eight-fided cryftals, having the apices of the pyramids pretty obtufe. Its tafte is faltifh, inclining to bitter; and it decrepitates on burning coals. It requires a very great degree of fire to make it flow.

The vitriolic acid is capable of uniting with the phlogifton, or rather it has a greater affinity with it than with any other body: whence it follows, that all compounds of which it makes a part may be decompofed by means of the phlogifton.

From the conjunction of the vitriolic acid with the phlogifton arifes a compound called *mineral fulphur*, becaufe it is found perfectly formed in the bowels of the earth. It is alfo called *fulphur vivum*, or fimply *fulphur*.

Sulphur

Sulphur is absolutely insoluble in water, and incapable of contracting any sort of union with it. It melts with a very moderate degree of heat, and sublimes in fine light downy tufts called *flowers of sulphur*. By being thus sublimed it suffers no decomposition, let the operation be repeated ever so often; so that sublimed sulphur, or flower of sulphur, hath exactly the same properties as sulphur that has never been sublimed.

If sulphur be exposed to a brisk heat in the open air, in takes fire, burns, and is wholly consumed. This deflagration of sulphur is the only means we have of decomposing it, in order to obtain its acid in purity. The phlogiston is destroyed by the flame, and the acid exhales in vapours; these vapours collected have all the properties of the vitriolic acid, and differ from it only as they still retain some portion of the phlogiston; which, however, soon quits them of its own accord, if the free access of the common air be not precluded.

The portion of phlogiston retained by the acid of sulphur is much more considerable when that mineral is burnt gradually and slowly: in that case the vapours which rise from it have such a penetrating odour, that they instantaneously suffocate any person who draws in a certain quantity of them with his breath. These vapours constitute what is called the *volatile spirit of sulphur*. There is reason to think this portion of phlogiston which the acid retains is combined therewith in a manner different from that in which these two are united in the sulphur itself; for nothing but actual burning is capable of separating the vitriolic acid and the phlogiston, which by their union form sulphur; whereas in the volatile spirit of sulphur they separate spontaneously when exposed to the open air; that is, the phlogiston flies off and leaves the acid, which then becomes in every respect similar to the vitriolic acid.

That the volatile spirit of sulphur is a compound, appears evidently from hence, that whenever the vitriolic acid touches any substance containing the phlogiston, provided that phlogiston be disengaged or opened to a certain degree, a volatile spirit of sulphur is infallibly and immediately generated. This spirit hath all the properties of acids, but considerably weakened, and of course less perceptible. It unites with absorbent earths or fixed alkalis; and with them forms neutral salts: but when combined therewith it may be separated from them by the vitriolic acid, and indeed by any of the mineral acids, because its affinities are weaker. Sulphur hath the property of uniting with absorbent earths, but not near so intimately as with fixed alkalis.

If equal parts of sulphur and an alkali be melted together, they incorporate with each other; and from their conjunction proceeds a compound of a most unpleasant smell, much like that of rotten eggs, and of a red colour nearly resembling that of an animal liver, which has occasioned it to bear the name of *hepar sulphuris*, or *liver of sulphur*.

In this composition the fixed alkali communicates to the sulphur the property of dissolving in water: and hence it comes that liver of sulphur may be made as well when the alkali is dissolved by water into a fluid, as when it is fused by the action of fire.

Sulphur has less affinity than any acid with the fixed alkalis: and therefore liver of sulphur may be decompounded by any acid whatever; which will unite with the fixed alkali, form therewith a neutral salt, and separate the sulphur.

If liver of sulphur be dissolved in water, and an acid poured thereon, the liquor, which was transparent before, instantly turns to an opaque white; because the sulphur, being forced to quit its union with the alkali, loses at the same time the property of dissolving in water, and appears again in its own opaque form. The liquor thus made white by the sulphur is called *milk of sulphur*.

If this liquor be suffered to stand still for some time, the particles of sulphur, now most minutely divided, gradually approach each other, unite, and fall insensibly to the bottom of the vessel; and then the liquor recovers its transparency. The sulphur thus deposited on the bottom of the vessel is called the *magistery* or *precipitate sulphur*. The names of magistery and precipitate are also given to all substances whatever that are separated from another by this method; which is the reason that we use the expression of precipitating one substance by another, to signify the separating one of them by means of the other.

3. *Of the* Nitrous Acid.

The nitrous acid combined with certain absorbent earths, such as chalk, marle, boles, forms neutral salts which do not crystallize; and which, after being dried, run in the air *per deliquium*.

All those neutral salts which consist of the nitrous acid joined to an earth, may be decomposed by a fixed alkali, with which the acid unites, and deserts the earth; and from this union of the nitrous acid with a fixed alkali results a new neutral salt, which is called *nitre*, or *salt-petre*. This latter name signifies the *salt of stone*; and in fact, nitre is extracted from the stones and plaister, in which it forms, by boiling them in water saturated with a fixed alkali.

Nitre shoots in long crystals adhering sideways to each other; it has a saltish taste, which produces a sensation of cold on the tongue.

This salt easily dissolves in water; which, when it boils, takes up still a greater quantity thereof.

It flows with a pretty moderate degree of heat, and continues fixed therein: but being urged by a brisk fire, and in the open air, it lets go some part of its acid, and indeed flies off itself in part.

The most remarkable property of nitre, and that which characterizes it, is its fulmination or explosion; the nature of which is as follows:

When nitre touches any substance containing a phlogiston, and actually ignited, that is, red hot, it bursts out into a flame, burns, and is decompounded with much noise.

In this deflagration the acid is dissipated, and totally separated from the alkali, which now remains by itself.

Indeed the acid, at least the greatest part of it, is by this means quite destroyed. The alkali which is left when nitre is decompounded by deflagration, is called in general

general *fixed nitre*, and, more particluarly, nitre fixed by ſuch and ſuch a ſubſtance as was uſed in the operation. But if nitre be deflagrated with an inflammable ſubſtance containing the vitriolic acid, as ſulphur, for inſtance, the fixed ſalt produced by the deflagration is not a pure alkali but retains a good deal of the vitriolic acid, and, by combining therewith, hath now formed a neutral ſalt.

The reaſon why nitre flames, and is decompounded in the manner above mentioned, when it comes in contact with a phlogiſton properly circumſtanced, is, that the nitrous acid, having a greater affinity with the phlogiſton than with the fixed alkali, naturally quits the latter to join with the former, and ſo produces a kind of ſulphur, differing probably from the common ſulphur, formed by the vitriolic acid, in that it is combuſtible to ſuch a degree, as to take fire and be conſumed in the very moment of its production; ſo that it is impoſſible to prevent its being thus deſtroyed, and conſequently impoſſible to ſave it. In ſupport of this opinion let it be conſidered, that the concurrence of the phlogiſton is abſolutely neceſſary to produce this deflagration, and that the matter of pure fire is altogether incapable of effecting it: for though nitre be expoſed to the moſt violent degree of fire, even that in the focus of the moſt powerful burning-glaſs, it will not flame; nor will that effect ever happen till the nitre be brought into contact with a phlogiſton properly ſo called, that is, the matter of fire exiſting as a principle of ſome body; and it is moreover neceſſary that this phlogiſton be actually on fire, and agitated with the igneous motion, or elſe, that the nitre itſelf be red-hot, and ſo penetrated with fire as to kindle any inflammable matter that touches it.

This experiment, among others, helps to ſhew the diſtinction that ought to be made between pure elementary fire, and fire become a principle of bodies to which we have given the name of phlogiſton.

Before we leave this ſubject, we ſhall obſerve, that nitre deflagrates only with ſuch ſubſtances as contain the phlogiſton in its ſimpleſt and pureſt form; ſuch as charcoal, ſulphur, and the metalline ſubſtances; and that, though it will not deflagrate without the addition of ſome combuſtible matter, it is neverthels the only known body that will burn, and make other combuſtibles burn with it, in cloſe veſſels, without the admiſſion of freſh air.

The nitrous acid hath not ſo great an affinity with earths and alkalis as the vitriolic acid hath; whence it follows, that the vitriolic acid decompoſes all neutral ſalts ariſing from a combination of the nitrous acid with an earth or an alkali. The vitriolic acid expells the nitrous acid, unites with the ſubſtance which ſerved it for a baſis, and therewith forms a neutral ſalt, which is an alum, a ſelenites, or a vitriolated tartar, according to the nature of that baſis.

The nitrous acid, when thus ſeparated from its baſis by the vitriolic acid, is named *ſpirit of nitre*, or *aqua fortis*. If it be dephlegmated, or contain but little ſuperfluous water, it exhales in reddiſh vapours; theſe vapours being condenſed and collected, form a liquor of a browniſh yellow, that inceſſantly emits vapours of the ſame colour, and of a pungent diſagreeable ſmell. Theſe characters have procured it the names of *ſmoking ſpirit of nitre*, and *yellow aqua fortis*. This property in the nitrous acid of exhaling in vapours, ſhews it to be leſs fixed than the vitriolic acid; for the latter, though ever ſo thoroughly dephlegmated, never yields any vapours, nor has it any ſmell.

3. *Of the* Acid *of* Sea-salt.

The acid of ſea-ſalt is ſo called, becauſe it is in fact obtained from ſuch ſea-ſalt as is uſed in our kitchens. It is not certainly known in what this acid differs from the vitriolic and the nitrous, with regard to its conſtituent parts.

When it is combined with abſorbent earths, ſuch as lime and chalk, it forms a neutral ſalt that does not cryſtallize; and, when dried, attracts the moiſture of the air. If the abſorbent earth be not fully ſaturated with the marine acid, the ſalt thereby formed has the properties of a fixed alkali: And this is what made us ſay, when we were on the ſubject of thoſe ſalts that they might be imitated by combining an earth with an acid. The marine acid, like the reſt, hath not ſo great an affinity with earths as with fixed alkalis.

When it is combined with the latter, it forms a neutral ſalt which ſhoots into cubical cryſtals. This ſalt is inclined to grow moiſt in the air, and is conſequently one of thoſe which water diſſolves in equal quantities, at leaſt as to ſenſe, whether it be boiling hot or quite cold.

The affinity of this acid with alkalis and abſorbent earths is not ſo great as that of the vitriolic and nitrous acids: Whence it follows, that, when combined therewith, it may be ſeparated from them by either of thoſe acids.

The acid of ſea-ſalt, thus diſengaged from the ſubſtance which ſerved it for a baſis, is called *ſpirit of ſalt*. When it contains but little phlegm, it is of a lemon colour, and continually emits many white, very denſe, and very elaſtic vapours; on which account it is named the *ſmoking or volatile ſpirit of ſalt*. Its ſmell is not diſagreeable, nor much unlike that of ſaffron; but extremely quick and ſuffocating when it ſmokes.

The acid of ſea-ſalt, like the other two, ſeems to have a greater affinity with the phlogiſton, than with fixed alkalis. We are led to this opinion by a very curious operation, which gives ground to think, that ſea-ſalt may be decompoſed by the proper application of a ſubſtance containing the phlogiſton.

From the marine acid, combined with a phlogiſton, reſults a kind of ſulphur, differing from the common ſort in many reſpects; but particularly in this property, that it takes fire of itſelf upon being expoſed to the open air. This combination is called *Engliſh phoſphorus*, *phoſphorus of urine*, becauſe it is generally prepared from urine, or only *phoſphorus*.

This combination of the marine acid with a phlogiſton is not eaſily effected; becauſe it requires a difficult operation in appropriated veſſels. For theſe reaſons it does not always ſucceed; and phoſphorus is ſo ſcarce and dear, that hitherto chemiſts have not been able to make on it the experiments neceſſary to diſcover all its properties. If phoſphorus be ſuffered to burn away in the air, a

a ſmall quantity of an acid liquor may be obtained from it, which ſeems to be ſpirit of ſalt, but either altered, or combined with ſome adventitious matter; for it has ſeveral properties that are not to be found in the pure marine acid; ſuch as, leaving a fixed fuſible ſubſtance behind it when expoſed to a ſtrong fire, and being eaſily combined with the phlogiſton ſo as to reproduce a phoſphorus.

Phoſphorus reſembles ſulphur in ſeveral of its properties: It is ſoluble in oils; it melts with a gentle heat; it is very combuſtible; it burns without producing ſoot; and its flame is vivid and bluiſh.

From what has been ſaid of the union of the acid of ſea-ſalt with a fixed alkali, and of the neutral ſalt reſulting therefrom, it may be concluded, that this neutral ſalt is no other than the common kitchen-ſalt. But it muſt be obſerved, that the fixed alkali, which is the natural baſis of the common ſalt obtained from ſea-water, is of a ſort ſomewhat differing from fixed alkalis in general, and hath certain properties peculiar to itſelf. For,

1. The baſis of ſea-ſalt differs from other fixed alkalis in this, that it cryſtallizes like a neutral ſalt.

2. It does not grow moiſt in the air: On the contrary, when expoſed to the air, it loſes part of the water that united with it in cryſtallization, by which means its cryſtals loſe their tranſparency, become as it were mealy, and fall into a fine flour.

3. When combined with the vitriolic acid to the point of ſaturation, it forms a neutral ſalt differing from vitriolated tartar, firſt, in the figure of its cryſtals which are oblong ſix-ſided ſolids; ſecondly, in its quantity of water, which in cryſtallization unites therewith in a much greater proportion than with vitriolated tartar; whence it follows, that this ſalt diſſolves in water more readily than vitriolated tartar; thirdly, in that it flows with a very moderate degree of heat, whereas vitriolated tartar requires a very fierce one.

If the acid of ſea-ſalt be ſeparated from its baſis by means of the vitriolic acid, it is eaſy to ſee, that, when the operation is finiſhed, the ſalt we have been ſpeaking of muſt be the reſult. A famous chemiſt, named Glauber, was the firſt who extracted the ſpirit of ſalt in this manner, examined the neutral ſalt reſulting from his proceſs, and finding it to have ſome ſingular properties, called it his *ſal mirabile*, or wonderful ſalt: On this account it is ſtill called Glauber's *ſal mirabile*, or *Glauber's ſalt*.

4. When the baſis of the ſea-ſalt is combined with the nitrous acid to the point of ſaturation, there reſults a neutral ſalt, or a ſort of nitre, differing from the common nitre, firſt, in that it attracts the moiſture of the air pretty ſtrongly; and this makes it difficult to cryſtallize: ſecondly, in the figure of its cryſtals, which are parallelopipeds; and this has procured it the name of *quadrangular nitre*.

Common ſalt, or the neutral ſalt formed by combining the marine acid with this particular ſort of fixed alkali, has a taſte well known to every body. The figure of its cryſtals is exactly cubical. It grows moiſt in the air, and, when expoſed to the fire, it burſts, before it melts, into many little fragments, with a crackling noiſe; which is called the *decrepitation* of ſea-ſalt.

That neutral ſalt mentioned above, which is formed by combining the marine acid with a common fixed alkali, and called *ſal febrifugum ſylvii*, hath alſo this property.

India furniſhes us with a ſaline ſubſtance, known by the name of *borax*, which flows very eaſily, and then takes the form of glaſs. It is of great uſe in facilitating the fuſion of metallic ſubſtances. It poſſeſſes ſome of the properties of fixed alkalis, which has induced certain chemiſts to repreſent it, through miſtake, as a pure fixed alkali.

By mixing borax with the vitriolic acid, Mr Homberg obtained from it a ſalt, which ſublimes in a certain degree of heat, whenever ſuch a mixture is made. This ſalt has very ſingular properties; but its nature is not yet thoroughly underſtood. It diſſolves in water with great difficulty; it is not volatile, though it riſes by ſublimation from the borax. According to Mr Rouelle's obſervation, it riſes then only by means of the water which carries it up; for when once made, it abides the fierceſt fire, flows and vitrifies juſt as borax does, provided care be taken to free it previouſly from moiſture by drying it properly. Mr Homberg called it *ſedative ſalt*, on account of its medical effects. The ſedative ſalt hath the appearance, and ſome of the properties, of a neutral ſalt; for it ſhoots into cryſtals, and does not change the colour of violets: but it acts the part of an acid with regard to alkalis, uniting with them to the point of ſaturation, and thereby forming a true neutral ſalt. It alſo acts, like the acid of vitriol, on all neutral ſalts; that is, it diſcharges the acid of ſuch as have not the vitriolic acid in their compoſition.

Since Mr Homberg's time it hath been diſcovered, that a ſedative ſalt may be made either with the nitrous or with the marine acid; and that ſublimation is not neceſſary to extract it from the borax, but that it may be obtained by cryſtallization only. For this latter diſcovery we are indebted to Mr Geoffroy, as we are to Mr Lemery for the former.

Since that time M. Baron d'Henouville, an able chemiſt, hath ſhewn that a ſedative ſalt may be obtained by the means of vegetable acids; and hath lately demonſtrated, that the ſedative ſalt exiſts actually and perfectly in the borax, and that it is not produced by mixing acids with that ſaline ſubſtance, as it ſeems all the chemiſts before him imagined. This he proves convincingly from his analyſis of borax, (which thereby appears to be nothing elſe but the ſedative ſalt united with that fixed alkali which is the baſis of ſea-ſalt) and from his regenerating the ſame borax by uniting together that alkali and the ſedative ſalt: a proof the moſt complete that can poſſibly be produced in natural philoſophy, and equivalent to demonſtration itſelf.

In order to finiſh what remains to be ſaid upon the ſeveral ſorts of ſaline ſubſtances, we ſhould now ſpeak of the acids obtained from vegetables and animals, and alſo of the volatile alkalis; but, ſeeing theſe ſaline ſubſtances differ from thoſe of which we have already treated, only as

as they are variouſly altered by the unions they have contracted with certain principles of vegetables and animals, of which nothing has been yet ſaid, it is proper to defer being particular concerning them, till we have explained thoſe principles.

Of LIME.

ANY ſubſtance whatever, that has been roaſted a conſiderable time in a ſtrong fire without melting, is commonly called a *calx*. Stones and metals are the principal ſubjects that have the property of being converted into *calces*. We ſhall treat of metalline *calces* in a ſubſequent chapter, and in this confine ourſelves to the *calx* of *ſtone*, known by the name of *lime*.

In treating of earths in general, we obſerved that they may be divided into two principal kinds; one of which actually and properly flows when expoſed to the action of fire, and turns to glaſs; whence it is called a *fuſible* or *vitrifiable* earth; the other reſiſts the utmoſt force of fire, and is therefore ſaid to be an *unfuſible* or *unvitrifiable* earth. The latter is alſo not uncommonly called *calcinable* earth; though ſundry ſorts of unfuſible earths are incapable of acquiring by the action of fire all the qualities of *calcined* earth, or *lime* properly ſo called: ſuch earths are particularly diſtinguiſhed by the denomination of *refractory* earths.

As the different ſorts of ſtones are nothing more than compounds of different earths, they have the ſame properties with the earths of which they are compoſed, and may, like them, be divided into fuſible or vitrifiable, and unfuſible or calcinable. The fuſible ſtones are generally denoted by the name of *flints*; the calcinable ſtones, again, are the ſeveral ſorts of marbles, cretaceous ſtones, thoſe commonly called free-ſtones, *&c.* ſome of which, as they make the beſt lime, are, by way of eminence, called *lime-ſtones*. Sea-ſhells alſo, and ſtones that abound with foſſile ſhells, are capable of being burnt to lime.

All theſe ſubſtances being expoſed for a longer or ſhorter time to the violent action of fire, are ſaid to be *calcined*. By calcination they loſe a conſiderable part of their weight, acquire a white colour, and become friable, though ever ſo ſolid before; as, for inſtance, the very hardeſt marbles. Theſe ſubſtances, when thus calcined, take the name of *quick-lime*.

Water penetrates quick-lime, and ruſhes into it with vaſt activity. If a lump of newly calcined lime be thrown into water, it inſtantly excites almoſt as great a noiſe, ebullition, and ſmoke, as would be produced by a piece of red-hot iron; with ſuch a degree of heat too, that, if the lime be in due proportion to the water, it will ſet fire to combuſtible bodies; as hath unfortunately happened to veſſels laden with quick lime, on their ſpringing a ſmall leak.

As ſoon as quick-lime is put into water, it ſwells, and falls aſunder into an infinite number of minute particles: in a word, it is in a manner diſſolved by the water, which forms therewith a ſort of white paſte called *ſlacked lime*.

If the quantity of water be conſiderable enough for the lime to form with it a white liquor, this liquor is called *lac calcis*; which, being left ſome time to ſettle, grows clear and tranſparent, the lime which was ſuſpended therein and occaſioned its opacity ſubſiding to the bottom of the veſſel. Then there forms on the ſurface of the liquor a cryſtalline pellicle, ſomewhat opaque and dark coloured, which being ſkimmed off is reproduced from time to time. This matter is called *cremor calcis*.

Slacked lime gradually grows dry, and takes the form of a ſolid body, but full of cracks and deſtitute of firmneſs. The event is different when you mix it up, while yet a paſte, with a certain quantity of uncalcined ſtony matter, ſuch as ſand for example: then it takes the name of *mortar*, and gradually acquires, as it grows drier and older, a hardneſs equal to that of the beſt ſtones. This is a very ſingular property of lime, nor is it eaſy to account for it; but it is a beneficial one, for every body knows the uſe of mortar in building.

Quick-lime attracts the moiſture of the air in the ſame manner as concentrated acids and dry fixed alkalis, but not in ſuch quantities as to render it fluid: it only falls into extremely ſmall particles, takes the form of a fine powder, and the title of *lime ſlacked in the air*.

Lime once ſlacked, however dry it may afterwards appear, always retains a large portion of the water it had imbibed; which cannot be ſeparated from it again but by means of a violent calcination. Being ſo recalcined it returns to be quick-lime, recovering all its properties.

Beſides this great affinity of quick-lime with water, which diſcovers a ſaline character, it has ſeveral other ſaline properties, to be afterwards examined, much reſembling thoſe of fixed alkalis. In chemiſtry it acts very nearly as thoſe ſalts do, and may be conſidered as holding the middle rank between a pure abſorbent earth and a fixed alkali; and this hath induced many chemiſts to think that lime contains a true ſalt, to which all the properties it poſſeſſes in common with ſalts may be attributed.

But as the chemical examinatiou of this ſubject hath long been neglected, the exiſtence of a ſaline ſubſtance in lime hath been long doubtful. Mr du Fay was one of the firſt who obtained a ſalt from lime, by lixiviating it with a great deal of water, which he afterwards evaporated. But the quantity of ſalt he obtained by that means was very ſmall; nor was it of an alkaline nature, as one would think it ſhould have been, conſidering the properties of lime. Mr du Fay did not carry his experiments on this ſubject any further, probably for want of time; nor did he determine of what nature the ſalt was.

Mr Malouin had the curioſity to examine this ſalt of lime, and ſoon found that it was nothing elſe but what was above called *cremor calcis*. He found moreover, that, by mixing a fixed alkali with lime-water, a vitriolated tartar was formed; that, by mixing therewith an alkali like the baſis of ſea-ſalt, a Glauber's ſalt was produced; and, laſtly, by combining lime with a ſubſtance abounding in phlogiſton, he obtained a true ſulphur. Theſe very ingenious experiments prove to a demonſtration, that the vitriolic acid conſtitutes the ſalt of lime; for, as hath been ſhewn, no other acid is capable of forming ſuch combi-

combinations. On the other hand, Mr Malouin, having forced the vitriolic acid of this falt to combine with a phlogifton, found its bafis to be earthy, and analogous to that of the felenites: whence he concluded, that the falt of lime is a true neutral falt, of the fame kind as the felenites. Mr Malouin tells us he found feveral other falts in lime. But as none of them was a fixed alkali, and as all the faline properties of lime have an affinity with thofe of that kind of falt, there is great reafon to think that all thofe falts are foreign to lime, and that their union with it is merely accidental.

Lime unites with all acids, and in conjunction with them exhibits various phenomena.

The vitriolic acid poured upon lime diffolves it with effervefcence and heat. From this mixture there exhales a great quantity of vapours, in fmell and colour perfectly like thofe of fea-falt; from which however they are found to be very different when collected into a liquor. From this combination of the vitriolic acid with lime arifes a neutral falt, which fhoots into cryftals, and is of the fame kind with the felenitic falt obtained from lime by Mr Malouin.

The nitrous acid poured upon lime diffolves it in like manner with effervefcence and heat: but the folution is tranfparent, and therein differs from the former, which is opaque. From this mixture there arifes a neutral falt, which does not cryftallize, and has withal the very fingular property of being volatile, and rifing wholly by diftillation in a liquid form. This phenomenon is fo much the more remarkable, as lime, the bafis of this falt, is one of the moft fixed bodies known in chemiftry.

With the acid of fea-falt lime forms alfo a fingular fort of falt, which greedily imbibes the moifture of the air. We fhall have occafion to take further notice of it in another place.

Lime applied to fixed alkalis adds confiderably to their cauftic quality, and makes them more penetrating and active. An alkaline lixivium in which lime hath been boiled, being evaporated to drinefs, forms a very cauftic fubftance, which flows in the fire much more eafily, attracts and retains moifture much more ftrongly, than fixed alkalis that have not been fo treated. An alkali thus acuated by lime is called the *cauftic ftone*, or *potential cautery*, becaufe it is employed by furgeons to produce efchars on the fkin and cauterize it.

Of Metallic Subftances in general.

Metallic fubftances are heavy, glittering, opaque, fufible bodies. They confift chiefly of a vitrifiable earth united with the phlogifton.

Several chemifts infift on a third principle in thefe bodies, and have given it the name of *mercurial earth*; which, according to Becher and Stahl, is the very fame that being combined with the vitriolic acid forms and characterifes the acid of fea-falt. The exiftence of this principle hath not yet been demonftrated by any decifive experiment; but we fhall fhew that there are pretty ftrong reafons for admitting it.

We fhall begin with mentioning the experiments which prove metallic fubftances to confift of a vitrifiable earth united with the phlogifton. The firft is this: if they be calcined in fuch a manner as to have no communication with any inflammable matter, they will be fpoiled of all their properties, and reduced to an earth or calx, that has neither the fplendour nor the ductility of a metal, and in a ftrong fire turns to an actual glafs, inftead of flowing like a metal.

The fecond is, that the calx or the glafs refulting from a metal thus decompofed, recovers all its metalline properties by being fufed in immediate contact with an inflammable fubftance, capable of reftoring the phlogifton of which calcination had deprived it.

On this occafion we muft obferve, that chemifts have not yet been able, by adding the phlogifton, to give the properties of metals to all forts of vitrifiable earths indifcriminately, but to fuch only as originally made a part of fome metallic body. For example, a compound cannot be made with the phlogifton and fand that fhall have the leaft refemblance of a metal: and this is what feems to point out the reality of a third principle as neceffary to form the metalline combination. This principle may probably remain united with the vitrifiable earth of a metallic fubftance, when reduced to a glafs; whence it follows, that fuch vitrified metals require only the addition of a phlogifton to enable them to appear again in their priftine form.

It may be inferred from another experiment, that the calx and the glafs of a metal are not its pure vitrifiable earth, properly fo called: for by repeated or long continued calcinations, fuch a calx or glafs may be rendered incapable of ever refuming the metalline form, in what ever manner the phlogifton be afterwards applied to it; fo that by this means it is brought into the condition of a pure vitrifiable earth, abfolutely free from any mixture.

When by adding the phlogifton to a metallic glafs, we reftore it to the form of a metal, we are faid to *reduce*, *refufcitate*, or *revivify* that metal.

Metallic fubftances are of different kinds, and are divided into *metals* and *femi-metals*.

Thofe are called metals, which befides their metalline fplendor and appearance, are alfo malleable; that is, have the property of ftretching under the hammer.

Thofe which have only the metalline fplendor and appearance, without malleability, are called femi-metals.

Metals alfo are further fubdivided into two forts; *viz. perfect* and *imperfect* metals.

The perfect metals are thofe which fuffer no damage or change whatever by the moft violent and moft lafting action of fire.

The imperfect metals are thofe which by the force of fire may be deprived of their phlogifton, and confequently of their metalline form.

When a moderate degree of fire only is employed to deprive a metal of its phlogifton, the metal is faid to be *calcined*; and then it appears in the form of a powdered earth, which is called a *calx*; and this metalline calx being expofed to a more violent degree of fire, melts and turns to glafs.

Metallic ſubſtances have an affinity with acids, but not equally with all; that is, every metallic ſubſtance is not capable of uniting and joining with every acid.

When an acid unites with a metallic ſubſtance, there commonly ariſes an ebullition, attended with a kind of hiſſing noiſe and fuming exhalations. By degrees, as the union becomes more perfect, the particles of the metal combining with the acid become inviſible: this is termed *diſſolution*; and when a metalline maſs thus diſappears in an acid, the metal is ſaid to be *diſſolved* by that acid. It is proper to obſerve, that acids act upon metalline ſubſtances, in one reſpect, juſt as they do upon alkalis and abſorbent earths: for an acid cannot take up above ſuch a certain proportion thereof as is ſufficient to ſaturate it, to deſtroy ſeveral of its properties, and weaken others. For example, when an acid is combined with a metal to the point of ſaturation, it loſes its taſte, does not turn the blue colour of a vegetable red, and its affinity with water is conſiderably impaired. On the other hand, metalline ſubſtances, which, when pure, are incapable of uniting with water, by being joined with an acid, acquire the property of diſſolving in water. Theſe combinations of metalline ſubſtances with acids form different ſorts of neutral ſalts; ſome of which have the property of ſhooting into cryſtals, while others have it not: moſt of them, when thoroughly dried, attract the moiſture of the air.

The affinity which metalline ſubſtances have with acids is leſs than that which abſorbent earths and fixed alkalis have with the ſame acids; ſo that all metalline ſalts may be decompounded by one of theſe ſubſtances, which will unite with the acid, and precipitate the metal.

Metalline ſubſtances thus ſeparated from an acid ſolvent are called *magiſteries*, and *precipitates* of metals. None of theſe precipitates, except thoſe of the perfect metals, retain the metalline form: moſt of their phlogiſton hath been deſtroyed by the ſolution and precipitation, and muſt be reſtored before they can recover their properties. In ſhort, they are nearly in the ſame ſtate with metalline ſubſtances deprived of their phlogiſton by calcination; and accordingly ſuch a precipitate is called a *calx*.

A metalline calx prepared in this manner loſes a greater or a leſs portion of its phlogiſton, the more or leſs effectually and thoroughly the metalline ſubſtance of which it made a part was diſſolved by the acid.

Metallic ſubſtances have affinities with each other which differ according to their different kinds; but this is not univerſal, for ſome of them are incapable of any ſort of union with ſome others.

It muſt be obſerved, that metallic ſubſtances will not unite, except they be both in a ſimilar ſtate; that is, both in a metalline form, or both in the form of a glaſs; for a metalline ſubſtance, retaining its phlogiſton, cannot contract an union with any metallic glaſs, even its own.

Of METALS.

THERE are ſix metals, of which two are perfect, and four imperfect. The perfect metals are gold and ſilver; the others are copper, tin, lead, and iron. Some chemiſts admit a ſeventh metal, *viz.* quick-ſilver; but, as it is not malleable, it has been generally conſidered as a metallic body of a particular kind.

The ancient chemiſts, or rather the alchemiſts, who fancied a certain relation or analogy between metals and the heavenly bodies, beſtowed on the ſeven metals, reckoning quick ſilver one of them, the names of the ſeven planets of the ancients, according to the affinity which they imagined they obſerved between thoſe ſeveral bodies, Thus gold was called *Sol*, ſilver *Luna*, copper *Venus*. tin *Jupiter*, lead *Saturn*, iron *Mars*, and quick-ſilver *Mercury*. Though theſe names were aſſigned for reaſons merely chimerical, yet they ſtill keep their ground; ſo that it is not uncommon to find the metals called by the names, and denoted by the characters, of the planets, in the writings even of the beſt chemiſts. Metals are the heavieſt bodies known in nature.

Of GOLD.

GOLD is the heavieſt of all metals. The arts of wire-drawing and gold-beating ſhew its wonderful ductility. The greateſt violence of fire is not able to produce any alteration in it.

Gold cannot be diſſolved by any pure acid: but if the acid of nitre be mixed with the acid of ſea-ſalt, there reſults a compound acid liquor, with which it has ſo great an affinity, that it is capable of being perfectly diſſolved thereby. The chemiſts have called this ſolvent *aqua regis*, on account of its being the only acid that can diſſolve gold, which they conſider as the king of metals. The ſolution of gold is of a beautiful orange colour.

If gold diſſolved in *aqua regis* be precipitated by an alkali or an abſorbent earth, the precipitate gently dried, and then expoſed to a certain degree of heat, is inſtantly diſperſed into the air, with a moſt violent exploſion and noiſe: gold thus precipitated is therefore called *aurum fulminans*. But if the precipitated gold be carefully waſhed in plenty of water, ſo as to clear it of all the adhering ſaline particles, it will not fulminate; but may be melted in a crucible without any additament, and will then appear in its uſual form. The acid of vitriol being poured on *aurum fulminans* likewiſe deprives it of its fulminating quality.

Gold does not begin to flow till it be red-hot like a live coal. Though it be the moſt malleable and moſt ductile of all metals, it has the ſingular property of loſing its ductility more eaſily than any of them: even the fumes of charcoal are ſufficient to deprive it thereof, if they come to contact with it while it is in fuſion.

The malleability of this metal, and indeed of all the reſt, is alſo conſiderably diminiſhed by expoſing it ſuddenly to cold when it is red-hot; for example, by quenching it in water, or even barely expoſing it to the cold air. The way to reſtore ductility to gold, when loſt by its coming in contact with the vapour of coals, and in general to every other metal rendered leſs malleable by being ſuddenly cooled, is to heat it again, to keep them red hot a conſiderable time, and then to let them cool very ſlowly and gradually: this operation frequently repeated will by degrees much increaſe the malleability of a metal.

Pure ſulphur hath no effect on gold; but being combined

bined with an alkali into a *hepar ſulphuris*, it unites therewith very readily. Nay, ſo intimate is their union, that the gold by means thereof becomes ſoluble in water; and this new conpound of gold and liver of ſulphur, being diſſolved in water, will paſs through the pores of brown paper without ſuffering any decompoſition; which does not happen, at leaſt in ſuch a manifeſt degree, to other metallic ſubſtances diſſolved by liver of ſulphur.

Aurum fulminans mixed and melted with flour of ſulphur loſes its fulminating quality: which ariſes from hence, that on this occaſion the ſulphur burns, and its acid, which is the ſame with the vitriolic, being thereby ſet at liberty, becomes capable of acting upon the gold as a vitriolic acid would; which, as was ſaid above, deprives the gold of its fulminating quality.

Of Silver.

Next to gold, ſilver is the moſt perfect metal. Like gold, it reſiſts the utmoſt violence of fire, even that in the focus of a burning-glaſs. However, it holds only the ſecond place among metals; becauſe it is lighter than gold by almoſt one half; is alſo ſomewhat leſs ductile; and laſtly, becauſe it is acted upon by a greater number of ſolvents.

Yet ſilver hath one advantage over gold, namely that of being a little harder; which makes it alſo more ſonorous.

This metal, like gold, begins to flow when it is ſo thoroughly penetrated by the fire as to appear ignited like a live coal.

While this metal is in fuſion, the immediate contact of the vapour of burning coals deprives it almoſt entirely of its malleability, in the ſame manner as we obſerved happens to gold: but both theſe metals eaſily recover that property by being melted with nitre.

The nitrous acid is the true ſolvent of ſilver, and being ſomewhat dephlegmated will very readily and eaſily take up a quantity of ſilver equal in weight to itſelf.

Silver thus combined with the nitrous acid forms a metallic ſalt which ſhoots into cryſtals, called by the name of *lunar cryſtals*, or *cryſtals of ſilver*.

Theſe cryſtals are moſt violently cauſtic: applied to the ſkin, they quickly affect it much as a live coal would; they produce a blackiſh eſchar, corroding and entirely deſtroying the parts they touch. Surgeons uſe them to eat away the proud fungous fleſh of ulcers. As ſilver united with the nitrous acid hath the property of blackening all animal ſubſtances, a ſolution of this metallic ſalt is employed to die hair, or other animal matters, of a beautiful and durable black.

Theſe cryſtals flow with a very moderate heat, and even before they grow red. Being thus melted, they form a blackiſh maſs; and in this form they are uſed by ſurgeons, under the title of *lapis infernalis*, *infernal ſtone*, or *ſilver cauſtic*.

Silver is alſo diſſolved by the vitriolic acid: but then the acid muſt be concentrated, and in quantity double the weight of the ſilver: nor will the ſolution ſucceed without a conſiderable degree of heat.

Spirit of ſalt and *aqua regis*, as well as the other acids, are incapable of diſſolving this metal, at leaſt in the ordinary way.

Though ſilver be not ſoluble in the acid of ſea-ſalt, nor eaſily in the acid of vitriol, as hath juſt been obſerved, it doth not follow, that it hath but a weak affinity with the latter, and none at all with the former: on the contrary, it appears from experiment, that it hath with theſe two acids a much greater affinity than with the acid of nitre: which is ſingular enough, conſidering the facility with which this laſt acid diſſolves it.

The experiment which proves the fact is this. To a ſolution of ſilver in the nitrous acid add the acid either of vitriol or of ſea-ſalt, and the ſilver will inſtantly quit its nitrous ſolvent to join with the ſuperadded acid.

Silver thus united with the vitriolic or the marine acid is leſs ſoluble in water than when combined with the nitrous acid: and for this reaſon it is, that when either of theſe two acids is added to a ſolution of ſilver, the liquor immediately becomes white, and a precipitate is formed, which is no other than the ſilver united with the precipitating acid. If the precipitation be effected by the vitriolic acid, the precipitate will diſappear upon adding a ſufficient quantity of water, becauſe there will then be water enough to diſſolve it. But the caſe is not the ſame when the precipitation is made by the marine acid: for ſilver combined therewith is ſcarce ſoluble in water.

This precipitate of ſilver procured by means of the marine acid is very eaſily fuſed, and when fuſed changes to a ſubſtance in ſome meaſure tranſparent and flexible; which hath occaſioned it to be called by the name of *luna cornea*. If it be propoſed to decompound this *luna cornea*, that is, to ſeparate the marine acid from the ſilver with which it is united, the *luna cornea* muſt be melted along with fatty and abſorbent matters, with which the acid will unite, and leave the metal exceeding pure.

It muſt be obſerved, that if, inſtead of the marine acid, ſea-ſalt in ſubſtance be added to a ſolution of ſilver in the nitrous acid, a precipitate is alſo produced, which by fuſion appears to be a true *luna cornea*. The reaſon is, that the ſea-ſalt is decompoſed by the nitrous acid, which ſeizes its baſis, as having a greater affinity therewith than its own acid hath; and this acid being conſequently diſengaged and ſet at liberty unites with the ſilver, which, as has been ſhewn, has greater affinity with it than with the nitrous acid. This is an inſtance of decompoſition effected by means of one of thoſe double affinities mentioned in the ſeventh propoſition concerning affinities.

From what hath been already ſaid it is clear, that all theſe combinations of ſilver with acids may be decompounded by abſorbent earths and by fixed alkalis; it being a general law with regard to all metallic ſubſtances.

Silver, when ſeparated by theſe means from the acids in which it was diſſolved, requires nothing but ſimple fuſion to reſtore it to its uſual form; becauſe it does not, any more than gold, loſe its phlogiſton by thoſe ſolutions and precipitations.

Silver unites with ſulphur in fuſion. If this metal be only made red-hot in a crucible, and ſulphur be then added,

ded, it immediately flows; the ſulphur acting as a flux to it. Silver thus united with ſulphur forms a maſs that may be cut, is half malleable, and hath nearly the colour and conſiſtence of lead, If this ſulphurated ſilver be kept a long time in fuſion, and in a great degree of heat, the ſulphur flies off and leaves the ſilver pure. But if the ſulphur be evaporated by a violent heat, it carries off with it part of the ſilver.

Silver unites and mixes perfectly with gold in fuſion. The two metals thus mixed form a compound with properties partaking of both.

Metallurgiſts have hitherto ſought in vain for a perfectly good and eaſy method of ſeparating theſe two metals by the *dry way* only: (This term is uſed to ſignify all operations performed by fuſion:) but they are conveniently enough parted by the *moiſt way*, that is, by acid ſolvents. This method is founded on the above-mentioned properties of gold and ſilver with reſpect to acids. It hath been ſhewn, that *aqua regis* only will diſſolve gold; that ſilver, on the contrary, is not ſoluble by *aqua regis*, and that its proper ſolvent is the acid of nitre: Conſequently, when gold and ſilver are mixed together, if the compound maſs be put into *aqua fortis*, this acid will take up all the ſilver, without diſſolving a particle of the gold, which will therefore remain pure; and by this means the deſired ſeparation is effected. This method, which is commonly made uſe of by goldſmiths and in mints, is called the *parting aſſay*.

It is plain, that if *aqua regis* were employed inſtead of *aqua fortis*, the ſeparation would be equally effected; and that the only difference between this proceſs and the former would conſiſt in this, that now the gold would be diſſolved, and the ſilver remain pure. But the operation by *aqua fortis* is preferable; becauſe *aqua regis* does take up a little ſilver, whereas *aqua fortis* hath not the leaſt effect on gold.

It muſt be obſerved, that when gold and ſilver are mixed together in equal parts, they cannot be parted by the means of *aqua fortis*. To enable the *aqua fortis* to act duly on the ſilver, this metal muſt be, at leaſt, in a triple proportion to the gold. If it be in a leſs proportion, you muſt either employ *aqua regis* to make the ſeparation, or, if you prefer the uſe of *aqua fortis*, melt the metalline maſs, and add as much ſilver as is neceſſary to make up the proportion above-mentioned: And hence this proceſs is called *quartation*.

This effect, which is pretty ſingular, probably ariſes from hence, that when the gold exceeds, or even equals the ſilver in quantity, the parts of both being intimately united, the former are capable of coating over the latter, and covering them ſo as to defend them from the action of the *aqua fortis*; which is not the caſe when there is thrice as much ſilver as gold.

There is one thing more to be taken notice of with regard to this proceſs; which is, that perfectly pure *aqua fortis* is rarely to be met with, for two reaſons: Firſt, it is difficult in making it wholly to prevent the riſing of the medium employed to diſengage the nitrous acid; that is, a little of the vitriolic acid will mix with the vapours of the *aqua fortis*: Secondly, unleſs the ſaltpetre be very well purified, it will always hold ſome ſmall portion of ſea-ſalt, the acid of which, we know, is very readily ſet looſe by the vitriolic acid, and conſequently riſes together with the vapours of the *aqua fortis*. It is eaſy to ſee, that *aqua fortis*, mixed either with the one or the other, is not proper for the parting proceſs; becauſe, as has juſt been ſaid, the vitriolic and the marine acid equally precipitate ſilver diſſolved in the nitrous acid; by which means, when they are united with that acid, they weaken its action upon the ſilver, and hinder the diſſolution. Add, that *aqua fortis* adulterated with a mixture of ſpirit of ſalt becomes an *aqua regis*, and conſequently is rendered capable of diſſolving gold, in proportion as its action upon ſilver is diminiſhed.

In order to remedy this inconvenience, and free *aqua fortis* from the vitriolic or marine acid with which it is tainted, ſilver muſt be diſſolved therein: By degrees, as the metal diſſolves, thoſe heterogeneous acids lay hold of it, and precipitate with it in the form of a white powder, as we obſerved before. This precipitate being wholly fallen, the liquor grows clear; after which, if it be found capable of diſſolving more ſilver, without turning milky, it may be depended on as a perfectly pure *aqua fortis*. Then filtre it, diſſolve more ſilver in it, as long as it will take up any, and you will have a ſolution of ſilver in a very pure *aqua fortis*. By means of this ſolution may other *aqua fortis* be purified: For, pour a few drops thereof into a very impure *aqua fortis*, and immediately the vitriolic or marine acid, with which that *aqua fortis* is contaminated, will join the ſilver and fall therewith to the bottom. When the ſolution of ſilver prepared as above does not in the leaſt affect the tranſparency of the *aqua fortis*, it is then very pure, and fit for the purpoſes of quartation.

This operation of purifying *aqua fortis* by a ſolution of ſilver is called the *precipitation of aqua fortis;* and *aqua fortis* thus purified is called *precipitated aqua fortis*.

When ſilver is diſſolved in *aqua fortis* it may be ſeparated therefrom, as has been ſhewn, by abſorbent earths and fixed alkalis.

Of Copper.

Of all the imperfect metals, copper comes the neareſt to gold and ſilver. Its natural colour is a deep-red yellow. It reſiſts a very violent degree of fire for a conſiderable time; but loſing its phlogiſton at laſt, it changes its metalline form for that of a calx, or a pure reddiſh earth. This calx is hardly, if at all, reducible to glaſs, without the addition of ſomething to promote its fuſion; all that the fierceſt heat can do being only to render it ſoft. Copper, even while it retains its metalline form, and is very pure, requires a conſiderable degree of fire to melt it, and does not begin to flow till long after it is red-hot. When in fuſion, it communicates a greeniſh colour to the flame of the coals.

This metal is inferior to ſilver in point of gravity; nor is its ductility ſo great, though it be pretty conſiderable: But, on the other hand, it exceeds that metal in hardneſs. It unites readily with gold and ſilver; nor does it greatly leſſen their beauty when added to them in a ſmall quantity: Nay, it even procures them ſome advantages;

vantages; ſuch as making them harder, and leſs ſubject to loſe their ductility. This may probably ariſe from hence, that the ductility of copper has the peculiarity of reſiſting moſt of thoſe cauſes which rob the perfect metals of theirs.

The property which other metalline ſubſtances have in common with copper, of loſing the phlogiſton by calcining and then vitrifying, furniſhes us with a method of ſeparating them from gold and ſilver, when they are combined therewith. Nothing more is required than to expoſe the maſs, compounded of the perfect metals and other metalline ſubſtances, to a degree of heat ſufficient to calcine whatever is not either gold or ſilver. It is evident that by this means theſe two metals will be obtained as pure as is poſſible; for, as hath already been ſaid, no metalline calx or glaſs is capable of uniting with metals poſſeſſed of their phlogiſton. On this principle is formed the whole buſineſs of refining gold and ſilver.

When the perfect metals have no other alloy but copper, as this metal is not to be calcined or vitrified without great difficulty, which is increaſed by its union with the unvitrifiable metals, it is eaſy to ſee that it is almoſt impoſſible to ſeparate them without adding ſomething to facilitate the vitrification of the copper. Such metals as have the property of turning eaſily to glaſs are very fit for this purpoſe; and it is neceſſary to add a certain quantity thereof, when gold or ſilver is to be purified from the alloy of copper. We ſhall have occaſion to be more particular on this ſubject when we come to treat of lead.

Copper is ſoluble in all the acids, to which it communicates a green colour, and ſometimes a blue. Even the neutral ſalts, and water itſelf, act upon this metal. With regard to water indeed, as the procuring it abſolutely pure and free from any ſaline mixture is next to an impoſſibility, it remains a queſtion, whether the effect it produces on copper be not owing to certain ſaline particles contained in it. It is this great facility of being diſſolved that renders copper ſo ſubject to ruſt; which is nothing elſe but ſome parts of its ſurface corroded by ſaline particles contained in the ſurrounding air and water.

The ruſt of copper is always green or blue, or of a colour between theſe two. Internally uſed it is very noxious, being a real poiſon, as are all the ſolutions of this metal made by any acid whatever. The blue colour, which copper conſtantly aſſumes, when corroded by any ſaline ſubſtance, is a ſure ſign by which it may be diſcovered where-ever it exiſts, even in a very ſmall quantity.

Copper diſſolved in the vitriolic acid forms a kind of metalline ſalt, which ſhoots into rhomboidal cryſtals of a moſt beautiful blue colour. Theſe cryſtals are called *blue vitriol*, or *vitriol of copper*. They are ſometimes found ready formed in the bowels of the earth; and may be artificially made by diſſolving copper in the vitriolic acid; but the ſolution will not ſucceed unleſs the acid be well dephlegmated. The taſte of this vitriol is ſaltiſh and aſtringent. It retains a conſiderable quantity of water in cryſtallizing, on which account it is eaſily rendered fluid by fire.

It muſt be obſerved, that when it is expoſed to a certain degree of heat in order to free it of its humidity, a great part of its acid flies off at the ſame time: And hence it is that, after calcination, there remains only a kind of earth, or metalline calx, of a red colour, which contains but very little acid. This earth cannot be brought to flow but with the greateſt difficulty.

A ſolution of copper in the nitrous acid forms a ſalt which does not cryſtallize, but, when dried, powerfully attracts the moiſture of the air. The ſame thing happens when it is diſſolved in the ſpirit of ſalt, or in *aqua regis*.

If the copper, thus diſſolved by any of theſe acids, be precipitated by an earth or an alkali, it retains nearly the colour it had in the ſolution: But theſe precipitates are ſcarce any thing more than the earth of copper, or copper deprived of moſt of its phlogiſton; ſo that if they were expoſed to a violent fire, without any additament, a great part of them would be converted into an earth that could never be reduced to a metalline form. Therefore, when we intend to reduce theſe precipitates to copper, it is neceſſary to add a certain quantity of a ſubſtance capable of reſtoring to them the phlogiſton they have loſt.

The ſubſtance which hath been found fitteſt for ſuch reductions is charcoal duſt; becauſe charcoal is nothing but a phlogiſton cloſely combined with an earth, which renders it exceedingly fixed, and capable of reſiſting a violent force of fire. But as charcoal will not melt, and conſequently is capable of preventing rather than forwarding the flux of a metalline calx or glaſs, which nevertheleſs is eſſentially neceſſary to complete the reduction, it hath been contrived to mix it, or any other ſubſtance containing the phlogiſton, with ſuch fixed alkalis as eaſily flow, and are fit to promote the flux of other bodies. Theſe mixtures are called *reducing fluxes*; becauſe the general name of fluxes is given to all ſalts, or mixtures of ſalts, which facilitate fuſion.

If ſulphur be applied to copper made perfectly red-hot, the metal immediately runs; and theſe two ſubſtances uniting, form a new compound much more fuſible than pure copper.

This compound is deſtroyed by the ſole force of fire, for two reaſons: The firſt is, that, ſulphur being volatile, the fire is capable of ſubliming a great part of it, eſpecially when it is in a great proportion to the copper with which it is joined; the ſecond is, that the portion of ſulphur which remains, being more intimately united with the copper, though it be rendered leſs combuſtible by that union, is nevertheleſs burnt and conſumed in time. Copper being combined with ſulphur, and together with it expoſed to the force of fire, is found to be partly changed into a blue vitriol; becauſe the vitriolic acid, being diſengaged by burning the ſulphur, is by that means qualified to diſolve the copper. The affinity of copper with ſulphur is geater than that of ſilver.

This metal, as well as the other imperfect metals and the ſemi-metals, being mingled with nitre and expoſed to the fire, is decompoſed and calcined much ſooner than by itſelf; becauſe the phlogiſton which it contains occaſions the deflagration of the nitre, and conſequently the two ſubſtances mutually decompoſe each other. There are certain metalline ſubſtances whoſe phlogiſton is ſo abundant,

dant, and fo weakly connected with their earth, that, when they are thus treated with nitre, there arifes immediately a detonation, accompanied with flame, and as violent as if fulphur or charcoal-duft had been employed; fo that in a moment the metalline fubftance lofes its phlogifton, and is calcined. The nitre, after thefe detonations, always affumes an alkaline character.

Of Iron.

Iron is lighter and lefs ductile than copper; but it is much harder, and of more difficult fufion.

It is the only body that has the property of being attracted by the magnet, which therefore ferves to difcover it where-ever it is. But it muft be obferved, that it hath this property only when in its metalline ftate, and lofes it when converted to an earth or calx. Hence very few iron-ores are attracted by the loadftone; becaufe, for the moft part, they are only forts of earths, which require a phlogifton to be added before they can be brought to the form of true iron.

When iron hath undergone no other preparation but the fufion which is neceffary to fmelt it from its ore, it is ufually quite brittle, and flies to pieces under the hammer: Which arifes in fome meafure from its containing a certain portion of unmetallic earth interpofed between its parts. This we call *pig-iron.*

By melting this a fecond time it is rendered purer, and more free from heterogeneous matters: But ftill, as its proper parts are probably not brought fufficiently near, or clofely enough united, till the iron hath undergone fome further preparation befides that of fufion, it feldom hath any degree of malleability.

The way to give it this property is to make it juft red-hot, and then hammer it for fome time in all directions; to the end that its parts may be properly united, incorporated, and welded together, and that the heterogeneous matters which keep them afunder may be feparated. Iron made by this means as malleable as poffible, we call *bar-iron*, or *forged iron.*

Bar-iron is ftill harder to fufe than pig-iron: To make it flow requires the utmoft force of fire.

Iron has the property of imbibing a greater quantity of phlogifton than is neceffary to give it the metalline form. It may be made to take in this fuperabundant phlogifton two ways: The firft is by fufing it again with matters that contain the phlogifton; the fecond is, by encompaffing it with a quantity of fuch matters, charcoal-duft, for inftance, and then expofing it fo encompaffed, for a certain time, to a degree of fire barely fufficient to keep it red-hot. This fecond method, whereby one fubftance is incorporated with another by means of fire, but without fufing either of them, is in general called *cementation.*

Iron thus impregnated with an additional quantity of phlogifton is called *fteel.* The hardnefs of fteel may be confiderably augmented by *tempering* it; that is, by making it red-hot, and fuddenly quenching it in fome cold liquor. The hotter the metal, and the colder the liquor in which it is quenched, the harder will the fteel be. By this means tools are made, fuch as files and fheers, capable of cutting and dividing the hardeft bodies, as glafs, pebbles, and iron itfelf. The colour of fteel is darker than that of iron, and the facets which appear on breaking it are fmaller. It is alfo lefs ductile and more brittle, efpecially when tempered.

As iron may be impregnated with an additional quantity of phlogifton, and thereby converted into fteel, fo may fteel be again deprived of that fuperabundant phlogifton, and brought back to the condition of iron. This is effected by cementing it with poor earths, fuch as calcined bones and chalk. By the fame operation fteel may be *untempered*: nay, it will lofe the hardnefs it had acquired by tempering, if it be but made red-hot, and left to cool gradually. As iron and fteel differ only in the refpects we have here taken notice of, their properties being in all other refpects the fame, what follows is equally applicable to both.

Iron being expofed to the action of fire for fome time, efpecially when divided into fmall particles, fuch as filings, is calcined, and lofes its phlogifton. By this means it turns to a kind of reddifh yellow earth, which on account of its colour is called *crocus Martis*, or *faffron of Mars.*

This calx of iron has the fingular property of flowing in the fire with fomewhat lefs difficulty than iron itfelf; whereas every other metalline calx flows with lefs eafe than the metal that produced it. It has moreover the remarkable property of uniting with the phlogifton, and of being reduced to iron without fufion; requiring for that purpofe only to be made red-hod.

Iron may be incorporated with filver, and even with gold, by means of certain operations. Under the article of lead, we fhall fee how it may be feparated from thefe metals.

The acids produce on it much the fame effects as on copper: every one of them acts upon it. Certain neutral falts, alkalis, and even water itfelf, are capable of diffolving it; and hence it is alfo very fubject to ruft.

The vitriolic acid diffolves it with the greateft eafe: but the circumftances which attend the diffolution thereof are different from thofe with which the fame acid diffolves copper. For, 1. Whereas the vitriolic acid muft be concentrated to diffolve copper, it muft on the contrary be diluted with water to diffolve iron, which it will not touch when well dephlegmated. 2. The vapours which rife in this diffolution are inflammable; fo that if it be made in a fmall-necked bottle, and the flame of a candle be applied to the mouth thereof, the vapours in the bottle take fire with fuch rapidity as to produce a confiderable explofion.

This folution is of a beautiful green colour; and from this union of the vitriolic acid with iron, there refults a neutral metalline falt, which has the property of fhooting into cryftals of a rhomboidal figure, and a green colour. Thefe cryftals are called *green vitriol*, and *vitriol of Mars.*

Green vitriol hath a faltifh and aftringent tafte. As it retains a great deal of water in cryftallizing it quickly flows by the action of fire: but this fluidity is owing to its water only, and is not a real fufion; for as foon as its moifture is evaporated, it refumes a folid form Its green tranfparent colour is now changed into an opaque white:

white: and, if the calcination be continued, its acid alſo exhales, and is diſſipated in vapours; and as it loſes that, it turns gradually to a yellow colour, which comes ſo much the nearer to a red the longer the calcination is continued, or the higher the force of the fire is raiſed; which being driven to the utmoſt, what remains is of a very deep red. This remainder is nothing but the body of the iron, which, having loſt its phlogiſton, is now no more than an earth, nearly of the ſame nature with that which is left after calcining the metal itſelf.

Green vitriol diſſolved in water ſpontaneouſly lets fall a yellowiſh earthy ſediment. If this ſolution be defecated by filtration, it ſtill continues to depoſite ſome of the ſame ſubſtance, till the vitriol be wholly decompoſed. This ſediment is nothing but the earth of iron, which is then called *ochre*.

The nitrous acid diſſolves iron with great eaſe. This ſolution is of a yellow colour, inclining more or leſs to a ruſſet, or dark-brown, as it is more or leſs ſaturated with iron. Iron diſſolved by this acid alſo falls ſpontaneouſly into a kind of calx, which is incapable of being diſſolved a ſecond time; for the nitrous acid will not act upon iron that has loſt its phlogiſton. This ſolution does not cryſtallize, and if evaporated to dryneſs attracts the moiſture of the air.

Spirit of ſalt likewiſe diſſoves iron, and this ſolution is green. The vapours which riſe during the diſſolution are inflammable, like thoſe which aſcend when this metal is attacked by the vitriolic acid. *Aqua regis* makes a ſolution of iron, which is of a yellow colour.

Iron hath a greater affinity than either ſilver or copper with the nitrous and vitriolic acids: ſo that if iron be preſented to a ſolution of either, in one of theſe two acids, the diſſolved metal will be precipitated; becauſe the acid quits it for the iron, with which it has a greater affinity.

On this occaſion it muſt be obſerved, that if a ſolution of copper in the vitriolic acid be precipitated by means of iron, the precipitate has the form and ſplendour of a metal, and does not require the addition of a phlogiſton to reduce it to true copper; which is not the caſe, when the precipitation is effected by earths or alkaline ſalts.

The colour of this metalline precipitate hath deceived ſeveral perſons, who being unacquainted with ſuch phenomena, and with the nature of blue vitriol, imagined that iron was tranſmuted into copper, when they ſaw a bit of iron, laid in a ſolution of that vitriol, become, in form and external appearance, exactly like copper: whereas the ſurface only of the iron was cruſted over with the particles of copper contained in the vitriol, which had gradually fallen upon, and adhered to the iron, as they were precipitated out of the ſolution.

Among the ſolvents of iron we mentioned fixed alkalis; and that they have ſuch a power, is proved by the following phenomenon. If a large proportion of alkaline ſalts be ſuddenly mixed with a ſolution of iron in an acid, no precipitation enſues, and the liquor remains clear and pellucid; or if at firſt it look a little turbid, that appearance laſts but a moment, and the liquor preſently recovers its tranſparency. The reaſon is, that quantity of alkali is more than ſufficient to ſaturate all the acid of the ſolution; and the ſuperabundant portion thereof, meeting with the iron already finely divided by the acid, diſſolves it with eaſe as faſt as it falls, and ſo prevents its mudding in liquor. To evince that this is ſo in fact, let the alkali be applied in a quantity that is not ſufficient, or but qarely ſufficient, to ſaturate the acid, and the iron will then precipitate like any other metal.

Water alſo acts upon iron; and therefore iron expoſed to moiſture grows ruſty. If iron-filings be expoſed to the dew, they turn wholly to a ruſt, which is called *crocus Martis aperiens*.

Iron expoſed to the fire, together with nitre, makes it detonate pretty briſkly, ſets it in a flame, and decompoſes it with rapidity.

This metal hath a greater affinity than any other metalline ſubſtance with ſulphur; on which account, it is ſucceſsfully uſed to precipitate, and ſeparate all metalline ſubſtances combined with ſulphur.

Sulphur uniting with iron communicates to it ſuch a degree of fuſibility, that if a maſs of this metal, heated red-hot, be rubbed with a bit of ſulphur, it inceſſantly runs into as perfect a fuſion as a metal expoſed to the focus of a large burning-glaſs.

Of TIN.

TIN is the lighteſt of all metals. Though it yields eaſily to the impreſſion of hard bodies, it has but little ductility. Being bent backwards and forwards it makes a ſmall crackling noiſe. It flows with a very moderate degree of fire, and long before it comes to be red-hot. When it is in fuſion, its ſurface ſoon grows duſky, and there forms upon it a thin dark-coloured duſty pellicle, which is no other than a part of the tin that has loſt its phlogiſton, or a calx of tin. The metal thus calcined eaſily recovers its metalline form, on the addition of a phlogiſton. If the calx of tin be urged by a ſtrong fire it grows white, but the greateſt violence of heat will not fuſe it; which makes ſome chemiſts conſider it as a calcinable or abſorbent earth, rather than a vitrifiable one. Yet it turns to glaſs in ſome ſort, when mixed with any other ſubſtance that vitrifies eaſily. However, it always produces an imperfect glaſs only, which is not at all tranſparent, but of an opaque white. The calx of tin thus vitrified is called *enamel*. Enamels are made of ſeveral colours by the addition of this or that metalline calx.

Tin unites eaſily with all the metals; but it deſtroys the ductility and malleability of every one of them, lead excepted. Nay, it poſſeſſes this property of making metals brittle, in ſuch an eminent degree, that the very vapour of it, when in fuſion, is capable of producing this effect. Moreover, which is very ſingular, the moſt ductile metals, even gold and ſilver, are thoſe on which it works this change with the moſt eaſe, and in the greateſt degree. It has alſo the property of making ſilver, mixed with it, flow over a very ſmall fire.

It adheres to, and in ſome meaſure incorporates with, the ſurface of copper and of iron; whence aroſe the practice of coating over thoſe metals with tin. Tin-plates are no other than thin plates of iron tinned over.

If to twenty parts of tin one part of copper be added, this

this alloy renders it much more ſolid, and the mixed maſs continues tolerably ductile.

If, on the contrary, to one part of tin ten parts of copper be added, together with a little zinc, a ſemi-metal to be conſidered hereafter, from this combination there reſults a metalline compound, which is hard, brittle, and very ſonorous; ſo that it is uſed for caſting bells: This compoſition is called *bronze* and *bell-metal*.

Tin hath an affinity with the vitriolic, nitrous, and marine acids. All of them attack and corrode it; yet none of them is able to diſſolve it without great difficulty: So that if a clear ſolution thereof be deſired, particular methods muſt be employed for that purpoſe; for the acids do but in a manner calcine it, and convert it to a kind of white calx or precipitate. The ſolvent which has the greateſt power over it is *aqua regis*, which has even a greater affinity therewith than with gold itſelf; whence it follows, that gold diſſolved in *aqua regis* may be precipitated by means of tin; but then the *aqua regis* muſt be weakened. Gold thus precipitated by tin is of a moſt beautiful colour, and is uſed for a red in enamelling and painting on porcelain, as alſo to give a red colour to artificial gems. If the *aqua regis* be not lowered, the precipitate will not have the purple colour.

Tin hath the property of giving a great luſtre to all red colours in general; on which account it is uſed by the dyers for ſtriking a beautiful ſcarlet, and tin-veſſels are employed in making fine ſyrup of violets. Water does not act upon this metal, as it does upon iron and copper; for which reaſon it is not ſubject to ruſt: neverthelefs, when it is expoſed to the air, its ſurface ſoon loſes its poliſh and ſplendor.

Tin mixed with nitre, and expoſed to the fire, deflagrates with it, makes it detonate, and is immediately converted to a *refractory calx*; for ſo all ſubſtances are called which are incapable of fuſion.

Tin readily unites with ſulphur, and with it becomes a brittle and friable maſs.

Of LEAD.

NEXT to gold and mercury, lead is the heavieſt of all metalline ſubſtances, but in hardneſs is exceeded by every one of them. Of all metals alſo it melts the eaſieſt, except tin. While it is in fuſion there gathers inceſſantly on its ſurface, as on that of tin, a blackiſh, duſty pellicle, which is nothing but a calx of lead.

This calx further calcined by a moderate fire, the flame being reverberated on it, ſoon grows white. If the calcination be continued it becomes yellow, and at laſt of a beautiful red. In this ſtate it is called *minium*, and is uſed as a pigment. *Minium* is not eaſily made, and the operation ſucceeds well in large manufactures only.

To convert lead into *litharge*, which is the metal in a manner half vitrified, you need only keep it melted by a pretty ſtrong fire; for then, as its ſurface gradually calcines, it tends more and more to fuſion and vitrification.

All theſe preparations of lead are greatly diſpoſed to perfect fuſion and vitrification, and for that purpoſe require but a moderate degree of fire; the calx or earth of lead being of all metalline earths that which vitrifies the moſt eaſily.

Lead hath not only the property of turning into glaſs with the greateſt facility, but it hath alſo that of promoting greatly the vitrification of all the other imperfect metals; and, when it is actually vitrified, procures the ready fuſion of all earths and ſtones in general, even thoſe which are refractory, that is, which could not be fuſed without its help.

Glaſs of lead, beſides its great fuſibility, hath alſo the ſingular property of being ſo ſubtile and active as to corrode and penetrate the crucibles in which it is melted, unleſs they be of an earth that is exceeding hard, compact, and withal very refractory: for glaſs of lead being one of the moſt powerful fluxes that we know, if the earth of the crucible in which it is melted be in the ſmalleſt degree fuſible, it will be immediately vitrified; eſpecially if there be any metallic matter in its compoſition.

The great activity of glaſs of lead may be weakened by joining it with other vitrifiable matters; but unleſs theſe be added in a very great proportion, it will ſtill remain powerful enough to penetrate common earths, and carry off the matters combined with it.

On theſe properties of lead, and of the glaſs of lead, depends the whole buſineſs of refining gold and ſilver. It hath been ſhewn, that as theſe two metals are indeſtructible by fire, and the only ones which have that advantage, they may be ſeparated from the imperfect metals, when mixed therewith, by expoſing the compound to a degree of fire ſufficiently ſtrong to vitrify the latter; which when once converted into glaſs can no longer remain united with any metal that has its metalline form. But it is very difficult to procure this vitrification of the imperfect metals, when united with gold and ſilver; nay, it is in a manner impoſſible to vitrify them entirely, for two reaſons: firſt, becauſe moſt of them are naturally very difficult to vitrify: ſecondly, becauſe the union they have contracted with the perfect metals defends them, in a manner, from the action of the fire, and that ſo much the more effectually as the proportion of the perfect metals is greater; which being indeſtructible, and in ſome ſort coating over thoſe with which they are alloyed, ſerve them as a preſervative and impenetrable ſhield againſt the utmoſt violence of fire.

It is therefore clear, that a great deal of labour may be ſaved, and that gold and ſilver may be refined to a much greater degree of purity than can otherwiſe be obtained, if to a mixture of theſe metals with copper, for inſtance, or any other imperfect metal, be added a certain quantity of lead. For the lead, by its known property, will infallibly produce the deſired vitrification; and as it likewiſe increaſes the proportion of the imperfect metals, and ſo leſſens that of the perfect metals, in the maſs, it evidently deprives the former of a part of their guard, and ſo effects a more complete vitrification. As the glaſs of lead hath the property of running through the crucible, and carrying with it the matters which it has vitrified, it follows, that when the vitrification of the imperfect metals is effected by its means, all thoſe vitrified matters together penetrate the veſſel containing the fuſed metalline maſs, diſappear, and leave only the gold and ſilver perfectly

perfectly pure, and freed, as far as is poſſible, from all admixture of heterogeneous parts.

The better to promote the ſeparation of ſuch parts, it is uſual to employ in this proceſs a particular ſort of ſmall crucibles, made of the aſhes of calcined bones, which are exceedingly porous and eaſily pervaded. They are called *cupels*, on account of their figure, which is that of a wide-mouthed cup: and from hence the operation takes its name; for when we refine gold and ſilver in this manner, we are ſaid to *cupel* thoſe metals. It is eaſy to perceive, that the more lead is added, the more accurately will the gold and ſilver be refined; and that ſo much the more lead ought to be added as the perfect metals are alloyed with a greater proportion of the imperfect. This is the moſt ſevere trial to which a perfect metal can be put, and conſequently any metal that ſtands it may be fairly conſidered as ſuch.

In order to denote the fineneſs of gold, it is ſuppoſed to be divided into twenty-four parts called *carats*; and gold, which is quite pure and free from all alloy, is ſaid to be twenty-four carats fine; that which contains $\frac{1}{24}$ part of alloy is called gold of twenty-three carats; that which contains $\frac{2}{24}$ of alloy is but twenty-two carats; and ſo on. Silver again is ſuppoſed to be divided into twelve parts only, which are called *penny-weights*; ſo that when abſolutely pure it is ſaid to be twelve penny-weights fine; when it contains $\frac{1}{12}$ of alloy, it is then called eleven penny-weights fine; when it contains $\frac{2}{12}$ of alloy, it is called ten penny-weights fine; and ſo on.

In treating of copper, we promiſed to ſhew under the article of lead how to ſeparate it from iron. The proceſs is founded on that property of lead which renders it incapable of mixing and uniting with iron, though it readily diſſolves all other metalline ſubſtances. Therefore if you have a maſs compounded of copper and iron, it muſt be fuſed with a certain quantity of lead, and then the copper, having a greater affinity with lead than with iron, will deſert the latter and join the former, which being incapable of any union with iron, as was ſaid, will wholly exclude it from the new compound. The next point is to ſeparate the lead from the copper; which is done by expoſing the maſs compounded of theſe two metals to a degree of fire ſtrong enough to deprive the lead of its metalline form, but too weak to have the ſame effect on the copper: and this may be done, ſince of all the imperfect metals lead is, next to tin, the eaſieſt to be calcined, and copper, on the contrary, reſiſts the greateſt force of fire longeſt, without loſing its metalline form. Now what we gain by this exchange, *viz.* by ſeparating copper from iron, and uniting it with lead, conſiſts in this, that as lead is calcined with leſs fire than iron, the copper is leſs expoſed to be deſtroyed: for it muſt be obſerved, that, however moderate the fire be, it is hardly poſſible to prevent a certain quantity thereof from being calcined in the operation.

Lead melted with a third part of tin forms a compound, which being expoſed to a fire capable of making it thoroughly red hot, ſwells, puffs up, ſeems in ſome ſort to take fire, and is preſently calcined. Theſe two metals mixed together are much ſooner calcined than either of them ſeparately.

Both lead and tin are in ſome meaſure affected by water, and by a moiſt air; but they are both much leſs ſubject than iron or copper to be corroded by theſe ſolvents, and of courſe are much leſs liable to ruſt.

The vitriolic acid acts upon and diſſolves lead much in the ſame manner as it doth ſilver.

The nitrous acid diſſolves this metal with much eaſe, and in great quantities; and from this ſolution a ſmall portion of mercury may be obtained.

When this ſolution of lead is diluted with a good deal of water, the lead precipitates in the form of a white powder; which happens becauſe the acid is rendered too weak to keep the lead diſſolved.

If this ſolution of lead be evaporated to a certain degree, it ſhoots into cryſtals formed like regular pyramids with ſquare baſes. Theſe cryſtals are of a yellowiſh colour, and of a ſaccharine taſte: they do not eaſily diſſolve in water. This nitrous metalline ſalt has the ſingular property of detonating in a crucible, without any additament, or the contact of any other inflammable ſubſtance. This property it derives from the great quantity of phlogiſton contained in, and but looſely connected with the lead, which is one of its principles.

If ſpirit of ſalt, or even ſea-ſalt in ſubſtance, be added to a ſolution of lead in the nitrous acid, a white precipitate immediately falls; which is no other than the lead united with the marine acid. This precipitate is extremely like the precipitate of ſilver made in the ſame manner; and that being called *luna cornea*, hath occaſioned this to be named *plumbum corneum*. Like the *luna cornea*, it is very fuſible, and, being melted, hardens like it into a kind of horny ſubſtance: it is volatile, and may be reduced by means of inflammable matters combined with alkalis. But it differs from the *luna cornea* in this chiefly, that it diſſolves eaſily in water; whereas the *luna cornea*, on the contrary, diſſolves therein with great difficulty, and in a very ſmall quantity.

As this precipitation of lead from its ſolution in ſpirit of nitre is procured by the marine acid, lead is thereby proved to have a greater affinity with the latter acid than with the former. Yet, if you attempt to diſſolve lead directly by the acid of ſea-ſalt, the ſolution is not ſo eaſily effected as by the ſpirit of nitre, and it is always imperfect; for it wants one of the conditions eſſential to every ſolution in a liquor, namely tranſparency.

If lead be boiled for a long time in a lixivium of fixed alkali, part of it will be diſſolved.

Sulphur renders this metal refractory and ſcarce fuſible; and the maſs they form when united together is friable. Hence it appears that ſulphur acts upon lead much in the ſame manner as upon tin; that is, it renders both theſe metals leſs fuſible, which are naturally the moſt fuſible of any, while it exceedingly facilitates the fuſion of ſilver, copper, and iron, metals which of themſelves flow with the greateſt difficulty.

Of QUICK-SILVER.

WE treat of quick-ſilver in a chapter apart, becauſe this metallic ſubſtance cannot be claſſed with the metals properly ſo called, and yet has ſome properties which will

will not allow us to confound it with the semi metals. The reason why quick-silver, by the chemists commonly called mercury, is not reputed a metal, is, that it wants one of the essential properties thereof, *viz.* malleability. When it is pure and unadulterated with any mixture, it is always fluid, and of course unmalleable. But as, on the other hand, it eminently possesses the opacity, the splendor, and above all the gravity of a metal, being, next to gold, the heaviest of all bodies, it may be considered as a true metal, differing from the rest no otherwise than by being constantly in fusion; which we may suppose arises from its aptness to flow with such a small degree of heat, that be there ever so little warmth on earth, there is still more than enough to keep mercury in fusion; which would become solid and malleable if it were possible to apply to it a degree of cold considerable enough for that purpose. These properties will not allow us to confound it with the semi-metals. Add, that we are not yet assured by any undoubted experiment that it can be wholly deprived of its phlogiston, as the imperfect metals may. Indeed we cannot apply the force of fire to it as could be wished: for it is so volatile, that it flies off and exhales in vapours with a much less degree of fire than is necessary to make it red-hot. The vapours of mercury thus raised by the action of fire, being collected and united in a certain quantity, appear to be no other than true mercury retaining every one of its properties; and no experiment hath ever been able to shew the least change thus produced in its nature.

If mercury be exposed to the greatest heat that it can bear without sublimation, and continued in it for several months, or even a whole year together, it turns to a red powder, which the chemists call *mercurius præcipitatus per se*. But to succeed in this operation, it is absolutely necessary that the heat be such as is above specified; for this metallic substance may remain exposed to a weaker heat for a considerable number of years, without undergoing any sensible alteration.

Some chemists fancied that by this operation they had fixed mercury, and changed its nature; but without any reason; for if the mercury thus seemingly transmuted be exposed to a somewhat stronger degree of fire, it sublimes and exhales in vapours as usual; and those vapours collected are nothing else but running mercury, which has recovered all its properties without the help of any additament.

Mercury has the property of dissolving all the metals, iron only excepted. But it is a condition absolutely necessary to the success of such dissolution, that the metalline substances be possessed of their phlogiston; for if they be calcined, mercury cannot touch them: and hence it follows, that mercury doth not unite with substances that are purely earthy. Such a combination of a metal with mercury is called an *amalgam*. Trituration alone is sufficient to effect it; however, a proper degree of heat also is of use.

Mercury amalgamated with a metal gives it a consistence more or less soft, and even fluid, according to the greater or smaller proportion of mercury employed. All amalgams are softened by heat, and hardened by cold.

Mercury is very volatile; vastly more so than the most unfixed metals: moreover, the union it contracts with any metal is not sufficiently intimate to entitle the new compound resulting from that union to all the properties of the two substances united; at least with regard to their degree of fixity and volatility. From all which it follows, that the best and surest method of separating it from metals dissolved by it, is to expose the amalgam to a degree of heat sufficient to make all the quick-silver rise and evaporate; after which the metal remains in the form of a powder, and being fused recovers its malleability. If it be thought proper to save the quick-silver, the operation must be performed in close vessels, which will confine and collect the mercurial vapours. This operation is most frequently employed to separate gold and silver from the several sorts of earths and sands with which they are mixed in the ore; because these two metals, gold especially, are of sufficient value to compensate the loss of mercury, which is inevitable in this process: besides, as they very readily amalgamate with it, this way of separating them from every thing unmetallic is very commodious.

Mercury is dissolved by acids; but with circumstances peculiar to each particular acid.

The vitriolic acid concentrated and made boiling hot seizes on it, and presently reduces it to a kind of white powder, which turns yellow by the affusion of water, but does not dissolve in it: it is called *turbith mineral*. However, the vitriolic acid on this occasion unites with a great part of the mercury in such a manner that the compound is soluble in water. For if to the water which was used to wash the turbith a fixed alkali be added, there falls instantly a russet-coloured precipitate, which is no other than mercury separated from the vitriolic acid by the intervention of the alkali.

This dissolution of mercury by the vitriolic acid is accompanied with a very remarkable phenomenon; which is, that the acid contracts a strong smell of volatile spirit of sulphur: a notable proof that part of the phlogiston of the mercury hath united therewith. And yet, if the mercury be separated by means of a fixed alkali, it does not appear to have suffered any alteration. Turbith mineral is not so volatile as pure mercury.

The nitrous acid dissolves mercury with ease. The solution is limpid and transparent, and as it grows cold shoots into crystals, which are a nitrous mercurial salt.

If this solution be evaporated to driness, the mercury remains impregnated with a little of the acid, under the form of a red powder, which hath obtained the names of *red precipitate*, and *arcanum corallinum*. This precipitate, as well as turbith, is less volatile than pure mercury.

If this solution of mercury be mixed with a solution of copper made likewise in the nitrous acid, and the mixture evaporated to driness, there will remain a green powder called *green precipitate*. These precipitates are caustic and corrosive; and are used as such in surgery.

Though mercury be dissolved more easily and completely by the nitrous acid than by the vitriolic, yet it has a greater affinity with the latter than with the former; for if a vitriolic acid be poured into a solution of mercury in spirit of nitre, the mercury will quit the lat-

ter acid in which it was diſſolved, and join the other which was added. The ſame thing happens when the marine acid is employed inſtead of the vitriolic.

Mercury combined with ſpirit of ſalt forms a ſingular body; a metalline ſalt which ſhoots into long cryſtals, pointed like daggers. This ſalt is volatile, and ſublimes eaſily without decompoſition. It is moreover the moſt violent of all the corroſives hitherto diſcovered by chemiſtry. It is called *corroſive ſublimate*, becauſe it muſt abſolutely be ſublimed to make the combination perfect. There are ſeveral ways of doing this: but the operation will never fail, if the mercury be rarefied into vapours and meet with the marine acid in a ſimilar ſtate.

Corroſive ſublimate is diſſoved by water, but in very ſmall quantities only. It is decompounded by fixed alkalis, which precipitate the mercury in a reddiſh yellow powder, called, on account of its colour, *yellow precipitate*.

If corroſive ſublimate be mixed with tin, and the compound diſtilled, a liquor comes over, which continually emits abundance of denſe fumes, and from the name of its inventor is called the *ſmoking liquor of Libavius*. This liquor is no other than the tin combined with the marine acid of the corroſive ſublimate, which therefore it hath actually decompounded: whence it follows, that this acid hath a greater affinity with tin than with mercury.

The marine acid in corroſive ſublimate is not quite ſaturated with mercury; but is capable of taking up a much greater quantity thereof. For if corroſive ſublimate be mixed with freſh mercury, and ſublimed a ſecond time, another compound will be produced containing much more mercury, and leſs acrimonious; for which reaſon it is named *ſweet ſublimate of mercury, mercurius dulcis, aquila alba*. This compound may be taken internally, and is purgative or emetic according to the doſe adminiſtered. It may be rendered ſtill more gentle by repeated ſublimations, and then it takes the title of *panacæa mercurialis*. No way hath hitherto been found to diſſolve mercury in *aqua regis* without great difficulty, and even then it is but imperfectly diſſolved.

Mercury unites eaſily and intimately with ſulphur. If theſe two ſubſtances be only rubbed together in a gentle heat, or even without any heat, they will contract an union, though but an incomplete one. This combination takes the form of a black powder, which has procured it the name of *Æthiops mineral*.

If a more intimate and perfect union be deſired, this compound muſt be expoſed to a ſtronger heat; and then a red ponderous ſubſtance will be ſublimed, appearing like a maſs of ſhining needles: this is the combination deſired, and is called *cinabar*. In this form chiefly is mercury found in the bowels of the earth. Cinabar finely levigated acquires a much brighter red colour, and is known to painters by the name of *vermilion*.

Cinabar riſes wholly by ſublimation, without ſuffering any decompoſition; becauſe the two ſubſtances of which it conſiſts, *viz.* mercury and ſulphur, are both volatile.

Though mercury unites and combines very well with ſulphur, as hath been ſaid, yet it hath leſs affinity with that mineral than any other metal, gold only excepted: whence it follows, that any of the other metals will decompound cinabar, by uniting with its ſulphur, and ſo ſetting the mercury at liberty to appear in its uſual form. Mercury thus ſeparated from ſulphur, is eſteemed the pureſt, and bears the name of *mercury revivified from cinabar*.

Iron is generally uſed in this operation preferably to the other metals, becauſe among them all it has the greateſt affinity with ſulphur, and is the only one that has none with mercury.

Cinabar may alſo be decompounded by means of fixed alkalis; the affinity of theſe ſalts with ſulphur being generally greater than that of any metalline ſubſtance whatever.

Of the Semi-Metals.

Of Regulus *of* Antimony.

Regulus of antimony is a metallic ſubſtance of a pretty bright white colour. It has the ſplendor, opacity, and gravity of a metal; but it is quite unmalleable, and crumbles to duſt, inſtead of yielding or ſtretching under the hammer; on which account it is claſſed with the ſemi-metals.

It begins to flow as ſoon as it is moderately red; but, like the other ſemi-metals, it cannot ſtand a violent degree of fire; being thereby diſſipated into ſmoke and white vapours, which adhere to ſuch cold bodies as they meet with, and ſo are collected into a kind of *farina* called *flowers of antimony*.

If regulus of antimony, inſtead of being expoſed to a ſtrong fire, be only heated ſo moderately that it ſhall not even melt, it will calcine, loſe its phlogiſton, and take the form of a greyiſh powder deſtitute of all ſplendor: this powder is called *calx of antimony*.

This calx is not volatile like the regulus, but will endure a very violent fire; and being expoſed thereto will flow, and turn to a glaſs of the yellowiſh colour of a hyacinth.

It is to be obſerved, that the more the regulus is deprived of its phlogiſton by continued calcination, the more refractory is the calx obtained from it. The glaſs thereof has alſo ſo much the leſs colour, and comes the nearer to common glaſs.

The calx and the glaſs of antimony will recover their metalline form, like every other calx and glaſs of a metal, if reduced by reſtoring to them their loſt phlogiſton. Yet, if the calcination be carried too far, their reduction will become much more difficult, and a much ſmaller quantity of regulus will be reſuſcitated.

Regulus of antimony is capable of diſſolving the metals; but its affinities with them are various, and differ according to the following order. It affects iron the moſt powerfully, next copper, then tin, lead, and ſilver. It promotes the fuſion of metals, but makes them all brittle and unmalleable.

It will not amalgamate with mercury; and though, by certain proceſſes, particularly the addition of water and continued trituration, a ſort of union between theſe two ſub-

substances may be produced, yet it is but apparent and momentary; for being left to themselves, and undisturbed, they quickly disunite and separate.

The vitriolic acid, assisted by heat, and even by distillation, dissolves regulus of antimony. The nitrous acid likewise attacks it; but the solution can by no art be made clear and limpid; so that the regulus is only calcined, in a manner, by this acid.

The marine acid dissolves it well enough; but then it must be exceedingly concentrated, and applied in a peculiar manner, and especially by distillation. One of the best methods of procuring a perfect union between the acid of sea-salt and regulus of antimony, is to pulverize the latter, mix it with corrosive sublimate, and distil the whole. There rises in the operation a white matter, thick, and scarce fluid, which is no other than the regulus of antimony united and combined with the acid of sea-salt. This compound is extremely corrosive, and is called *butter of antimony*.

It is plain, that the corrosive sublimate is here decompounded; that the mercury is revivified; and that the acid which was combined therewith hath quitted it to join the regulus of antimony, with which its affinity is greater. This butter of antimony, by repeated distillations, acquires a considerable degree of fluidity and limpidness.

If the acid of nitre be mixed with butter of antimony, and the whole distilled, there rises an acid liquor, or a sort of *aqua regis*, which still retains some of the dissolved regulus, and is called *bezoardic spirit of nitre*. After the distillation there remains a white matter, from which fresh spirit of nitre is again abstracted, and which being then washed with water, is called *bezoar mineral*. This bezoar mineral is neither so volatile, nor so caustic, as butter of antimony; because the nitrous acid hath not the property of volatilizing metallic substances, as the marine acid does, and because it remains much more intimately combined with the reguline part.

If butter of antimony be mixed with water, the liquor immediately becomes turbid and milky, and a precipitate falls, which is nothing but the metallic matter partly separated from its acid, which is too much weakened by the addition of water to keep it dissolved. Yet this precipitate still retains a good deal of acid; for which reason it continues to be a violent emetic, and in some degree corrosive. It hath therefore been very improperly called *mercurius vitæ*.

The proper solvent of regulus of antimony is *aqua regis*; by means whereof a clear and limpid solution of this semi-metal may be obtained.

Regulus of antimony mixed with nitre, and projected into a red-hot crucible, sets the nitre in a flame, and makes it detonate. As it produces this effect by means of its phlogiston, it must needs, at the same time, be calcined, and lose its metallic properties, which accordingly happens: and when the nitre is in a triple proportion to the regulus, the latter is so perfectly calcined as to leave only a white powder, which is fused with great difficulty, and then turns to a faintly coloured glass, not very different from common glass, and which is not reducible to a regulus by the addition of inflammable matter; at least it yields but a very small quantity thereof. If less nitre be used, the calx is not so white; the glass it produces is more like a metalline glass, and is more easily reduced. The calx of the regulus thus prepared by nitre is called, on account of the medicinal virtue ascribed to it, *diaphoretic antimony*, or *diaphoretic mineral*.

Nitre always becomes an alkali by deflagration, and in the present case retains part of the calx, which it even renders soluble in water. This calx may be separated from the alkali, if an acid be employed to precipitate it; and then it is called *materia perlata*. This pearly matter is a calx of antimony, so completely deprived of its phlogiston as to be altogether incapable of reduction to a regulus.

Regulus of antimony readily joins and unites with sulphur, forming therewith a compound which has a very faint metallic splendor. This compound appears like a mass of long needles adhering together laterally; and under this form it is usually found in the ore, or at least when only separated by fusion from the stones and earthy matters with which the ore is mixed. It is called *crude antimony*.

Antimony flows with a moderate heat, and becomes even more fluid than other metallic substances. The action of fire dissipates or consumes the sulphur it contains, and its phlogiston also, so as to convert it into a calx and a glass, as it does the regulus.

Aqua regis, which we observed to be the proper solvent of the regulus, being poured on antimony, attacks and dissolves the reguline part, but touches not the sulphur; in consequence whereof it decomposes the antimony, and separates its sulphur from its regulus.

There are several other ways of effecting this decomposition, and obtaining the reguline part of antimony by itself: They consist either in destroying the sulphureous part of the antimony by combustion, or in melting the antimony with some substance which has a greater affinity than its reguline part with sulphur. Most metals are very fit for this latter purpose: For though the regulus has a considerable affinity with sulphur, yet all the metals, except gold and mercury, have a greater.

If therefore iron, copper, lead, silver, or tin, be melted with antimony, the metal employed will unite with the sulphur, and separate it from the regulus.

It must be observed, that, as these metals have some affinity with the regulus of antimony, the regulus will be joined in the operation by some of the metal employed as a precipitant, (so those substances are called which serve as the means of separating two bodies from each other;) and therefore the regulus procured in this manner will not be absolutely pure: On this account care is taken to distinguish each by adding the name of the metal employed in its precipitation; and thence come these titles, *martial regulus of antimony*, or only *martial regulus*, *regulus veneris*; and so of the rest.

Antimony is employed with advantage to separate gold from all other metals with which it may be alloyed. It has been shewn, that all the metals have a greater affinity, than the reguline part of antimony, with sulphur, gold only excepted; which is incapable of contracting any union therewith: And therefore, if a mass compounded of gold and several other metals be melted with anti-

antimony, every thing in that mafs which is not gold will unite with the fulphur of the antimony. This union occafions two feparations, to wit, that of the fulphur of the antimony from its reguline part, and that of the gold from the metals with which it was adulterated; and from the whole two new compounds arife; namely, a combination of the metals with the fulphur, which being lighteft rifes to the furface in fufion; and a metalline mafs formed of the gold and the reguline part of the antimony united together, which being much the heavieft finks to the bottom. There is no difficulty in parting the gold from the regulus of antimony with which it is alloyed: For the metalline mafs need only be expofed to a degree of fire capable of diffipating into vapours all the femi-metal it contains; which being very volatile, the operation is much eafier, and more expeditioufly finifhed, than if the metals with which the gold was debafed were to be vitrified on the cupel; without taking into the account that if filver were one of them, recourfe muft needs be had to the procefs of quartation after that of the cupel.

If equal parts of nitre and antimony be mixed together, and the mixture expofed to the action of fire, a violent detonation enfues; the nitre deflagrating confumes the fulphur of the antimony, and even a part of its phlogifton. After the detonation there remains a greyifh matter which contains fixed nitre, vitriolated tartar, and the reguline part of the antimony in fome meafure deprived of its phlogifton, and half vitrified by the action of the fire, which is confiderably increafed by the deflagration. This matter is called *liver of antimony*.

If inftead of equal parts of nitre and antimony, two parts of the former be ufed to one of the latter, then the reguline part lofes much more of its phlogifton, and remains in the form of a yellowifh powder.

Again, if three parts of nitre be taken to one of antimony, the regulus is thereby entirely robbed of its phlogifton, and converted to a white calx which bears the name of *diaphoretic antimony*, or *diaphoretic mineral*. The pearly matter may be precipitated by pouring an acid on the faline fubftances which here remain after the detonation, in the fame manner as we fhewed above was to be done with regard to the regulus.

In the laft two operations, where the nitre is in a double or triple proportion to the antimony, the reguline part is found after the detonation to be converted into a calx, and not into a half vitrified matter, which we have feen is the effect when equal parts only of nitre and antimony are ufed. The reafon of this difference is, that in thefe two cafes the reguline part, being wholly, or almoft wholly, deprived of its phlogifton, becomes, as was obferved, more difficult to fufe, and confequently cannot begin to vitrify in the fame degree of heat as that which hath not loft fo much of its phlogifton. If, inftead of performing the operation with equal parts of nitre and antimony alone, a portion of fome fubftance which abounds with phlogifton be added, in that cafe the fulphur only of the antimony will be confumed, and the regulus will remain united with its phlogifton, and feparated from its fulphur.

The regulus prepared in this manner is abfolutely pure, becaufe no metalline fubftance being employed, none can mix with it and adulterate it. It is called *regulus of antimony per fe*, or only *regulus of antimony*.

It is true indeed, that in this operation, much of the reguline part unavoidably lofes its phlogifton and is calcined, and confequently a much fmaller quantity of regulus is obtained than when metalline precipitants are employed: But this lofs is eafily repaired, if it be thought proper, by reftoring to the calcined part its loft phlogifton.

Antimony melted with two parts of fixed alkali yields no regulus, but is entirely diffolved by the falt, and forms with it a mafs of a reddifh yellow colour.

The reafon why no precipitate is produced on this occafion is, that the alkali uniting with the fulphur of the antimony forms therewith the combination called *liver of fulphur*, which by its nature is qualified to keep the reguline part diffolved. This mafs, formed by the union of the antimony with the alkali, is foluble in water. If any acid whatever be dropt into this folution, there falls a precipitate of a reddifh yellow colour; becaufe the acid unites with the alkali, and forces it to quit the matters with which it is combined. This precipitate is called *golden fulphur of antimony*.

As in the operation for preparing regulus of antimony *per fe*, fome of the nitre is, by the inflammable matters added thereto, turned to an alkali; this alkali feizes on part of the antimony, and therewith forms a compound like that juft defcribed. Hence it comes, that if the fcoria formed in this procefs be diffolved in water, and an acid dropped into the folution, a true golden fulphur of antimony is thereby feparated.

This union of antimony with an alkali may alfo be brought about by the humid way; that is, by making ufe of an alkali refolved into a liquor, and boiling the mineral in it. The alkaline liquor, in proportion as it acts upon the antimony, gradually becomes reddifh and turbid. If left to fettle and cool, when well faturated therewith, it gradually depofites the antimony it had taken up, which precipitates in the form of a red powder: And this precipitate is the celebrated remedy known by the name of *kermes mineral*. It is plain, that the kermes is nearly the fame thing with the golden fulphur: Yet it differs from it in fome refpects; and efpecially in this, that being taken inwardly it operates much more gently than the golden fulphur, which is a violent emetic. Nitre, fixed by charcoal, and refolved into a liquor, is the only alkali employed in preparing the kermes.

It was fhewn above, that regulus of antimony, mixed and diftilled with corrofive fublimate, decompounds it, difengages the mercury, and joining itfelf to the marine acid forms therewith a new combination, called *butter of antimony*. If the fame operation be performed with crude antimony inftead of its regulus, the fame effects are produced; but then the antimony itfelf is alfo decompofed; that is, the reguline part is feparated from the fulphur, which being fet free unites with the mercury, now alfo at liberty, and thefe two together form a true cinabar, called *cinabar of antimony*.

Of Bismuth.

Bismuth, known alfo by the name *tin-glafs*, is a femi-metal, having almoft the fame appearance as regulus of antimony; yet it has a more dufky caft, inclining fomewhat to red, and even prefents fome changeable ftreaks, efpecially after lying long in the air.

When expofed to the fire it melts long before it is red, and confequently with lefs heat than regulus of antimony, which does not flow, as was fhewn above, till it begin to be red hot. It becomes volatile, like all the other femi-metals, when acted on by a violent fire: Being kept in fufion by a proper degree of heat it lofes its phlogifton with its metallic form, and turns to powder or a calx; and that again is converted into glafs by the continued action of fire. The calx and glafs of bifmuth may be reduced, like any other metallic calx, by reftoring their phlogifton.

Bifmuth mixes with all the metals in fufion, and even facilitates the fufion of fuch as do not otherwife flow readily. It whitens them by its union, and deftroys their malleability.

It amalgamates with mercury, if they be rubbed together with the addition of water: Yet after fome time thefe two metalline fubftances defert each other, and the bifmuth appears again in the form of a powder. Hence it is plain that the union it contracts with mercury is not perfect; and yet it has the fingular property of attenuating lead, and altering it in fuch a manner that it afterwards amalgamates with mercury much more perfectly, fo as even to pafs with it through fhamoy leather without any feparation. The bifmuth employed in making this amalgama afterwards feparates from it fpontaneoufly, as ufual; but the lead ftill continues united with the mercury, and always retains the property thus acquired.

The vitriolic acid does not diffolve bifmuth: Its proper folvent is the nitrous acid, which diffolves it with violence, and abundance of fumes.

Bifmuth diffolved in the nitrous acid is precipitated not only by alkalis, but even by the bare addition of water. This precipitate is extremely white, and known by the name of *magiftery of bifmuth*.

The acid of fea-falt and *aqua regis* likewife act upon bifmuth, but with lefs violence.

This femi-metal does not fenfibly deflagrate with nitre: yet it is quickly deprived of its phlogifton, and turned into a vitrifiable calx, when expofed with it to the action of fire.

It readily unites with fulphur in fufion, and forms therewith a compound which appears to confift of needles adhering laterally to each other.

It may be feparated from the fulphur with which it is combined, by only expofing it to the fire, without any additament; for the fulphur is either confumed or fublimed, and leaves the bifmuth behind.

Of Zinc.

Zinc to appearance differs but little from bifmuth, and has even been confounded with it by feveral authors. Neverthelefs, befides that it has fomething of a bluifh caft, and is harder than bifmuth, it differs from it effentially in its properties, as will prefently be fhewn. Thefe two metallic fubftances fcarce refemble each other in any thing, but the qualities common to all femi-metals.

Zinc melts the moment it grows red in the fire, and then alfo begins to turn to a calx, which, like any other metallic calx, may be reduced by means of the phlogifton: But if the fire be confiderably increafed, it fublimes, flames, and burns like an oily matter; which is a proof of the great quantity of phlogifton in its compofition. At the fame time abundance of flowers rife from it in the form of white flakes, flying about in the air like very light bodies; and into this form may the whole fubftance of the zinc be converted. Several names have been given to thefe flowers, fuch as *pompholix*, *philofophic wool*. They are fuppofed to be no other than the zinc itfelf deprived of its phlogifton; yet no body has hitherto been able to refufcitate them in the form of zinc, by reftoring their phlogifton according to the methods ufed in the reduction of metals. Though they rife in the air with very great eafe while the zinc is calcining, yet when once formed they are very fixed; for they withftand the utmoft violence of fire, and are capable of being vitrified, efpecially if joined with a fixed alkali. They are foluble in acids.

Zinc unites with all metalline fubftances, except bifmuth. It has this fingular property, that being mixed with copper, even in a confiderable quantity, fuch as a fourth part, it does not greatly leffen the ductility thereof, and at the fame time communicates to it a very beautiful colour not unlike that of gold: On which account the compofition is frequently made, and produces what is called *brafs*. This metal melts much more eafily than copper alone, becaufe of the zinc with which it is alloyed. If it be expofed to a great degree of heat, the zinc which it contains takes fire, and fublimes in white flowers, juft as when it is pure

It is to be obferved, that brafs is ductile only while it is cold, and not then unlefs the zinc ufed in making it was very pure; otherwife the compofition will prove but *tombac*, or *prince's metal*, having very little malleability.

Zinc is very volatile, and carries off with it any metallic fubftance with which it is fufed, making a kind of fublimate thereof. In the furnaces where they fmelt ores containing zinc, the matter thus fublimed is called *cadmia fornacum*, to diftinguifh it from the native cadmia called alfo *calamine*, or *lapis calaminaris*; which, properly fpeaking, is an ore of zinc, containing a great deal of that femi-metal, together with fome iron, and a ftony fubftance. The name of *cadmia fornacum* is not appropriated folely to the metallic fublimates procured by means of zinc, but is given in general to all the metallic fublimates found in fmelting-houfes.

If a violent and fudden heat be applied to zinc, it fublimes in its metalline form; there not being time for it to burn and be refolved into flowers.

This femi-metal is foluble in all the acids, but efpecially in fpirit of nitre, which attacks and diffolves it with very great violence.

Zinc has a greater affinity than iron or copper with the vitriolic acid; and therefore it decompounds the green and blue vitriols, precipitating thofe two metals

by uniting with the vitriolic acid, with which it forms a metallic ſalt or vitriol called *white vitriol*, or *vitriol of zinc*.

Nitre mixed with zinc, and projected into a red hot crucible, detonates with violence; and during the detonation there ariſes a great quantity of white flowers, like thoſe which appear when it is calcined by itſelf.

Sulphur has no power over zinc. Even liver of ſulphur, which diſſolves all other metallic ſubſtances, contracts no union with this ſemi-metal.

Of Regulus *of* Arsenic.

Regulus of arſenic is the moſt volatile of all the ſemi-metals. A very moderate heat makes it wholly evaporate, and fly off in fumes; on which account it cannot be brought to fuſion, nor can any conſiderable maſſes thereof be obtained. It has a metallic colour, ſomewhat reſembling lead; but ſoon loſes its ſplendor when expoſed to the air.

It unites readily enough with metallic ſubſtances, having the ſame affinities with them as regulus of antimony hath. It makes them brittle, and unmalleable. It hath alſo the property of rendering them volatile, and greatly facilitates their ſcorification.

It very eaſily parts with its phologiſton and metallic form. When expoſed to the fire it riſes in a kind of ſhining cryſtalline calx, which on that account looks more like a ſaline matter than a metallic calx. To this calx or theſe flowers are given the names of *white arſenic*, *cryſtalline arſenic*, and moſt commonly plain *arſenic*.

Arſenic differs from every other metalline calx, firſt, in being volatile; whereas the calxes of all other metallic ſubſtances, not excepting thoſe of the moſt volatile ſemi-metals, ſuch as regulus of antimony and zinc, are exceedingly fixed; and ſecondly, in having a ſaline character, which is not found in any other metalline calx.

The ſaline character of arſenic appears, firſt, from its being ſoluble in water; ſecondly, from its corroſive quality, which makes it none of the moſt violent poiſons: a quality from which the other metallic ſubſtances are free, when they are not combined with ſome ſaline matter. Regulus of antimony muſt however be excepted: but then the beſt chemiſts agree, that this ſemi-metal is either nearly of the ſame nature with arſenic, or contains a portion thereof in its compoſition: beſides its noxious qualities never diſcover themſelves ſo plainly as when it is combined with ſome acid. Laſtly, arſenic acts juſt like the vitriolic acid upon nitre; that is, it decompounds that neutral ſalt, by expelling its acid from its alkaline baſis, of which it takes poſſeſſion, and therewith forms a new ſaline compound.

This combination is a ſpecies of ſalt that is perfectly neutral. When the operation is performed in a cloſe veſſel, the ſalt ſhoots into cryſtals in the form of right-angled quadrangular priſms, terminated at each etremity by pyramids that are alſo quadrangular and right-angled; ſome of which, however, inſtead of ending in a point, are obtuſe as if truncated. The conſequence is different when the operation is performed in an open veſſel; for then nothing is obtained but an alkaline ſalt impregnated with arſenic, which cannot be cryſtallized.

The cauſe of this different effect is this: When the arſenic is once engaged in the alkaline baſis of the nitre, it can never be ſeparated from it by the utmoſt force of fire, ſo long as it is kept in a cloſe veſſel; whereas, if you expoſe it to the fire without that precaution, it readily ſeparates from it.

This ſalt poſſeſſes many ſingular properties, the chief of which are theſe: Firſt, it cannot be decompounded by the intervention of any acid, even the ſtrongeſt acid of vitriol; and this, joined to its property of expelling the nitrous acid from its baſis, ſhews that it has a very great affinity with fixed alkalis.

Secondly, this very ſalt, on which pure acids have no effect, is decompounded with the greateſt eaſe by acids united with metallic ſubſtances. The reaſon of this phenomenon is curious, and furniſhes us with an inſtance of what we advanced concerning double affinities.

If to a ſolution of any metallic ſubſtance whatever, made by any acid whatever, (except that of mercury by the marine acid, and that of gold by *aqua regis*,) a certain quantity of this ſalt diſſolved in water be added, the metallic ſubſtance is inſtantaneouſly ſeparated from the acid in which it was diſſolved, and falls to the bottom of the liquor.

All metallic precipitates obtained in this manner are found to be a combination of the metal with arſenic; whence it neceſſarily follows that the neutral ſalt is by this means decompounded, its arſenical part uniting with the metallic ſubſtance, and its alkaline baſis with the acid in which that ſubſtance was diſſolved.

The affinities of theſe ſeveral bodies muſt be conſidered as operating on this occaſion in the following manner: The acids which tend to decompound the neutral ſalt of arſenic, by virtue of their affinity with its alkaline baſis, are not able to accompliſh it, becauſe this affinity is powerfully counteracted by that which the arſenic has with the ſame alkaline baſis, and which is equal or even ſuperior to theirs. But if theſe acids happen to be united with a ſubſtance which naturally has a very great affinity with the arſenical part of the neutral ſalt, then, the two parts of which this ſalt conſiſts, being drawn different ways by two ſeveral affinities, tending to ſeparate them from each other, the ſalt will undergo a decompoſition, which could not have been effected without the help of this ſecond affinity. Now, as metallic ſubſtances have a great affinity with arſenic, it is not ſurpriſing that the neutral ſalt of arſenic, which cannot be decompounded by a pure acid, ſhould nevertheleſs yield to an acid combined with a metal. The decompoſition of this ſalt, therefore, and the precipitation which of courſe it produces in metallic ſolutions, are brought about by the means of a double affinity; namely, that of the acid with the alkaline baſis of the neutral ſalt, and that of the metal with the arſenical part of that ſalt.

Arſenic has not the ſame effect on ſea-ſalt as on nitre, and cannot expel its acid: a very ſingular phenomenon, for which it is hard to aſſign a reaſon; for the nitrous acid

acid is known to have a greater affinity than the marine acid with alkalis, and even with the basis of sea-salt itself.

Yet arsenic may be combined with the basis of sea-salt, and a neutral salt thereby obtained, like that which results from the decomposition of nitre by arsenic: but for that purpose a quadrangular nitre must be first prepared, and arsenic applied thereto as to common nitre.

The salt produced by uniting arsenic with the basis of sea-salt very much resembles the neutral salt of arsenic above treated of, as well in the figure of its crystals as in its several properties.

Arsenic presents another singular phenomenon, both with the alkali of nitre and with that of sea-salt; which is, that if it be combined with these salts in a fluid state, it forms with them a saline compound, quite different from the neutral salts of arsenic which results from the decomposition of nitrous salts.

This saline compound, called *liver of arsenic*, takes up a much greater quantity of arsenic than is necessary for the perfect saturation of the alkali. It has the appearance of a glue, which is so much the thicker the more arsenic it contains. Its smell is disagreeable; it attracts the moisture of the air, and does not crystallize; it is easily decompounded by any acid whatever, which precipitates the arsenic and unites with the alkali. Lastly, the effects it produces on metallic solutions are different from those of our neutral arsenical salts.

Arsenic is easily reduced to a regulus. It need only be mixed with any matter containing the phlogiston, and by the help of a moderate heat a true regulus will sublime. This regulus is very volatile, and calcines with the greatest ease; which is the reason why it cannot be obtained but in small quantities; and also why, in order to obtain masses of it, some have thought of adding thereto some metal with which it has a great affinity, such as copper or iron; because, by joining with the metal, it is partly fixed and restrained from flying off. But it is plain the regulus obtained by this means is not pure, as it must partake considerably of the metal employed.

Arsenic readily unites with sulphur, and rises with it in a yellow compound called *orpiment*.

Sulphur cannot be separated from arsenic but by the intervention of two bodies only; to wit, a fixed alkali and mercury.

The property which mercury possesses of separating sulphur from arsenic is founded on this, that these two metallic substances are incapable of contracting any union; whereas, though most of the other metals and semimetals have a greater affinity with sulphur than mercury hath, nevertheless they are all unable to decompound orpiment; because some of them have as great an affinity with arsenic as with sulphur; others have no affinity with either; and lastly, sulphur hath as great an affinity with arsenic as with any of them.

It must be observed, that, if fixed alkalis be employed to purify arsenic in this manner, no more must be used than is necessary to absorb the sulphur or the phlogiston, of which also it is their nature to deprive arsenic; for otherwise, as it has been shewn that arsenic readily unites with alkalis, they would absorb a considerable quantity thereof.

Of OIL *in general.*

OIL is an unctuous body, which burns and consumes with flame and smoke, and is not soluble in water. It consists of the phlogiston united with water by means of an acid. There is, moreover, in its composition a certain proportion of earth, more or less according to each several sort of oil.

The inflammability of oil evidently proves that it contains the phlogiston. That an acid is one of its constituent principles many experiments demonstrate, of which these are the chief: If certain oils be long triturated with an alkaline salt, and the alkali afterwards dissolved in water, crystals of a true neutral salt will be produced: some metals, and particularly copper, are corroded and rusted by oils, just as they are by acids: again, acid crystals are found in some oils that have been long kept. This acid in oil serves undoubtedly to unite its phlogiston with its water; because these two substances having no affinity with each other cannot be united without the intervention of such a medium as an acid, which has an affinity with both. As to the existence of water in oils, it appears plainly when they are decomposed by repeated distillations, especially after mixing them with absorbent earths. Lastly, when an oil is destroyed by burning, a certain quantity of earth is constantly left behind.

Oils exposed to the fire in close vessels pass over almost wholly from the containing vessel into any other applied to receive them. There remains, however, a small quantity of black matter, which is extremely fixed, and continues unalterable as long as it has no communication with the external air, be the force of the fire ever so violent. This matter is no other than part of the phlostiston of the oil united with its most fixed and grossest earth; and this is what we called *charcoal*, or plainly a *coal*.

Of CHARCOAL.

WHEN oil happens to be united to much earth, as it is in vegetable and animal bodies, it leaves a considerable quantity of *coal* or charred matter.

This coal, exposed to the fire in the open air, burns and wastes, but without blazing like other combustible matters: there appears only a small bluish flame, but not the least smoke. Most commonly it only glows and sparkles, and so gradually falls into ashes, which are nothing but the earth of the body combined with an alkaline salt in burning. This alkaline salt may be separated from the earth, by lixiviating the ashes with water, which dissolves all the salt, and leaves the earth quite pure.

Charcoal is unalterable and indestructible by any other body but fire; whence it follows, that when it is not actually kindled and ignited, the most powerful agents, such as the acids, though ever so strong and concentrated, have not the least effect on it.

The case is otherwise when it is lighted, that is, when its phlogiston begins to separate from its earth; for then the pure acid of vitriol being joined therewith contracts

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an inftantaneous union with its phlogifton, and evaporates in a volatile fulphureous fpirit. If the vitriolic acid, inftead of being applied quite pure, be firft clogged with fome bafis, efpecially an alkaline one, it quits that bafis, enters into a more intimate union with the phlogifton of the burning coal, and fo forms an actual fulphur, with which the alkali now unites and forms a hepar.

The pure acid fea-falt hath not been obferved to act in the leaft upon charcoal, efpecially when it is not on fire. But when this acid is incorporated with an alkaline or metallic bafis, and combined according to a peculiar procefs with burning charcoal, it in like manner quits its bafis, unites with the phlogifton, and therewith forms a phofphorus.

Nor has the pure nitrous acid any effect on a charred coal, even when ignited: and fo far is it from being able to kindle a cold one, that when poured on a live one, it extinguifhes it like water. But when this acid is united with a bafis, it quits it rapidly as foon as it touches a burning coal, and rufhes violently into an union with the phlogifton thereof. From this union there probably arifes, as we faid before, a kind of fulphur or phofphorus, which is fo inflammable as to be deftroyed by the fire the very moment it is generated.

The acids of nitre and vitriol act upon oils; but very differently, according to the quantity of phlegm they contain. If they be awakened with much water, they have no effect at all upon oils: if they contain little water, or be dephlegmated to a certain degree, they diffolve them with heat, and with them form compounds of a thick confiftence. Acids thus combined in a confiderable proportion with oils render them foluble in water.

Of Soap.

Alkalis alfo have the fame property. When an oil is combined with an acid, or an alkali, in fuch a manner that the compound refulting from their union is foluble in water; fuch a compound may in general be called *foap*. Soap itfelf hath the property of rendering fat bodies in fome meafure foluble in water; on which account it is very ufeful for fcouring or cleanfing any thing greafy.

Oily and faline fubftances, combined together, obferve the fame general rules as all other combinations; that is, they mutually communicate the properties belonging to each: thus oils, which naturally are not foluble in water, acquire by their union with faline matters the property of diffolving therein; and falts lofe by their conjunction with oils part of their natural tendency to incorporate with water; fo that while they ferve to conftitute foap, they do not, as before, attract the moifture of the air, *&c.* and in like manner, as they are not inflammable, they confiderably leffen the inflammability of the oils combined with them.

Acid foaps are decompounded by alkalis, as alkaline foaps are by acids, according to the general rules of affinities.

The acids of nitre and vitriol, when highly concentrated, diffolve oils with fuch violence as to heat them, make them black, burn them, and even fet them on fire. How fea-fealt affects oils is not yet fufficiently afcertained.

All oils have the property of diffolving fulphur; which is not at all furprifing, feeing each of its component principles hath an affinity with oil.

It is alfo a property common to all oils to become more fluid, fubtile, light, and limpid, the oftener they are diftilled. On the contrary, by being incorporated with faline fubftances they acquire a greater confiftence, and fometimes form compounds that are almoft folid.

Of the feveral forts of Oils.

Oils are diftinguifhed by the fubftances from which they are drawn: and as oils are extracted from minerals, from vegetables, and from animals, there are of courfe mineral, vegetable, and animal oils.

Of Mineral Oils.

In the bowels of the earth we find but one fort of oil, called *petroleum*: Its fmell is ftrong, and not difagreeable, and its colour fometimes more, fometimes lefs yellow. There are certain mineral fubftances which yield by diftillation a great deal of oil very like petroleum. This fort of fubftance is called a *bitumen*, and is, indeed, nothing but an oil rendered confiftent and folid by being combined with an acid; as appears from hence, that, by uniting petroleum with the acid of vitriol, we can produce an artificial bitumen very like the native.

Of Vegetable Oils.

Vegetable fubftances yield a very great quantity and variety of oils; for there is not a plant, or part of a plant, that does not contain one or more forts thereof, generally peculiar to itfelf, and different from all others.

By expreffion only, that is, by bruifing and fqueezing vegetable fubftances, particularly certain fruits and feeds, a fort of oil is obtained which has fcarce any fmell or tafte. Oils of this fort are very mild and unctuous; and, becaufe in this refpect they refemble animal fat more than the reft do; they are called *fat oils*.

Thefe oils, being expofed to the air for fome time, fooner or later grow thick, acquire an acrid tafte, and a ftrong difagreeable fmell. Some of them congeal with the fmalleft degree of cold. This fort of oil is well adapted to diffolve thofe preparations of lead called litharge and minium, with which they form a thick tenacious fubftance, that is ufed for the bafis of almoft all plaifters. They alfo diffolve lead in its metalline form, but not fo eafily as the forts of calx above-mentioned; probably becaufe its body is not fo much opened, nor its parts fo divided.

By expreffion alone we alfo procure from certain vegetable fubftances another fort of oil, which is thin, limpid, volatile, of a pungent tafte, and retains the fmell of the vegetable that yielded it; on which account it is called an *effential oil*. Of this there are feveral forts, differing from one another, like the fat oils, according to the fubjects from which they are obtained.

We muft obferve, that it is very difficult, or rather in moft cafes impoffible, to force from the greateft part of vegetables, by expreffion only, all the effential oil they contain.

contain. For this purpofe, therefore, recourfe muft be had to fire: a gentle heat, not exceeding that of boiling water, will extract all the effential oils of a vegetable; and this is the moft ufual and moft convenient way of procuring them.

The fat oils cannot be obtained by the fame method: thefe being much lefs volatile than the effential oils, require a much greater degree of heat to raife them; which, neverthelefs, they cannot bear without being much fpoiled and entirely changed in their nature, as fhall prefently be fhewn. All oils, therefore, which rife with the heat of boiling water, and fuch alone, fhould be called effential oils.

Effential oils, in a longer or fhorter time, according to the nature of each, lofe the fragrant fmell they had when newly diftilled, and acquire another which is ftrong, rancid, and much lefs agreeable: They alfo lofe their tenuity, becoming thick and vifcid; and in this ftate they greatly refemble thofe fubftances abounding in oil which flow from certain trees, and which are called *balfams* or *refins*, according as they are lefs or more confiftent.

Balfams and refins are not foluble in water. But there are other oily compounds which likewife run from trees; and, though not unlike refins, are however foluble in water. Thefe are called *gums*; and their property of diffolving in water arifes from their containing more water and more falt than refins have; or at leaft their faline parts are lefs clogged and more difengaged.

Balfams and refins diftilled with the heat of boiling water yield great quantities of a limpid, fubtile, odoriferous, and, in one word, effential oil. In the ftill there remains a fubftance thicker and more confiftent than the balfam or refin was before diftillation. The fame thing happens to effential oils which by length of time have acquired a confiftence, and are grown refinous. If they be rediftilled, they recover their former tenuity, leaving behind them a remainder thicker and more refinous than they themfelves were. This fecond diftillation is called the *rectification* of an oil.

It muft be obferved, that an effential oil, combined with an acid ftrong enough to diffolve it, immediately becomes as thick and refinous, in confequence of this union, as if it had been long expofed to the air; which proves the confiftence an oil acquires by long keeping to be owing to this, that its lighteft and lefs acid parts being evaporated, the proportion of its acid to the remainder is fo increafed, that it produces therein the fame change as an additional acid mixed with the oil would have wrought before the evaporation.

This alfo fhews us, that balfams and refins are only effential oils combined with a great proportion of acid, and thereby thickened.

If vegetable fubftances, from which no more effential oil can be drawn by the heat of boiling water, be expofed to a ftronger heat, they yield an additional quantity of oil; but it is thicker and heavier than the effential oil. Thefe oils are black, and have a very difagreeable burnt fmell, which hath made them be called *fetid*, or *empyreumatic* oils. They are moreover very acrid.

It muft be obferved, that if a vegetable fubftance be expofed to a degree of heat greater than that of boiling water, before the fat or the effential oil is extracted from it, an empyreumatic oil only will then be obtained; becaufe both the fat and effential oils, when expofed to the force of fire, are thereby burnt, rendered acrid, acquire a fmell of the fire, and, in a word, become truly empyreumatic. There is ground to think, that an empyreumatic oil is nothing elfe but an effential or fat oil burnt and fpoiled by the fire, and that no other oil befides thefe two exifts naturally in vegetables.

Empyreumatic oils, diftilled and rectified feveral times by a gentle heat, acquire by every diftillation a greater degree of tenuity, lightnefs, and limpidity. By this means alfo they lofe fomething of their difagreeable odour; fo that they gradually come nearer and nearer to the nature of effential oils: and if the rectifications be often enough repeated, ten or twelve times for inftance, they become perfectly like thofe oils; except that their fmell will never be fo agreeable, nor like that of the fubftances from which they were obtained.

Fat oils may alfo be brought by the fame means to refemble effential oils: but neither effential nor empyreumatic oils are capable of acquiring the properties of fat oils.

Of Animal Oils.

Distillation procures us confiderable quantities of oil from all the parts of animal bodies, and efpecially from their fat. This oil at firft is not very fluid, and is extremely fetid; but by many rectifications it gradually acquires a great degree of clearnefs and tenuity, and at the fame time lofes much of its difagreeable odour.

Of Fermentation *in general.*

By fermentation is meant an inteftine motion, which, arifing fpontaneoufly among the infenfible parts of a body, produces a new difpofition and a different combination of thofe parts.

To excite a fermentation in a mixt body, it is neceffary, firft, that there be in the compofition of that mixt a certain proportion of watery, faline, oily, and earthy parts; but this proportion is not yet fufficiently afcertained. Secondly, it is requifite that the body to be fermented be placed in a certain degree of temperate heat; for much cold obftructs fermentation, and too much heat decompofes bodies. Laftly, the concurrence of the air is alfo neceffary to fermentation.

All vegetable and animal fubftances are fufceptible of fermentation, becaufe all of them contain in a due proportion the principles above fpecified. However, many of them want the proper quantity of water, and cannot ferment while they remain in fuch a ftate of drinefs. But it is eafy to fupply that defect.

With refpect to minerals properly fo called, they are not fubject to any fermentation, at leaft that our fenfes can perceive.

There are three forts of fermentation, diftinguifhed from one another by their feveral productions. The firft produces wines and fpiritous liquors; for which reafon it is called the *vinous* or *fpirituous fermentation*: The refult of the fecond is an acid liquor; and therefore it is called

called the *acetous fermentation:* and the third generates an alkaline falt; which, however, differs from the alkaline falts hitherto treated of, in this refpect chiefly, that, inftead of being fixed, it is extremely volatile: This laft fort takes the name of the *putrid* or *putrefactive fermentation*. We fhall now confider thefe three forts of fermentation and their effects a little more particularly.

Thefe three forts of fermentation may take place fucceffively in the fame fubject; which proves them to be only three different degrees of fermentation, all proceeding from one and the fame caufe. Thefe degrees of fermentation always follow the order in which we have here placed them.

Of the SPIRITUOUS, *or* VINOUS FERMENTATION.

THE juices of almoft all fruits, all faccharine vegetable matters, all farinaceous feeds and grains of every kind, being diluted with a fufficient quantity of water, are proper fubjects of fpirituous fermentation. If fuch liquors be expofed, in veffels flightly ftopped, to a moderate degree of heat, they begin in fome time to grow turbid; there arifes infenfibly a fmall commotion among their parts, attended with a hiffing noife; this by little and little increafes, till the groffer parts appear, like little feeds or grains, moving to and fro, agitated among themfelves, and thrown up to the furface. At the fame time fome air-bubbles rife, and the liquor acquires a pungent, penetrating fmell, occafioned by the very fubtile vapours which exhale from it.

Thefe vapours have never yet been collected, in order to examine their nature; and they are known only by their noxious effects. They are fo actively pernicious, that if a man comes rafhly into a clofe place, where large quantities of liquors are fermenting, he fuddenly drops down and expires, as if he were knocked on the head.

When thefe feveral phenomena begin to go off, it is proper to ftop the fermentation, if a very fpirituous liquor be required: for if it be fuffered to continue longer, the liquor will become acid, and from thence proceed to its laft ftage, that is, to putrefaction. This is done by ftopping the containing veffels very clofe, and removing them into a cooler place. Then the impurities precipitate, and fettling at the bottom leave the liquor clear and tranfparent: And now the palate difcovers that the fweet faccharine tafte it had before fermentation is changed to an agreeable pungency which is not acid.

Liquors thus fermented are in general called *wines:* For though in common life that word properly fignifies the fermented juice of grapes only, and particular names are given to the fermented juices of other vegetable fubftances, as that obtained from apples, is called *cyder*; that made from malt is called *beer*; yet in chemiftry it is of ufe to have one general term denoting every liquor that has undergone this firft degree of fermentation.

By diftillation we draw from wine an inflammable liquor, of a yellowifh white colour, light, and of a penetrating pleafant fmell. This liquor is the truly fpirituous part of the wine, and the product of fermentation. That which comes off in the firft diftillation is commonly loaded with much phlegm and fome oily parts, from which it may be afterwards freed. In this ftate it goes by the name of *brandy*; but, when freed from thefe heterogeneous matters by repeated diftillations, it becomes ftill clearer, lighter, more fragrant, and much more inflammable, and then is called *fpirit of wine*, and *rectified fpirit of wine*, or *ardent fpirits*, if confiderably purified. The properties which diftinguifh an ardent fpirit from all other fubftances are, its being inflammable; its burning and confuming entirely, without the leaft appearance of fmoke or fuliginofity; its containing no particles reducible to a coal; and its being perfectly mifcible with water. Ardent fpirits are lighter and more volatile than any of the principles of the mixts from which they were produced, and confequently more fo than the phlegm, the acid, and the oil of which they themfelves confift. This arifes from a particular difpofition of thefe principles, which are in a fingular manner attenuated by fermentation, and thereby rendered more fufceptible of expanfion and rarefaction.

Ardent fpirits are fuppofed to be the natural folvents of oils and oily matters. But it is very remarkable, that they diffolve effential oils only, without touching the fat of animals, or the fat oils obtained from vegetables by expreffion; yet when thefe oils have once undergone the action of fire, they become foluble in fpirit of wine, and even acquire a new degree of folubility every time they are diftilled. It is not fo with effential oils, which can never be rendered more foluble in ardent fpirits than they are at firft; and are fo far from acquiring a new degree of folubility every time they are diftilled, that on the contrary they even in fome meafure lofe that property by repeated rectifications.

Spirit of wine doth not diffolve fixed alkalis; or at leaft it takes up but a very fmall quantity thereof; and hence ardent fpirits may be freed from much of their phlegm by means of thefe falts thoroughly dried: For as they ftrongly imbibe moifture, and have even a greater affinity than ardent fpirits with water, if a fixed alkali well exficcated be mixed with fpirit of wine that is not perfectly dephlegmated, the alkali immediately attracts its fuperfluous moifture, and is thereby refolved into a liquor, which on account of its gravity defcends to the bottom of the veffel. The fpirit of wine, which fwims a-top, is by this means as much dephlegmated, and as dry, as if it had been rectified by feveral diftillations. As it takes up fome alkaline particles in this operation, it is thereby qualified to diffolve oily matters with the greater facility. When rectified in this manner, it is called *tartarifed fpirit of wine*.

Yet fpirit of wine, even when rectified to an alcohol, is not capable of diffolving all oily matters. Thofe named gums will by no means enter into any fort of union therewith; but it readily diffolves moft of thofe which are known by the appellation of refins. When it has diffolved a certain proportion of refinous particles, it acquires a greater confiftence, and forms what is called a *fpirit varnifh*, or a *drying varnifh*, becaufe it foon dries. This varnifh is fubject to be damaged by water. Many forts thereof are prepared, different from each other according to the different refins employed, or the propor-

tions

tions in which they are ufed. Moft of thefe varnifhes are tranfparent and colourlefs.

Such bitumens or refins as fpirit of wine will not touch are diffolved in oils by means of fire, and then form another kind of varnifh which water does not hurt. Thefe varnifhes are ufually coloured, and require much longer time to dry than the fpirit-varnifhes: They are called *oil-varnifhes*.

Spirit of wine hath a much greater affinity with water than with oily matters; and therefore if a folution of any oil or refin in fpirit of wine be mixed with water, the liquor immediately grows turbid, and acquires a whitifh milky colour, owing entirely to the oily parts being feparated from the fpirituous menftruum by the acceffion of water, and too finely divided to appear in their natural form. But if the liquor ftands fome time quiet, feveral of thefe particles unite together, and gradually acquire a bulk fufficient to render them very perceptible to the eye.

Acids have an affinity with fpirit of wine, and may be combined with it. By this union they lofe moft of their acidity, and on that account are faid to be *dulcified*.

One part of highly concentrated oil of vitriol being mixed with four parts of well dephlegmated fpirit of wine, there arifes immediately a confiderable ebullition and effervefcence, attended with great heat, and abundance of vapours, which fmell pleafantly, but are hurtful to the lungs. At the fame time is heard a hiffing like that produced by a piece of red-hot iron plunged in water. Indeed it is proper to mix the liquors very gradually; for otherwife the veffels in which the operation is performed will be in great danger of breaking.

If two liquors thus mixed be diftilled with a very gentle heat, there rifes firft a fpirit of wine of a moft penetrating and grateful odour: When about half thereof is come over, what follows has a quicker and more fulphureous fmell, and is alfo more loaded with phlegm. When the liquor begins to boil a little, there comes off a phlegm which fmells very ftrong of fulphur, and grows gradually more acid. On this phlegm floats a fmall quantity of a very light and very limpid oil. In the ftill there remains a thick, blackifh fubftance, fomewhat like a refin or bitumen. From this fubftance may be feparated a good deal of a vitriolic but fulphureous acid. When that is extracted, there remains a black mafs like a charred coal, which, being put into a crucible, and expofed to a violent heat, leaves a fmall portion of earth, very fixed, and even vitrifiable.

By rectifying the ardent fpirit, which came over in diftilling the above-mentioned mixture, a very fingular liquor is obtained, which differs effentially both from oils and from ardent fpirits, though in certain refpects it refembles them both. This liquor is known in chemiftry by the name of *æther*, and its chief properties are as follows.

Æther is lighter, more volatile, and more inflammable, than the moft highly rectified fpirit of wine. It quickly flies off when expofed to the air, and fuddenly catches fire when any flame approaches it. It burns like fpirit of wine without the leaft fmoke, and confumes entirely without leaving the fmalleft appearance of a coal or of afhes. It diffolves oils and oily matters with great eafe and rapidity. Thefe properties it has in common with an ardent fpirit. But it refembles an oil, in that it is not mifcible with water; and this makes it effentially different from fpirit of wine, the nature of which is to be mifcible with all aqueous liquors.

Another very fingular property of æther is its great affinity with gold, exceeding even that of *aqua regis*. It does not indeed diffolve gold when in a mafs, and in its metalline form: But if a fmall quantity of æther be added to a folution of gold in *aqua regis*, and the whole fhaken together, the gold feparates from the *aqua regis*, joins the æther, and remains diffolved therein.

The reafon of all the phenomena above-mentioned, refulting from the mixture of fpirit of wine with oil of vitriol, is founded on the great affinity between this acid and water. For if the vitriolic acid be weak, and as it were over-dofed with watery parts, neither oil nor æther can be obtained by means thereof: But when highly concentrated, it attracts the aqueous parts very powerfully; and therefore being mixed with fpirit of wine, lays hold of moft of the water contained in it, and even robs it of fome portion of that which is effential to its nature, and neceffary to conftitute it fpirit of wine: Whence it comes to pafs, that a certain quantity of the oily particles in its compofition being feparated from the watery particles, and fo brought nearer to each other, they unite and affume their natural form; and thus the oil that fwims at top of the fulphureous phlegm is produced.

The vitriolic acid moreover thickens and even burns fome of this oil; and hence comes the bituminous refiduum left at the bottom of the ftill, which looks like the refult of a vitriolic acid combined with common oil. Laftly, the vitriolic acid becomes fulphureous, as it always doth when united with oily matters, and alfo very aqueous, on account of the quantity of phlegm which it attracts from the fpirit of wine.

Æther may be confidered as a fpirit of wine exceedingly dephlegmated, even to fuch a degree that its nature is thereby changed; fo that the few aqueous particles left in it are not fufficient to diffolve the oily particles and keep them afunder; which therefore being now much nearer to one another than in common fpirit of wine, the liquor hath loft its property of being mifcible with water.

Spirit of nitre, well dephlegmated, and combined with fpirit of wine, prefents likewife fome very fingular appearances.

Firft, in the very inftant of its mixture with fpirit of wine, it produces a greater and more violent effervefcence than the vitriolic acid occafions.

Secondly, this mixture, without the help of diftillation, and only by ftopping the bottle in which the liquors are contained, affords a fort of æther, produced probably by the vapours which afcend from, and fwim atop of the mixture.

Thirdly, fome authors pretend, that by diftilling the mixture under confideration an oil is obtained greatly refembling that which rifes from fpirit of wine combined with vitriolic acid.

Fourthly, the two liquors we are fpeaking of, being intimately

intimately mixed by diſtillation, form a liquor ſlightly acid, uſed in medicine, and known by the name of *ſweet* or *dulcified ſpirit of nitre:* a very proper name, ſeeing the nitrous acid, by uniting with the ſpirit of wine, actually loſes almoſt all its acidity and corroſive quality.

Fifthly, when the diſtillation is finiſhed, there remains in the bottom of the veſſel a thick, blackiſh ſubſtance, nearly reſembling that which is found after diſtilling oil of vitriol and ſpirit of wine.

Spirit of ſalt hath likewiſe been combined with ſpirit of wine; but it does not unite therewith ſo eaſily or ſo intimately as the two acids above mentioned. To mix them thoroughly, the ſpirit of ſalt muſt be highly concentrated, and ſmoking; and moreover the aſſiſtance of the ſtill muſt be called in. Some authors pretend, that from this mixture alſo a ſmall quantity of oil may be obtained; which probably happens when the liquors have the qualities above ſpecified. The marine acid likewiſe, by uniting with ſpirit of wine, loſes moſt of its acidity; on which account it is in like manner called *ſweet* or *dulcified ſpirit of ſalt.* A thick reſiduum is alſo found here after diſtillation.

Of the Acetous Fermentation.

Besides an ardent ſpirit, wine affords a great deal of water, oil, earth, and a ſort of acid which ſhall be conſidered preſently. When the ſpirituous part is ſeparated from theſe other matters, they undergo no further change. But if all the conſtituent parts of wine remain combined together, then, after ſome time, ſhorter or longer as the degree of heat in which the wine ſtands is greater or leſs, the fermentation begins afreſh, or rather arrives at its ſecond ſtage. The liquor once more grows turbid, a new inteſtine motion ariſes, and after ſome days it is found changed into an acid; which, however, is very different from thoſe hitherto treated of. The liquor then takes the name of *vinegar.* The acetous fermentation differs from the ſpirituous, not only in its effect, but alſo in ſeveral of its concomitant circumſtances. Moderate motion is of ſervice to this, whereas it obſtructs the ſpirituous; and it is attended with much more warmth than the ſpirituous. The vapours it produces are not noxious, like thoſe of fermenting wine, Laſtly, Vinegar depoſites no tartar, even when the wine employed in this operation is quite new, and hath not had time to diſcharge its tartar: inſtead of tartar, vinegar depoſites a viſcid matter which is very apt to putrify.

Of Vinegar.

If wine, which has gone through this ſecond ſtage of fermentation, be diſtilled, inſtead of an ardent ſpirit, only an acid liquor is obtained, which is called *diſtilled vinegar.*

This acid has the ſame properties as the mineral acids; that is, it unites with alkaline ſalts, abſorbent earths, and metallic ſubſtances, and therewith forms neutral ſaline combinations.

Its affinity with theſe ſubſtances obſerves the ſame order as that obſerved by the mineral acids with regard to the ſame ſubſtances; but in general it is weaker; that is, any mineral acid is capable of expelling the acid of vinegar out of all matters with which it is united.

Vinegar hath likewiſe a greater affinity than ſulphur with alkalis: whence it follows, that it is capable of decompounding that combination of ſulphur with an alkali called liver of ſulphur, and of precipitating the ſulphur it contains.

The acid of vinegar is always clogged with a certain proportion of oily parts, which greatly weaken it, and deprive it of much of its activity; and for this reaſon it is not near ſo ſtrong as the mineral acids, which are not entangled with any oil. By diſtillation, indeed, it may be freed from this oil, and at the ſame time from the great quantity of water which in a manner ſuffocates it, and by that means may be brought much nearer to the nature of the mineral acids: but this attempt hath not yet been proſecuted with the aſſiduity it deſerves. Beſides diſtillation, there is another way of freeing vinegar from a good deal of its phlegm; and that is, by expoſing it to a hard froſt, which readily congeals the watery part into ice, while the acid retains its fluidity.

Vinegar, ſaturated with a fixed alkali, forms a neutral oily ſalt, of a dark colour, which is ſemi-volatile, melts with a very gentle heat, flames when thrown upon burning coals, and diſſolves in ſpirit of wine, of which, however, it requires ſix parts to complete the ſolution. This ſolution being evaporated to drineſs leaves a matter in the form of leaves lying on each other; on which account it hath obtained the name of *terra foliata.* The ſame foliated matter will be obtained, though the ſalt be not previouſly diſſolved in ſpirit of wine; but not ſo readily. This ſalt is alſo called *regenerated tartar.* Under the head of tartar we ſhall ſee the reaſon of theſe different appellations. Regenerated tartar is alſo in ſome degree capable of cryſtallizing: for th s purpoſe a reſolution thereof in water muſt be ſlowly evaporated to the conſiſtence of a ſyrup, and then ſuffered to ſtand quiet in a cool place; by which means it will ſhoot into cluſters of cryſtals, lying one upon another, not unlike the feathers on a quill.

With vinegar and ſeveral abſorbent earths, ſuch as calcined pearls, coral, ſhells of fiſh, *&c.* are alſo formed neutral ſaline compounds, each of which take the name of the particular earth employed in its compoſition.

Vinegar perfectly diſſolves lead, and converts it to a neutral metallic ſalt, which ſhoots into cryſtals, and has a ſweet ſaccharine taſte. This compound is called *ſugar of lead*, or *ſal Saturni.*

If lead be expoſed to the bare vapour of vinegar, it will be thereby corroded, calcined, and converted into a white matter much uſed in painting, and known by the name of *ceruſe*, or, when it is finer than ordinary, *white-lead.*

Vinegar corrodes copper likewiſe, and converts it into a beautiful green ruſt, which alſo is uſed in painting, and diſtinguiſhed by the name of *verdegris.* However, vinegar is not commonly employed to make verdegris: for this purpoſe they uſe wine, or the rape of wine, from which fire extricates an acid analogous to that of vinegar.

Of Tartar.

This ſubſtance is a ſaline compound, conſiſting of earthy, oily, and eſpecially acid parts. It is found in the form of cruſts, adhering to the inner ſides of veſſels in which wines have ſtood for ſome time, particularly acid wines, ſuch as thoſe of Germany.

Tartar derives its origin from the ſuperabundant quantity of the acid contained in the juice of the grape. This ſuperfluous acid, being more than is requiſite to conſtitute the ardent ſpirit, unites with ſome of the oil and earth contained in the fermented liquor, and forms a kind of ſalt; which for ſome time continues ſuſpended in that liquor, but, when the wine ſtands undiſturbed in a cool place, is depoſited, as hath been ſaid, on the ſides of the caſk.

When it is purified, there appears on the ſurface of the liquor a ſort of white cryſtalline pellicle, which is ſkimmed off as it forms. This matter is called *cream of tartar*. The ſame liquor which produces this cream, and in which the purified tartar is diſſolved, being ſet to cool, yields a great number of white ſemi-tranſparent cryſtals, which are called *cryſtals of tartar*. The cream and the cryſtals of tartar are therefore no other than purified tartar, and differ from each other in their form only.

Though the cryſtals of tartar have every appearance of a neutral ſalt, yet they are far from being ſuch; for they have all the properties of a true acid, which ſcarce differs from that of vinegar, except that it contains leſs water, and more earth and oil; to which it owes its ſolid form, as well as its property of not being ſoluble in water without much difficulty: for a very great quantity of water is requiſite to keep the cryſtals of tartar in ſolution; and it muſt moreover be boiling hot; otherwiſe as ſoon as it cools moſt of the tartar diſſolved in it ſeparates from the liquor, and falls to the bottom in the form of a white powder.

Tartar is decompoſed by calcination in the open fire. All its oily parts are conſumed or diſſipated in ſmoke, together with moſt of its acid. The other part of its acid, uniting intimately with its earth, forms a very ſtrong and very pure fixed alkali, called *ſalt of tartar*.

It will be ſhewn in its proper place, that almoſt every vegetable matter, as well as tartar, leaves a fixed alkali in its aſhes: yet tartar has theſe peculiar properties; firſt, it aſſumes an alkaline character even when burnt or calcined in cloſe veſſels, whereas other ſubſtances acquire it only by being burnt in the open air; ſecondly, the alkali of tartar is ſtronger and more ſaline than almoſt any that is obtained from other matters.

This alkali, when thoroughly calcined, powerfully attracts the moiſture of the air, and melts into an unctuous alkaline liquor, improperly called *oil of tartar per deliquium*. This is the alkali generally uſed in making the *terra foliata*, mentioned under the head of vinegar; for which reaſon this combination is called *terra foliata tartari*.

Cryſtals of tartar combined with alkali of tartar produce a great effervеſcence while they are mixing, as all acids uſually do; and if the combination be brought exactly up to the point of ſaturation, a perfectly neutral ſalt is formed, which ſhoots into cryſtals, and eaſily diſſolves in water; and this hath procured it the name of *ſoluble tartar*. It is alſo called the *vegetable ſalt*, as being obtained from vegetables only; and again *tartariſed tartar*, becauſe it conſiſts of the acid and the alkali of tartar combined together.

Cryſtals of tartar combined with alkalis procured from the aſhes of ſea-weeds, ſuch as ſoda, which alkalis reſemble the baſis of ſea-ſalt, form likewiſe a neutral ſalt, which cryſtallizes well, and diſſolves eaſily in water. This ſalt is another ſort of ſoluble tartar. It is called *Saignette's ſalt*, from the inventor's name.

Tartar likewiſe diſſolves the abſorbent earths, as lime, chalk, *&c.* and with them forms neutral ſalts which are ſoluble in water. It even attacks metallic bodies, and when combined with them becomes ſoluble. A ſoluble tartar for medical uſe is prepared with cryſtals of tartar and iron: the metallic ſalt thereby produced hath the name of *chalybeated ſoluble tartar*. This ſalt attracts the moiſture of the air, and is one of thoſe which do not cryſtallize.

Cryſtallized tartar acts alſo upon ſeveral other metallic ſubſtances: for inſtance, it diſſolves the regulus, liver, and glaſs of antimony, and thence acquires an emetic quality: It is then called *ſtibiated*, or *emetic tartar*. It likewiſe diſſolves lead, and therewith forms a ſalt which, in the figure of its cryſtals, reſembles tartariſed tartar.

It is very extraordinary, that tartar, which of itſelf is not ſoluble in water, ſhould be ſoluble therein when become a neutral ſalt by uniting either with alkalis or with abſorbent earths, or even with metals. All the ſoluble tartars are eaſily decompounded by expoſing them to a certain degree of heat. In diſtillation they yield the ſame principles which are obtained from tartar; and what remains fixed in the fire, after they are thoroughly burnt, is a compound of the alkali which tartar naturally produces, and of the alkaline or metallic ſubſtance with which it was converted into a neutral ſalt

As cryſtal of tartar is the weakeſt of all acids, on account of the oily and earthy matters with which it is combined, ſoluble tartars are decompounded by all the acids; by any of which cryſtal of tartar may be ſeparated from the ſubſtance that ſerves it for a baſis and renders it a neutral ſalt.

Of the Putrid Fermentation, or Putrefaction.

Every body which hath gone through the two ſtages of fermentation above deſcribed, that is, the ſpirituous and the acetous fermentation, being left to itſelf in a due degree of warmth, which varies according to the ſubject, advances to the laſt ſtage of fermentation; that is, to putrefaction.

When a body is in a putrefying ſtate, it is eaſy to diſcover, by the vapours which riſe from it, by the opacity which invades it, if a pellucid liquor, and frequently even by a greater degree of heat than is found in the two other ſorts of fermentation, that an inteſtine motion is begun among its conſtituent parts, which laſts till the whole be entirely putrefied.

The effect of this inteſtine motion is to break the union,

union, and change the difpofition, of the particles conftituting the body in which it is excited, and to produce a new combination.

If we examine a fubftance that has undergone putrefaction, we fhall foon perceive that it contains a principle which did not exift in it before. If this fubftance be diftilled, there rifes firft, by means of a very gentle heat, a faline matter which is exceedingly volatile, and affects the organ of fmelling brifkly and difagreeably. Nor is the aid of diftillation neceffary to difcover the prefence of this product of putrefaction: it readily manifefts itfelf in moft fubftances where it exifts, as any one may foon be convinced by obferving the different fmell of frefh and of putrefied urine; for the latter not only affects the nofe, but even makes the eyes fmart, and irritates them fo as to draw tears from them in abundance.

This faline principle, which is the product of putrefaction, when feparated from the other principles of the body which affords it, and collected by itfelf, appears either in the form of a liquor, or in that of a concrete falt, according to the different methods ufed to obtain it. In the former ftate it is called a *volatile urinous fpirit*; and in the latter a *volatile urinous falt*. The qualification of urinous is given it, becaufe a great deal thereof is generated in putrefied urine, to which it communicates its fmell. It goes alfo by the general name of a *volatile alkali*, whether in a concrete or in a liquid form. The enumeration of its properties will fhew why it is called an alkali.

Volatile alkalis, from whatever fubftance obtained, are all alike, and have all the fame properties; differing only according to their degrees of purity. The volatile alkali, as well as the fixed, confifts of a certain quantity of acid combined with, and entangled by a portion of the earth of the mixt body from which it was obtained; and on that account it has many properties like thofe of a fixed alkali. But there is moreover in its compofition a confiderable quantity of a fat or oily matter, of which there is none in a fixed alkali; and on this account again there is a great difference between them. Thus the volatility of the alkali produced by putrefaction, which is the principal difference between it and the other kind of alkali, whofe nature it is to be fixed, muft be attributed to the portion of oil which it contains: for there is a certain method of volatilizing fixed alkalis by means of a fatty fubftance.

Volatile alkalis have a great affinity with acids, unite therewith rapidly, and with ebullition, and form with them neutral falts, which fhoot into cryftals, but differ from one another according to the kind of acid employed in the combination.

The neutral falts which have a volatile alkali for their bafis are in general called *ammoniacal falts*. That whofe acid is the acid of fea-falt is called *fal ammoniac*. As this was the firft known, it gave name to all the reft. Great quantities of this falt are made in Egypt, and thence brought to us. They fublime it from the foot of cow's-dung, which is the fuel of that country, and contains fea-falt, together with a volatile alkali, or at leaft the materials proper for forming it; and confequently all the ingredients that enter into the compofition of fal ammoniac.

The neutral falts formed by combining the acids of nitre and of vitriol with a volatile alkali, are called, after their acids, *nitrous fal ammoniac*, and *vitriolic fal ammoniac*: The latter, from the name of its inventor, is alfo called Glauber's *fecret fal ammoniac*.

A volatile alkali, then, has the fame property as a fixed alkali with regard to acids; yet they differ in this, that the affinity of the former with acids is weaker than that of the latter: and hence it follows, that any fal ammoniac may be decompounded by a fixed alkali, which will lay hold of the acid, and difcharge the volatile alkali.

A volatile alkali will decompound any neutal falt which has not a fixed alkali for its bafis; that is, all fuch as confift of an acid combined with an abforbent earth or a metallic fubftance. By joining with the acids in which they are diffolved, it difengages the earths or metallic fubftances, takes their place, and, in conjunction with their acids, forms ammoniac falts.

Hence it might be concluded, that, of all fubftances, next to the phlogifton and the fixed alkalis, volatile alkalis have the greateft affinity with acids in general. Yet there is fome difficulty in this matter: for abforbent earths and feveral metallic fubftances are alfo capable of decompounding ammoniacal falts, difcharging their volatile alkali, and forming new compounds by uniting with their acids. This might induce us to think that thefe fubftances have nearly the fame affinity with acids.

But it is proper to obferve, that a volatile alkali decompounds fuch neutral falts as have for their bafis either an abforbent earth or a metallic fubftance, without the aid of fire; whereas abforbent earths or metallic fubftances will not decompound an ammoniacal falt, unlefs they be affifted by a certain degree of heat.

Now, as all thefe matters are extremely fixed, at leaft in comparifon with a volatile alkali, they have the advantage of being able to refift the force of fire, and fo of acting in conjunction therewith; and fire greatly promotes the natural action of fubftances upon one another: whereas the volatile alkali in the ammoniacal falt, being unable to abide the force of fire, is compelled to defert its acid; and that fo much the more quickly, as its affinity therewith is confiderably weakened by the prefence of an earthy or metallic fubftance, both of which have a great affinity with acids.

Thefe confiderations oblige us to conclude, that volatile alkalis have a fomewhat greater affinity, than abforbent earths and metallic fubftances, with acids.

Ammoniacal falts projected upon nitre in fufion make it detonate; and the nitrous fal ammoniac detonates by itfelf, without the addition of any inflammable matter. This fingular effect evidently demonftrates the exiftence of an oily matter in volatile alkalis; for it is certain that nitre will never deflagrate without the concurrence and even the immediate contact of fome combuftible matter.

This oily fubftance is often found combined with volatile alkalis in fuch a large proportion as to difguife it in fome meafure, and render it exceeding foul. The falt may be freed from its fuperfluous oil by repeated fublimations;

tions; and particularly by fubliming it from abforbent earths, which readily drink up oils. This is called the *rectification* of a volatile alkali. The falt, which before was of a yellowifh or dirty colour, by being thus rectified, becomes very white, and acquires an odour more pungent and lefs fetid than it had at firft, that is, when obtained by one fingle diftillation from a putrid fubftance.

It is proper to obferve, that the rectification of a volatile alkali muft not be carried too far, or repeated too often; for by that means it may be entirely decompofed at length; and particularly if an abforbent earth, and efpecially chalk, be employed for that purpofe, the falt may be converted into an oil, an earth, and water.

Volatile alkalis act upon feveral metallic fubftances, and particularly on copper; of which they make a moft beautiful blue folution. On this property depends a pretty fingular effect, which happens fometimes when we attempt by means of a volatile alkali to feparate copper from an acid with which it is combined. Inftead of feeing the liquor grow turbid, and the metal fall, both which generally happen when any alkali whatever is mixed with a metallic folution, we are furprifed to obferve the folution of copper, upon adding a volatile alkali, retain its limpidity, and let fall no precipitate; or at leaft if the liquor does grow turbid, it remains fo but for a moment, and inftantly recovers its tranfparency. This is occafioned by adding fuch a quantity of volatile alkali as is more than fufficient fully to faturate the acid of the folution, and confiderable enough to diffolve all the copper as faft as it is feparated from the acid. On this occafion the liquor requires a deeper blue than it had before; which arifes from the property which volatile alkalis have of giving this metal, when combined with them, a fuller blue than any other folvent can: Hence we have a touchftone to difcover copper where-ever it is; for, let the quantity of this metal, combined with other metals, be ever fo fmall, a volatile alkali never fails to difcover it, by making it appear of a blue colour.

Though a volatile alkali be conftantly the refult of putrefaction, yet it muft not therefore be imagined, that none can be produced by any other means; on the contrary, moft of thofe which contain the ingredients neceffary to form it, yield no inconfiderable quantity thereof in diftillation. Tartar, for example, which by being burnt in an open fire is converted, as was fhewn, into a fixed alkali, yields a volatile alkali when it is decompofed in clofe veffels; that is, when it is diftilled: Becaufe, in this latter cafe, the oily part is not diffipated or burnt, as it is by calcination in a naked fire, but has time to unite with fome of the earth and acid of the mixt, in fuch a manner as to form a true volatile alkali.

To prove that on this occafion, as well as on all others, where unputrefied bodies yield a volatile alkali, this falt is the product of the fire, we need only obferve, that in thefe diftillations it never rifes till after fome part of the phlegm of the acid, and even of the thick oil of the mixt, is come over; which never is the cafe when it is formed before-hand in the body which is the fubject of the operation, as it is in thofe which have undergone putrefaction: For this falt, being much lighter and more volatile than thofe other fubftances, rifes of courfe before them in diftillation.

A General View of Chemical Decompofition.

Though we have confidered all the fubftances which enter into the compofition of vegetables, animals, and minerals, whether as primary or as fecondary principles, it will not be improper to fhew in what order we obtain thefe principles from the feveral mixts; and efpecially from vegetables and animals, becaufe they are much more complicated than minerals. This is called *analyfing* a compound.

The method moft commonly taken to decompofe bodies is by applying to them fucceffive degrees of heat, from the gentleft to the moft violent, in appropriated veffels, fo contrived as to collect what exhales from them. By this means the principles are gradually feparated from each other; the moft volatile rife firft, and the reft follow in order, as they come to be acted on by the proper degree of heat: And this is called *diftillation.*

But it being obferved that fire, applied to the decompofition of bodies, moft commonly alters their fecondary principles very fenfibly, by combining them in a different manner with each other, or even partly decompofing them, and reducing them to their primitive principles; other means have been ufed to feparate thofe principles without the help of fire.

With this view the mixts to be decompofed are forcibly compreffed, in order to fqueeze out of them all fuch parts of their fubftance as they will by this means part with; or elfe thofe mixts are for a long time triturated, either along with water, which carries off all their faline and faponaceous contents; or with folvents, fuch as ardent fpirits, capable of taking up every thing in them that is of an oily or refinous nature.

We fhall here give a fuccinct account of the effects of thefe different methods, as applied to the principal fubftances among vegetables and animals, and likewife to fome minerals.

The Analysis *of* Vegetable Substances.

A vaft many vegetable fubftances, fuch as kernels and feeds, yield by ftrong compreffion great quantities of mild, fat, unctuous oils, which are not foluble in ardent fpirits: Thefe are what we called *expreffed oils*. They are alfo fometimes called *fat oils*, on account of their unctuoufnefs, in which they exceed all other forts of oil. As thefe oils are obtained without the aid of fire, it is certain that they exifted in the mixt juft as we fee them, and that they are not in the leaft altered; which could not have been the cafe had they been obtained by diftillation: For that never produces any oils but fuch as are acrid and foluble in fpirit of wine.

Some vegetable matters, fuch as the rind of citrons, lemons, oranges, &c. alfo yield, only by being fqueezed between the fingers, a great deal of oil. This fpirts out in fine fmall jets, which being received upon any polifhed furface, fuch as a looking-glafs, run together, and form a liquor that is a real oil.

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But it must be carefully noted, that this sort of oil, though obtained by expression only, is nevertheless very different from the oils mentioned before to which the title of *expressed oils* peculiarly belongs: For this is far lighter and thinner; moreover, it retains the perfect odour of the fruit which yields it, and is soluble in spirit of wine; in a word, it is a true essential oil, but abounds so in the fruits which produce it, and is lodged therein in such a manner, occupying a vast number of little cells provided in the peel for its reception, that a very slight pressure discharges it; which is not the case with many vegetables that contain an essential oil.

Succulent and green plants yield by compression a great deal of liquor or juice, which consists of most of the phlegm of the salts, and a small portion of the oil and earth of the plant. These juices, being set in a cool place for some time, deposit saline crystals, which are a combination of the acid of the plant with part of its oil and earth, wherein the acid is always predominant. These salts, as is evident from the description here given, bear a great resemblance to the tartar of wine treated of above. They are called *essential salts*; so that tartar might likewise be called the *essential salt of wine*.

Dried plants, and such as are of a ligneous, or acid nature, require to be long triturated with water, before they will yield their essential salts. Trituration with water is an excellent way to get out of them all their saline and saponaceous contents.

A vegetable matter that is very oily yields its essential salt with much difficulty, if at all; because the excessive quantity of oil entangles the salt so that it cannot extricate itself or shoot into crystals. Mr Gerike, in his *Princples of Chemistry*, says, That if part of the oil of a plant be extracted by spirit of wine, its essential salt may be afterwards obtained with more ease and in greater quantity.

Essential salts are among those substances which cannot be extracted from mixts by distillation; for the first impression of fire decomposes them.

Though the acid which predominates in the essential salts of plants be most commonly analogous to the vegetable acid, properly so called, that is, to the acid of vinegar and tartar, which is probably no other than the vitriolic acid disguised; yet it sometimes differs therefrom, and somewhat resembles the nitrous or the marine acid. This depends on the places where the plants grow which produce these salts: If they be submarine plants, their acid is a-kin to the acid of sea-salt; if, on the contrary, they grow upon walls, or in nitrous grounds, their acid is like that of nitre. Sometimes one and the same plant contains salts analogous to all the three mineral acids; which shews that the vegetable acids are no other than the mineral acids variously changed by circulating through plants.

Liquors containing the essential salts of plants being evaporated by a gentle heat to the consistence of honey, or even further, are called *extracts*. Hence it is plain, that an extract is nothing but the essential salt of a plant, combined with some particles of its oil and earth, that remained suspended in the liquor, and are now incorporated by evaporation.

Extracts of plants are also prepared by boiling them long in water, and then evaporating some part of it. But these extracts are of inferior virtue; because the fire dissipates many of the oily and saline parts.

EMULSIONS.

Substances which abound much in oil, being bruised and triturated with water for some time, afford a liquor of an opaque dead-white colour like milk. This liquor consists of such juices as the water is capable of dissolving, together with a portion of the oil, which being naturally indissoluble in water, is only divided and dispersed in the liquor, the limpidity whereof is by that means destroyed. This sort of oily liquor, in which the oil is only divided, not dissolved, is called an *emulsion*. The oily particles in emulsions spontaneously separate from the water, when left at rest, and, uniting into geater masses, rise, on account of their lightness, to the surface of the liquor, which by that means recovers a degree of transparency.

If vegetables, abounding in essential oils and resins, be digested in spirit of wine, the menstruum takes up these oily matters as being capable of dissolving them; and they may afterwards be easily separated from it by the affusion of water. The water, with which spirit of wine has a greater affinity than with oily matters, separates them by this means from their solvent, agreeable to the common laws of affinities.

Without the help of fire scarce any thing, besides the substances already mentioned, can be obtained from a plant: But by the means of distillation we are enabled to analyse them more completely. In prosecuting this method of extracting from a plant the several principles of which it consists, the following order is to be observed.

A plant being exposed to a very gentle heat, in a distilling vessel set in the *balneum mariæ*, yields a water which retains the perfect smell thereof. Some chemists, and particularly the illustrious Boerhaave, have called this liquor the *spiritus rector*. The nature of this odoriferous part of plants is not yet thoroughly known; because it is so very volatile, that it is difficult to subject it to the experiments necessary for discovering all its properties.

If instead of distilling the plant in the *balneum mariæ*, it be distilled over a naked fire, with the precaution of putting a certain quantity of water into the distilling vessel along with it, to prevent its suffering a greater heat than that of boiling water, all the essential oil contained in that plant will rise together with that water, and with the same degree of heat.

On this occasion it must be observed, that no essential oil can be obtained from a plant after the *spiritus rector* hath been drawn off; which gives ground to think that the volatility of these oils is owing to that spirit.

The heat of boiling water is also sufficient to separate from vegetable matters the fat oils which they contain: That, however, is to be done by the way of decoction only,

only, and not by diſtillation; becauſe, though theſe oils will ſwim on water, yet they will not riſe in vapours without a greater degree of heat,

When the eſſential oil is come over, if the plant be expoſed to a naked fire, without the addition of water, and the heat be increaſed a little, a phlegm will riſe that gradually grows acid; after which, if the heat be increaſed as occaſion requires, there will come over a thicker and heavier oil; from ſome a volatile alkali; and laſt of all, a very thick, black, empyreumatic oil.

When nothing more riſes with the ſtrongeſt degree of heat, there remains of the plant a mere coal only, called the *caput mortuum*, or *terra damnata*. This coal when burnt falls into aſhes, which being lixiviated with water give a fixed alkali.

It is obſervable, that in the diſtillation of plants which yield an acid and a volatile alkali, theſe two ſalts are often found quite diſtinct and ſeparate in the ſame receiver; which ſeems very extraordinary, conſidering that they are naturally diſpoſed to unite, and have a great affinity with one another. The reaſon of this phenomenon is, that they are both combined with much oil, which embarraſſes them ſo that they cannot unite to form a neutral ſalt, as they would not fail to do were it not for that impediment.

All vegetables, except ſuch as yield a great deal of volatile alkali, being burnt in an open fire, and ſo as to flame, leave in their aſhes a large quantity of an acrid, cauſtic, fixed alkali. But if care be taken to ſmother them, ſo as to prevent their flaming while they burn, by covering them with ſomething that may continually beat down again what exhales, the ſalt obtained from their aſhes will be much leſs acrid and cauſtic; the cauſe whereof is, that ſome part of the acid and oil of the plant being detained in the burning, and ſtopped from being diſſipated by the fire, combines with its alkali. Theſe ſalts cryſtallize, and being much milder than the common fixed alkalis, may be uſed in medicine, and taken internally. They are called *Tachenius*'s *ſalts*, becauſe invented by that chemiſt.

Marine plants yield a fixed alkali analogous to that of ſea-ſalt. As for all other plants or vegetable ſubſtances, the fixed alkalis obtained from them, if rightly prepared and thoroughly calcined, are all perfectly alike, and of the ſame nature.

The laſt obſervation we have to make on the production of a fixed alkali is, that if the plant you intend to work upon be ſteeped or boiled in water before you burn it, a much ſmaller quantity of ſalt will be obtained from it; nay, it will yield none at all, if repeated boilings have robbed it entirely of thoſe ſaline particles which muſt neceſſarily concur with its earth to form a fixed alkali.

The Analysis *of* Animal Substances.

Succulent animal ſubſtances, ſuch as new-killed fleſh, yield by expreſſion a juice or liquid, which is no other than the phlegm, replete with all the principles of the animal body, except the earth, of which it contains but little. The hard or dry parts, ſuch as the horns, bones, *&c.* yield a ſimilar juice, by boiling them in water. Theſe juices become thick, like a glue or jelly, when their watery parts are evaporated; and in this ſtate they are true extracts of animal matters These juices afford no cryſtals of eſſential ſalt, like thoſe obtained from vegetables, and ſhew no ſign either of an acid or an alkali.

Great part of the oil which is in the fleſh of animals may be eaſily ſeparated without the help of fire; for it lies in a manner by itſelf: It is commonly in a concrete form, and is called *fat*. This oil ſomewhat reſembles the fat oils of vegetables; for like them it is mild, unctuous, indiſſoluble in ſpirit of wine, and is ſubtilized and attenuated by the action of fire. But there is not in animals, as in vegetables, any light eſſential oil, which riſes with the heat of boiling water; ſo that, properly ſpeaking, animals contain but one ſort of oil.

Few animal ſubſtances yield a perceptible acid. Ants and bees are almoſt the only ones from which any can be obtained; and indeed the quantity which they yield is very ſmall, as the acid itſelf is extremely weak.

The reaſon thereof is, that as animals do not draw their nouriſhment immediately from the earth, but feed wholly either on vegetables or on the fleſh of other animals, the mineral acids, which have already undergone a great change by the union contracted between them and the oily matters of the vegetable kingdom, enter into a cloſer union and combination with theſe oily parts while they are paſſing through the organs and ſtrainers of animals; whereby their properties are deſtroyed, or at leaſt ſo impaired that they are no longer ſenſible.

Animal matters yield in diſtillation, firſt, a phlegm, and then, on increaſing the fire, a pretty clear oil, which gradually becomes thicker, blacker, more fetid, and empyreumatic. It is accompanied with a great deal of volatile alkali; and if the fire be raiſed and kept up till nothing more comes over, there will remain in the diſtilling veſſel a coal like that of vegetables; except that when it is reduced to aſhes, no fixed alkali, or at leaſt very little, can be obtained from them, as from the aſhes of vegetables. This ariſes from hence that, as we ſaid before, the ſaline principle in animals being more intimately united with the oil than it is in plants, and being conſequently more attenuated and ſubtilized, is too volatile to enter into the combination of a fixed alkali; on the contrary, it is more diſpoſed to join in forming a volatile alkali, which on this occaſion does not riſe till after the oil, and therefore muſt certainly be the production of the fire.

The chyle, and the milk of animals which feed on plants, ſtill retain ſome likeneſs to vegetables; becauſe the principles of which theſe liquors are compoſed have not gone through all the changes which they muſt ſuffer before they enter into the animal combination.

Urine and ſweat are excrementitious aqueous liquors, loaded chiefly with the ſaline particles which are of no ſervice towards the nouriſhment of the animal, but paſs through its ſtrainers without receiving any alteration; ſuch as the neutral ſalts which have a fixed alkali for their baſis, and particularly the ſea-ſalt which happens to be in the food of animals, whether it exiſt therein naturally, as it does in ſome plants, or whether the animals eat it to pleaſe their palates.

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The saliva, the pancreatic juice, and especially the bile, are saponaceous liquors; that is, they consist of saline and oily particles combined together; so that being themselves dissolved in an aqueous liquor, they are capable of dissolving likewise the oily parts, and of rendering them miscible with water.

Lastly, The blood being the receptacle of all these liquors, partakes of the nature of each, more or less in proportion to the quantity thereof which it contains.

The Analysis *of* Mineral Substances.

Minerals differ greatly from vegetables, and from animals; they are not near so complex as those organized bodies, and their principles are much more simple; whence it follows, that these principles are much more closely connected, and that they cannot be separated without the help of fire; which not having on their parts the same action and the same power as on organized bodies, hath not the same ill effect on them; we mean the effect of changing their principles, or even destroying them entirely.

We do not here speak of pure, vitrifiable, or refractory earths; of mere metals and semi-metals; of pure acids; or even of their simplest combinations, such as sulphur, vitriol, alum, sea salt: Of all these we have said enough.

We are now to treat of bodies that are more complex, and therefore more susceptible of decomposition. These bodies are compound masses or combinations of those above-mentioned; that is, metallic substances as they are found in the bowels of the earth, united with several sorts of sand, stones, earths, semi-metals, sulphur, *&c.* When the metallic matter is combined with other matters in such a proportion to the rest that it may be separated from them with advantage and profit, these compounds are called *ores*: when the case is otherwise, they are called *pyrites*, and *marcasites*; especially if sulphur or arsenic be predominant therein, which often happens.

In order to analyse an ore, and get out of it the metal it contains, the first step is to free it from a great deal of earth and stones which commonly adhere to it very slightly and superficially. This is effected by pounding the ore, and then washing it in water; to the bottom of which the metalline parts presently sink, as being the heaviest, while the small particles of earth and stone remain suspended some time longer.

Thus the metallic part is left combined with such matters only as are most intimately complicated with it. These substances are most commonly sulphur and arsenic. Now, as they are much more volatile than other mineral matters, they may be dissipated in vapours, or the sulphur may be consumed, by exposing the ore which contains them to a proper degree of heat. If the sulphur and arsenic be desired by themselves, the fumes thereof may be catched and collected in proper vessels and places. This operation is called *roasting* in ore.

The metal thus depurated is now fit to be exposed to a greater force of fire, capable of melting it.

On this occasion the semi-metals and the imperfect metals require the addition of some matter abounding in phlogiston, particularly charcoal-dust; because these metallic substances lose their phlogiston by the action of the fire, or of the fluxes joined with them, and therefore without this precaution would never acquire either the splendor or the ductility of a metal. By this means the metallic substance is more accurately separated from the earthy and stony parts, of which some portion always remains combined therewith till it is brought to fusion. For, as we observed before, a metallic glass or calx only will contract an union with such matters; a metal possessed of its phlogiston and metalline form being utterly incapable thereof.

We took notice of the cause of this separation above, where we shewed that a metal possessed of its phlogiston and metalline form will not remain intimately united with any calcined or vitrified matter, not even with its own calx or glass.

The metal therefore on this occasion gathers into a mass, and lies at the bottom of the vessel, as being most ponderous; while the heterogeneous matters float upon it in the form of a glass, or a semi-vitrification. These floating matters take the name of *scoriæ*, and the metalline substance at bottom is called the *regulus*.

It frequently happens, that the metalline regulus thus precipitated, is itself a compound of several metals mixed together, which are afterwards to be separated.

It is proper to observe, before we quit this subject, that the rules here laid down for analysing ores are not absolutely general: For example, it is often adviseable to roast the ore before you wash it; for by that means some ores are opened, attenuated, and made very friable, which would cost much trouble and expence, on account of their excessive hardness, if you should attempt to pound them without a previous torrefaction.

It is also frequently necessary to separate the ore from part only of its stone; sometimes to leave the whole; and sometimes to add more to it, before you smelt it. This depends on the quality of the stone, which always helps to promote fusion when it is in its own nature fusible and vitrifiable: It is then called the *fluor* of the ore.

We shall now give a succinct account of the principal ores and mineral bodies, contenting ourselves with just pointing out the particulars of which they severally consist.

Of the Pyrites.

The Yellow Pyrites.

The yellow pyrites is a mineral consisting of sulphur, iron, an unmetallic earth, and frequently a little copper: The sulphur, which is the only one of these principles that is volatile, may be separated from the rest by sublimation: It usually makes a fourth, and sometimes a third, of the whole weight of these pyrites. The other principles are separated from one another by fusion and reduction with the phlogiston, which, by metallizing the ferruginous and cupreous earths, parts them from the unmetallic earth: for this earth vitrifies, and cannot afterwards continue united with metallic matters possessed of their metalline form.

There is yet another way of decomposing the yellow pyrites, which is to let it lie till it effloresces, or begins

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to ſhoot into flowers; which is nothing but a ſort of ſlow accenſion of the ſulphur it contains. The ſulphur being by this means decompoſed, its acid unites with the ferruginous and cupreous parts of the pyrites, and therewith forms green and blue vitriols; which may be extracted by ſteeping in water the pyrites which has effloreſced or been burnt, and then evaporating the lixivium to a pellicle; for by this means the vitriol will ſhoot into cryſtals.

Sometimes the pyrites contains alſo an earth of the ſame nature with that of alum: A pyrites of this ſort, after flowering, yields alum as well as vitriol.

The White Pyrites.

The white pyrites contains much arſenic, a ferruginous earth, and an unmetallic earth. The arſenic being a volatile principle, may be ſeparated by ſublimation or diſtillation from the reſt, which are fixed; and theſe again may be disjoined from each other by fuſion and reduction, as was ſaid in relation to the yellow pyrites.

The Copper Pyrites.

The copper pyrites contains ſulphur, copper, and an unmetallic earth. A great deal thereof likewiſe holds arſenic, and its colour approaches more or leſs to orange, yellow, or white, according to the quantity of arſenic in it. It may be decompoſed by the ſame means as the yellow and white pyrites.

Of Ores.

Of Gold Ores.

Gold being conſtantly found in its metalline form, and never combined with ſulphur and arſenic, its ores are not, properly ſpeaking, ores; becauſe the metal contained in them is not mineralized. The gold is only lodged between particles of ſtone, earth, or ſand, from which it is eaſily ſeparated by lotion, and by amalgamation with quick-ſilver. The gold thus found is ſeldom pure, but is frequently alloyed with more or leſs ſilver, from which it is to be ſeparated by quartation.

It is alſo very common to find gold in moſt ores of other metals or ſemi-metals, and even in the pyrites; but the quantity contained therein is generally ſo ſmall, that it would not pay the coſt of extracting it. However, if any ſhould incline to attempt it, merely out of curioſity, it would be neceſſary to begin with treating theſe ores in the manner proper for ſeparating their metalline part; then to cupel the metalline regulus ſo obtained; and laſtly, to refine it by quartation.

Of Silver Ores.

It is no rare thing to find ſilver, as well as gold, in its metalline form, only lodged in ſundry earths and ſtony matters, from which it may be ſeparated in the ſame manner as gold. But the greateſt quantities of this metal are uſually dug out of the bowels of the earth in a truly mineral ſtate; that is, combined with different ſubſtances, and particularly with ſulphur and arſenic.

Several ſilver ores are diſtinguiſhed by peculiar characteriſtics, and are accordingly denoted by particular names. That which is called the *vitreous ſilver ore*, is ſcarce any thing elſe but a combination of ſilver and ſulphur. Another is known by the name of the *horny ſilver ore*, becauſe when in thin plates it is ſemi-tranſparent: In this ore the ſilver is mineralized by ſulphur and a little arſenic. The *red ſilver ore* is of the colour which its name imports, ſometimes more, ſometimes leſs vivid; and is chiefly compoſed of ſilver, arſenic, and ſulphur: It alſo contains a little iron.

Theſe three ores are very rich in ſilver: the firſt contains nearly three-fourths of its weight, and the others about two-thirds of theirs.

There is a fourth, called the *white ſilver ore*, which though it be heavier, is not ſo rich in ſilver, becauſe it contains much copper. Many other ores contain ſilver, yet are not, properly ſpeaking, ſilver ores; becauſe a much greater quantity of other metals than of ſilver is found in them.

When a ſilver ore is to be decompoſed, in order to have the ſilver pure, or when ſilver is to be extracted out of any ore that contains it, the firſt thing to be done is to roaſt the ore in order to clear it of the volatile minerals: and as ſilver cannot be had pure without the operation of the cupel, which requires more or leſs lead to be joined with it, it is uſual to mix with the torrified ſiler ore a quantity of lead proportioned to that of the heterogeneous matters combined with the ſilver, and to melt the whole together Part of the added lead vitrifies during the fuſion, and at the ſame time converts ſome of the heterogeneous matter alſo into glaſs, with which it forms a ſcoria that riſes to the ſurface of the matter. The other part of the lead, with which the ſilver is mixed, falls to the bottom in the form of a regulus, which muſt be cupelled in order to have the ſilver pure.

Of Copper Ores.

Copper is much ſeldomer found in a metalline form, than gold or ſilver; it is commonly in a mineral ſtate: it is mineralized by ſulphur and arſenic: almoſt all its ores contain alſo more or leſs iron; ſometimes a little ſilver or even gold, together with unmetallic earths and ſtones, as all ores do.

Moſt copper ores are of a beautiful green or blue, or elſe in ſhades blended of theſe two colours. The minerals called mountain green, and mountain blue, are true copper ores; not in the form of hard ſtones, like other ores, but crumbly and friable like earth.

Nevertheleſs there are ſeveral copper ores of different colours, as aſh-coloured, whitiſh, and ſhaded with yellow or orange: which colours ariſe from the different proportions of arſenic, ſulphur, and iron, which theſe ores contain.

In order to decompoſe a copper ore, and to extract the copper it contains, it is firſt of all to be freed from as many of its earthy, ſtony, ſulphureous, and arſenical parts, as is poſſible, by roaſting and waſhing; then what remains is to be mixed with a flux compounded of a fixed alkali and ſome inflammable matter; a little ſea-ſalt is to be put over all, and the whole melted by a ſtrong fire. The ſalts facilitate the ſuſion and ſcorification of the

the unmetallic matters, and therewith form a flag, which being the lighteſt riſes to the ſurface. The metalline matters are collected below in the form of a ſhining regulus of copper; which however, is not uſually fine copper, but requires to be purified.

In order to ſeparate the copper from the unmetallic matters, it is abſolutely neceſſary to melt its ore along with the inflammable ſubſtances abounding in phlogiſton. For, as this metal is not poſſeſſed of its metalline form while it is in a mineral ſtate, as it is deſtitute of the true quantity of phlogiſton, and, though it were not, would loſe it by the action of the fire, it would come to paſs, that, if its ore were melted without the addition of any inflammable matter, the cupreous earth, or calx, would be ſcorified and confounded with the unmetallic matters; and as all metallic matters, except gold and ſilver, are ſubject to this inconvenience as well as copper, the addition of an inflammable ſubſtance, in fluxing all ores that contain them, is a general rule that ought conſtantly to be obſerved.

Of Iron Ores.

Iron is ſeldom found pure and malleable in the earth; yet it is much ſeldomer found in the mineral ſtate, properly ſo called, than any of the other metals: for moſt iron ores are ſcarce any thing more than a ferruginous earth mixed in different proportions with unmetallic earths and ſtones. Some of them, however, contain alſo volatile minerals, ſuch as ſulphur and arſenic; and therefore it is neceſſary to roaſt the iron ores, like all others, before you attempt to extract the metal out of them. That being done, they are to be ſmelted with a flux conſiſting of fuſible and inflammable matters, as the general rule directs.

Iron is the commoneſt of all metals; nay, it is ſo univerſally diffuſed through the earth, that it is difficult to find any ſtone, earth, or ſand, that does not contain ſome of it; and therefore none of theſe are uſually conſidered and treated as iron ores, except ſuch as contain a great deal of that metal, and melt eaſily. The hematites, emery, yellow pyrites, calamine, all contain a pretty conſiderably quantity of iron; but nobody attempts to extract it from them, becauſe they are very hard to melt.

Ferruginous earth being naturally of an orange colour, a ſtone or earth may be judged to contain iron, if either naturally or after roaſting it appears to have any ſhade of yellow or red.

The ſingular property which iron has of being attracted by the magnet, and of being the only body, excluſive of all others, that is ſo, likewiſe affords us an eaſy method of diſcovering the preſence of this metal among other matters, where it often exiſts in ſuch a ſmall quantity that it could not otherwiſe be found out. For this purpoſe the body in which iron is ſuſpected to lurk, muſt be pulveriſed and torrefied with ſome inflammable matter; and then the powder thus roaſted being touched with a magnet, or a magnetical bar, if it contains any particles of iron they will infallibly adhere to the magnet or bar.

Of Tin Ores.

Tin is never found in the earth pure and malleable, but always in a mineral ſtate, and always mineraliſed by arſenic. Tin ores are not ſulphureous; whence it comes that though tin be the lighteſt of all metals, its ores are nevertheleſs heavier than thoſe of other metals, as arſenic greatly exceeds ſulphur in gravity. Some tin ores contain alſo a little iron. The ores of tin are to be waſhed, roaſted, and ſmelted with a reducing flux, according to the general rules.

Of Lead Ores.

Lead, like tin, is never found but in a mineral ſtate. It is moſt commonly mineraliſed by ſulphur; yet there are ſome lead ores which alſo contain arſenic.

Lead ores, as well as all others, muſt be roaſted and ſmelted with a reducing flux: however, as it is difficult to free them from all their ſulphur by torrefaction only, the reducing flux employed in their fuſion may be made up with a quantity of iron filings, which being incapable of any union with lead, and having a much greater affinity than that metal with ſulphur, will on this occaſion be of great ſervice by interpoſing between them.

Of Quick-Silver Ores.

Running mercury is ſometimes found in certain earths, or grey friable ſtones; but moſt commonly in a mineral ſtate. It is always mineralized by ſulphur, and by ſulphur alone: ſo that cinabar is the only ore of quick-ſilver that we know of: and a very rich one it is, ſeeing it contains ſix or ſeven times as much mercury as ſulphur.

Roaſting can be of no uſe towards decompoſing the ore of mercury, and ſeparating its ſulphur; becauſe mercury being itſelf very volatile would be carried off by the fire together with the ſulphur. In order therefore to part the two ſubſtances of which cinabar conſiſts, recourſe muſt neceſſarily be had to ſome third body, which will unite with one of them, and by that means ſeparate it from the other. Now all the metals, except gold, having a greater affinity than mercury with ſulphur, ſuch a body is eaſily found: any metal but gold may be employed with ſucceſs in this decompoſition; but as iron hath a greater affinity with ſulphur than any of the reſt, and is, moreover, the only one that cannot unite with mercury, it muſt, on account of theſe two qualities, be preferred to all the reſt.

Fixed alkalis are alſo well qualified to abſorb the ſulphur of cinabar. Cinabar muſt be decompounded in cloſe veſſels, and by the way of diſtillation: otherwiſe the mercury, as ſoon as it ſeparates from the ſulphur, will be diſſipated in vapours and entirely loſt.

In this operation it is needleſs to add either flux or phlogiſton; becauſe the cinabar is decompoſed without melting, and the mercury, though in a mineral ſtate, contains, like gold and ſilver, all the phlogiſton requiſite to ſecure its metalline properties.

Of the Ores of Regulus of Antimony.

Regulus of antimony is always found in a mineral ſtate: it is mineraliſed by ſulphur: but ſometimes, tho' rarely, it is alſo combined with a little arſenic.

When the ore of regulus of antimony is to be decompoſed,

poſed, the firſt thing to be done, is to expoſe it to a degree of heat too weak to melt its earthy and ſtony parts, but ſtrong enough to fuſe its reguline together with its ſulphureous parts, which by this means are ſeparated from the earth, and united into one maſs, known by the name of Antimony.

It is plain, that this firſt operation, which is founded on the great fuſibility of antimony, produces, with regard to the ore of regulus of antimony, the ſame effect that waſhing hath on other ores: ſo that after this firſt fuſion nothing more is requiſite to the obtaining of a pure regulus of antimony, but to ſeparate it from its ſulphur by roaſting, and to melt it with ſome matter abounding in phlogiſton, in the ſame manner as other metallic matters are treated. The term calcination is generally uſed to expreſs this torrefaction of antimony, by means whereof the metallic earth of the regulus of antimony is ſeparated from its ſulphur.

As regulus of antimony hath, like mercury, much leſs affinity with ſulphur than the other metals have, it follows that antimony may be decompoſed by the ſame means as cinabar; but the regulus ſo obtained is adulterated with a portion of the additament made uſe of, which combines therewith.

Of the Ores of Biſmuth.

The ore of biſmuth conſiſts of the ſemi-metal mineraliſed by the arſenic, and of an unmetallic earth. It is very eaſy to decompoſe this ore, and to extract the biſmuth it contains: for this purpoſe it need only be expoſed to a moderate heat, whereby the arſenic will be diſſipated in vapours, and the biſmuth melted, which will then ſeparate from the unmetallic earth. This earth, at leaſt in ſeveral ores of biſmuth, poſſeſſes the property of tinging all vitrifiable matters with which it is melted of a beautiful blue colour.

To decompoſe the ore of biſmuth no flux or inflammable matter is uſed; becauſe this ſemi-metal is poſſeſſed, even in its mineral ſtate, of all the phlogiſton requiſite to maintain its metalline properties; and its great fuſibility makes it unneceſſary to melt the metallic earth contained in its ore.

Of the Ores of Zinc.

Zinc is not generally obtained from a particular ore of its own; but ſublimes during the fuſion of a mineral, or rather a confuſed maſs of minerals, that contains this ſemi-metal together with iron, copper, lead, ſulphur, arſenic, and, like all other ores, an unmetallic earth.

Neverthelefs there is a ſubſtance which may be conſidered as the proper ore of zinc, becauſe it contains a pretty large quantity of that ſemi-metal, a little iron, and an unmetallic earth. It is called calamine, or *lapis calaminaris:* but hitherto the art of procuring zinc directly from this mineral hath no where been practiſed. Calamine is commonly employed only to convert copper into braſs or a yellow metal, by cementing it therewith. Indeed till lately no eaſy or practicable method of obtaining pure zinc from calamine was publicly known; for that ſemi-metal being volatile and very inflammable, its ore cannot be fuſed like others. Mr Margraaf was the firſt who, by mixing powdered charcoal with calamine, in cloſe veſſels, obtained a perfect zinc from it, by the means of diſtillation or ſublimation.

Of Arſenical Minerals.

Arsenic, as well as ſulphur, is naturally combined with almoſt all ores, or minerals containing metallic ſubſtances. As it is very volatile, while the matters with which it is united are fixed, at leaſt in compariſon therewith, it is eaſily ſeparated by ſublimation.

The minerals that contain moſt arſenic are the white pyrites, orpiment, and cobalt. We have already conſidered the white pyrites: as to orpiment, it conſiſts of ſulphur and arſenic. Both theſe ſubſtances being very volatile, it is difficult to ſeparate them by ſublimation: yet, with proper management, and a due regulation of the fire, this ſeparation may be effected; becauſe ſulphur ſublimes a little more eaſily than arſenic. But it is more convenient, as well as more expeditious, to make uſe of ſome additament that hath a greater affinity with one of thoſe ſubſtances than with the other. Fixed alkalis and mercury, both of which have more affinity with ſulphur than with arſenic, may be very properly employed on this occaſion. Cobalt is a mineral compoſed of arſenic, an unmetallic earth, and frequently biſmuth: and as none of theſe are very volatile, except the arſenic, this may be eaſily ſeparated from the reſt by ſublimation. The unmetallic earth which remains has, like that of the ore of biſmuth, the property of giving a blue colour to any vitrifiable matters melted with it; whence it is conjectured, that cobalt and the ore of biſmuth have a great reſemblance, or are often blended with each other.

Beſides the minerals already recited, there is found in the bowels of the earth another ſpecies of compound body, of which we have already taken notice; but which is ſuppoſed, with ſome degree of probability, to belong as much to the vegetable as to the mineral kingdom: we mean the bitumens; which the beſt obſervations oblige us to conſider as vegetable oils, that by lying long in the earth have contracted an union with the mineral acids, and by that means acquired the thickneſs, conſiſtence, and other properties obſervable in them.

By diſtillation they yield an oil, and an acid not unlike a mineral acid. Mr Bourdelin has even demonſtrated, by a very artful and ingenious proceſs, that amber contains a manifeſt acid of ſea-ſalt.

Explanation of the Table of Affinities or elective Attractions.

We have already explained what is meant by affinities, and have laid down the principal laws to which the relations of different bodies are ſubject. The late Mr Geoffroy, being convinced of the advantages which all who cultivate chemiſtry would receive from having conſtantly before their eyes a ſtate of the beſt aſcertained relations between the chief agents in chemiſtry, was the firſt who undertook to reduce them into order, and unite them all in one point of view, by means of a table. This table will be of conſiderable uſe to ſuch as are beginning to ſtudy

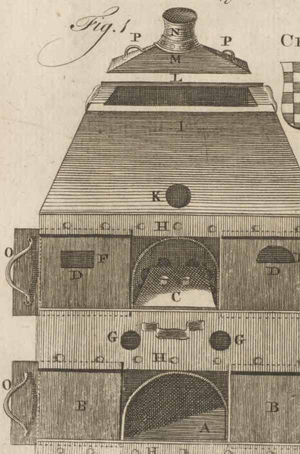
GEOFFROY'S TABLE of the COMPARATIVE AFFINITIES observ'd between sundry Substances. Plate LXV.

I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.
Acid Spirits	Marine Acid	Nitrous Acid	Vitriolic Acid	Absorbent Earths	Fixed Alkali	Volatile Alkali	MS	Sulphur	Mercury	Lead	Copper	Silver	Iron	Regulus of Antimony	Water
Fixed Alkali	Tin	Iron	Phlogiston	Vitriolic Acid	Vitriolic Acid	Vitriolic Acid	Marine Acid	Fixed Alkali	Gold	Silver	Mercury	Lead	Regulus of Antimony	Iron	Ardent Spirits
Volatile Alkali	Regulus of Antimony	Copper	Fixed Alkali	Nitrous Acid	Nitrous Acid	Nitrous Acid	Vitriolic Acid	Iron	Silver	Copper	LC	Copper	Silver Copper Lead	Silver Copper Lead	Neutral Salts
Absorbent Earths	Copper	Lead	Volatile Alkali	Marine Acid	Marine Acid	Marine Acid	Nitrous Acid	Copper	Lead						
MS	Silver	Mercury	Absorbent Earths		Spirits of Vinegar		Spirits of Vinegar	Lead	Copper						
	Mercury	Silver	Iron		Sulphur			Silver	Zinc						
			Copper					Regulus of Antimony	Regulus of Antimony						
			Silver					Mercury							
	Gold							Gold							

Explanation of the Characters

Acid Spirits
Marine Acid
Nitrous Acid
Vitriolic Acid
Fixed Alkali
Volatile Alkali
Absorbent Earths
MS Metallic Substances
Mercury
Regulus of Antimony
Gold
Silver
Copper
Iron
Lead
Tin
Ze Zinc
LC Calamine
Sulphur
Phlogiston
Spirits of Vinegar
Water
Neutral Salts
Ardent Spirits

Fig. 1



2 CHECKY

3 CHEVRON

4 CHIEF

5 CLARION

6 CLECHE

7 COEUR

8 COMPONED

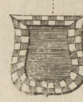
9 COUCHANT

10 CRESCENT

11 COTISE

12 CHANGED

COUNTER 13 COMPONED



14 ERMINE

A. Bell Sculp.

ſtudy chemiſtry, in helping them to form a juſt idea of the relations which different ſubſtances have with one another; and the practical chemiſt will thereby be enabled to account for what paſſes in ſeveral of his operations, otherwiſe difficult to be underſtood, as well as to judge what may be expected to reſult from mixtures of different compounds. Theſe reaſons have induced us to inſert it at the end of this elementary treatiſe, and to give a ſhort explanation of it here; eſpecially as it will ſerve at the ſame time for a recapitulation of the whole work, in which the ſeveral axioms of this table are diſperſed. See Plate LXV.

The upper line of Mr Geoffroy's table comprehends ſeveral ſubſtances uſed in chemiſtry. Under each of thoſe ſubſtances are ranged in diſtinct columns ſeveral matters compared with them, in the order of their relation to that firſt ſubſtance; ſo as that which is the neareſt to it is that which hath the greateſt affinity with it, or that which none of the ſubſtances ſtanding below it can ſeparate therefrom; but which, on the contrary, ſeparates them all when they are combined with it, and expels them in order to join itſelf therewith. The ſame is to be underſtood of that which occupies the ſecond place of affinity; that is, it has the ſame property with regard to all below it, yielding only to that which is above it: and ſo of all the reſt.

At the top of the firſt column ſtands the character which denotes an acid in general. Immediately under this ſtands the mark of a fixed alkali, being placed there as the ſubſtance which has the greateſt affinity with an acid. After the fixed alkali, appears the volatile alkali, whoſe affinity with acids yields only to the fixed alkali. Next come the abſorbent earths; and, laſt of all, metallic ſubſtances. Hence it follows, that when a fixed alkali is united with an acid, it cannot be ſeparated therefrom by any other ſubſtance; that a volatile alkali united with an acid cannot be ſeparated from it by any thing but a fixed alkali; that an abſorbent earth combined with an acid may be ſeparated from it either by a fixed or by a volatile alkali; and laſtly, that any metallic ſubſtance combined with an acid, may be ſeparated from it by a fixed alkali, a volatile alkali, or an abſorbent earth.

At the head of the ſecond column ſtands the character of the marine acid, which ſignifies that the affinities of this acid are the ſubject of the column. Immediately below it is placed the mark of tin. As this is a metalline ſubſtance, and as the firſt column places metalline ſubſtances in the loweſt degree of affinity with all acids, it is plain we muſt ſuppoſe fixed alkalis, volatile alkalis, and abſorbent earths, to be placed here in order after the marine acids, and before tin. Tin, then, is of all metalline ſubſtances that which has the greateſt affinity with the marine acid; and then follow regulus of antimony, copper, ſilver, mercury. Gold comes laſt of all; and there are no leſs than two vacant places above it. By this means it is in ſome ſort excluded from the rank of ſubſtances that have an affinity with the marine acid. The reaſon thereof is, that this acid alone is not capable of diſſolving gold and combining therewith, neceſſarily requiring for that purpoſe the aid of the nitrous acid, or at leaſt of the phlogiſton.

The third column exhibits the affinities of the nitrous acid, the character whereof ſtands at its head. Immediately below it is the ſign of iron, as the metal which has the greateſt affinity with this acid; and then follow other metals, each according to the degree of its relation, *viz.* copper, lead, mercury, and ſilver. In this column, as in the preceding one, we muſt ſuppoſe the ſubſtances, which in the firſt column ſtand above metallic ſubſtances, to be placed in their proper order before iron.

The fourth column is intended to repreſent the affinities of the vitriolic acid. The phlogiſton ſtands uppermoſt. Below it the fixed alkalis, volatile alkalis, and abſorbent earths, to ſhew that this is an exception to the firſt column. As to metalline ſubſtances, Mr Geoffroy has ſet down but three, being thoſe with which the vitriolic acid has the moſt perceptible affinity: theſe metals, placed in the order of their affinities, are iron, copper, and ſilver.

The fifth column ſhews the affinities of abſorbent earths. As theſe earths have no ſenſible affinity but with acids, this column contains only the characters of the acids ranked according to the degree of their ſtrength, or affinity with the earths, *viz.* the vitriolic, the nitrous, and the marine acids. Underneath this laſt might be placed the acid of vinegar, or the vegetable acid.

The ſixth column expreſſes the affinities of fixed alkalis with acids, which are the ſame with thoſe of abſorbent earths. Moreover, we find ſulphur placed here below all the acids; becauſe liver of ſulphur, which is a combination of ſulphur with a fixed alkali, is actually decompounded by any acid: for any acid precipitates the ſulphur and unites with the alkali.

Immediately over the ſulphur, or in the ſame ſquare with it, might be ſet a mark denoting the volatile ſulphureous ſpirit; becauſe, like ſulphur, it has leſs affinity than any other acid with fixed alkalis. Oils might alſo be ranked with ſulphur, becauſe they unite with fixed alkalis, and therewith form ſoaps which are decompounded by any acid whatever.

The ſeventh column points out the affinities of volatile alkalis, which are likewiſe the ſame as thoſe of abſorbent earths; and the vegetable acid might be placed here alſo under the marine acid.

The eighth column ſpecifies the affinities of metallic ſubſtances with acids. The affinities of the acids, which with reſpect to fixed alkalis, volatile alkalis, and abſorbent earths, ſucceed each other uniformly, do not appear in the ſame order here. The marine acid, inſtead of being placed below the vitriolic and nitrous acids, ſtands, on the contrary, at their head; becauſe, in fact, this acid ſeparates metalline ſubſtances from all the other acids with which they happen to be united, and, forcing theſe acids to quit poſſeſſion, intrudes into their place. Nevertheleſs, this is not a general rule; for ſeveral metalline ſubſtances muſt be excepted, particularly iron and copper.

The ninth column declares the affinities of ſulphur. Fixed alkalis, iron, copper, lead, ſilver, regulus of antimony, mercury, and gold, ſtand below it in the order of their affinities. With regard to gold, it muſt be obſerved, that it will not unite with pure ſulphur; it ſuffers

fers itſelf to be diſſolved only by the liver of ſulphur, which is known to be a compoſition of ſulphur and fixed alkali.

At the head of the tenth column appears mercury, and beneath it ſeveral metalline ſubſtances, in the order of their affinities with it. Thoſe metalline ſubſtances are gold, ſilver, lead, copper, zinc, and regulus of antimony.

The eleventh column ſhews that lead has a greater affinity with ſilver than with copper.

The twelfth, that copper has a greater affinity with mercury than with calamine.

The thirteenth, that ſilver has a greater affinity with lead than with copper.

The fourteenth contains the affinities of iron. Regulus of antimony ſtands immediately underneath it, as being the metallic ſubſtance which has the greateſt affinity with it. Silver, copper, and lead, are placed together in the next ſquare below, becauſe the degrees of affinity which thoſe metals have with iron are not exactly determined.

The ſame is to be ſaid of the fifteenth column: Regulus of antimony ſtands at its head; iron is immediately below it; and below the iron the ſame three metals occupy one ſquare as before.

Laſtly, The ſixteenth column indicates that water has a greater affinity with ſpirit of wine than with ſalts. By this general expreſſion muſt not be underſtood any ſaline ſubſtance whatever; but only the neutral ſalts, which ſpirit of wine frees from the water that kept them in ſolution. Fixed alkalis, on the contrary, as well as the mineral acids, have a greater affinity than ſpirit of wine with water; ſo that theſe ſaline ſubſtances, being well dephlegmated and mixed with ſpirit of wine, imbibe the water it contains and rectify it.

The Theory of Conſtructing the Veſſels moſt commonly uſed in Chemiſtry.

Chemists cannot perform the operations of their art without the help of a conſiderable number of veſſels, inſtruments, and furnaces, adapted to contain the bodies on which they intend to work, and to apply to them the ſeveral degrees of heat required by different proceſſes.

Veſſels intended for chemical operations ſhould be able to bear, without breaking, the ſudden application of great heat and great cold; be impenetrable to every thing, and unalterable by any ſolvent; unvitrifiable, and capable of enduring the moſt violent fire without melting: But hitherto no veſſels have been found with all theſe qualities united.

They are made of ſundry materials, namely, of metal, of glaſs, and of earth. Metalline veſſels, eſpecially thoſe made of iron or copper, are apt to be corroded by almoſt every ſaline, oily, or even aqueous ſubſtance. For this reaſon, in order to render the uſe of them a little more extenſive, they are tinned on the inſide. But, notwithſtanding this precaution, they are on many occaſions not to be truſted; and ſhould never be employed in any nice operations which require great accuracy; they are, moreover, incapable of reſiſting the force of fire.

Earthen veſſels are of ſeveral ſorts. Some, that are made of a refractory earth, are capable of being ſuddenly expoſed to a ſtrong fire without breaking, and even of ſuſtaining a great degree of heat for a conſiderable time: But they generally ſuffer the vapours of the matters which they contain, as well as vitrified metals, to paſs through them; eſpecially the glaſs of lead, which eaſily penetrates them, and runs through their pores, as through a a ſieve. There are others made of an earth, that, when well baked, looks as if it were half vitrified: Theſe being much leſs porous are capable of retaining the vapours of the matters which they contain, and even glaſs of lead in fuſion; which is one of the ſevereſt trials a veſſel can be put to: But then they are more brittle than the other ſort.

Good glaſs-veſſels ſhould conſtantly be employed in preference to all others, whenever they can poſſibly be uſed: And that not only becauſe they are no way injured by the moſt active ſolvents, nor ſuffer any part of what they contain to paſs through, but alſo becauſe their tranſparency allows the chemiſt to obſerve what paſſes within them; which is always both curious and uſeful. But it is pity, that veſſels of this ſort ſhould not be able to endure a fierce fire without melting.

Diſtillation, as hath been already ſaid, is an operation by which we ſeparate from a body, by the help of a gradual heat, the ſeveral principles of which it conſiſts.

There are three methods of diſtilling. The firſt is performed by applying the heat over the body whoſe principles are to be extracted. In this caſe, as the liquors when heated and converted into vapours conſtantly endeavour to fly from the centre of heat, they are forced to re-unite in the lower part of the veſſel that contains the matter in diſtillation, and ſo paſſing through the pores or holes of that veſſel, they fall into another cold veſſel applied underneath to receive them. This way of diſtilling is, on this account, called diſtilling *per deſcenſum*. It requires no other apparatus than two veſſels figured like ſegments of hollow ſpheres, whereof that which is pierced with little holes, and intended to contain the matter to be diſtilled, ought to be much leſs than the other which is to contain the fire, and cloſe its aperture exactly; the whole together being ſupported vertically upon a third veſſel, which is to ſerve the purpoſe of a recipient, admitting into its mouth the convex bottom of the veſſel containing the matter to be diſtilled, which muſt accurately fill it. This method of diſtilling is but little uſed.

The ſecond method of diſtilling is performed by applying the heat underneath the matter to be decompoſed. On this occaſion the liquors being heated, rarefied, and converted into vapours, riſe, and are condenſed in a veſſel contrived for that purpoſe, which we ſhall preſently deſcribe. This way of diſtilling is called diſtilling *per aſcenſum*, and is much uſed.

The veſſel in which the diſtillation *per aſcenſum* is performed, we call an alembic. Plate LXIV. fig. 1.

There are ſeveral ſorts thereof differing from one another both in the matter of which, and the manner in which, they are made.

Thoſe

Thoſe employed to draw the odoriferous waters and eſſential oils of plants are generally made of copper, and conſiſt of ſeveral pieces. The firſt, which is deſigned to contain the plant, is formed nearly like a hollow cone, the vertex whereof is drawn out in the ſhape of a hollow cylinder or tube: This part is named the cuburbit, Plate LXIV. fig. 1. A; and its tube the neck of the alembic B. To the upper end of this tube another veſſel is ſoldered: This is called the head C, and commonly has likewiſe the form of a cone, joined to the neck of the alembic by its baſe, round which on the inſide is hollowed a ſmall groove communicating with an orifice that opens at its moſt depending part. To this orifice is ſoldered a ſmall pipe in a direction ſloping downwards, which is called the noſe, ſpout, or beak D of the alembic.

As ſoon as the matters contained in the alembic grow hot, vapours begin to ariſe from them, and aſcending through the neck of the alembic into the head, are by the ſides thereof ſtopped and condenſed: From thence they trickle down in little ſtreams to the groove, which conveys them to the ſpout; and by that they paſs out of the alembic into a glaſs veſſel or receiver G with a long neck, the end of the ſpout being introduced into that neck and luted thereto.

To facilitate the refrigeration and condenſation of the vapours circulating in the head, all alembics of metal are moreover provided with another piece, which is a kind of large pan of the ſame metal, fitted and ſoldered round the head. This piece ſerves to keep cold water in, which inceſſantly cools the head, and therefore it is called the refrigeratory E. The water in the refrigeratory itſelf grows hot after ſome time, and muſt therefore be changed occaſionally; the heated water being firſt drawn off by means of a cock fixed near the bottom of the refrigeratory. All copper alembics ſhould be tinned on the inſide for the reaſons already given.

When ſaline ſpirits are to be diſtilled, alembics of metal muſt not be uſed; becauſe the ſaline vapours would corrode them. In this caſe recourſe muſt be had to alembics of glaſs. Theſe conſiſt of pieces only; namely, a cucurbit, whoſe ſuperior orifice is admitted into, and exactly luted with its head, which is the ſecond piece.

In general, as alembics require that the vapours of the matter to be diſtilled ſhould riſe to a conſiderable height, they ought to be uſed only when the moſt volatile principles are to be drawn from bodies: And the lighter and more volatile the ſubſtances to be ſeparated by diſtillation are, the taller muſt the alembic be; becauſe the moſt ponderous parts, being unable to riſe above a certain heighth, fall back again into the cucurbit as ſoon as they arrive there, leaving the lighter to mount alone, whoſe volatility qualifies them to aſcend into the head.

When a matter is to be diſtilled that requires a very tall alembic, and yet does not admit of a metalline veſſel, the end will be beſt anſwered by a glaſs veſſel of a round or oval ſhape, having a very long neck, with a ſmall head fitted to its extremity. Such a veſſel ſerves many purpoſes: It is ſometimes employed as a receiver, and at other times as a digeſting veſſel; on which laſt occaſion it goes under the name of a matraſs, fig. 3. When one of theſe provided with a head, (fig. 3. C), is applied to the purpoſe of diſtilling, it forms a ſort of alembic.

There are ſome alembics of glaſs, blown in ſuch a manner by the workmen, that the body and head form but one continued piece. As theſe alembics do not ſtand in need of having their ſeveral pieces luted together, they are very uſeful on ſome occaſions, when ſuch exceeding ſubtile vapours riſe as are capable of tranſpiring through lutes. The head muſt be open at the top, and provided with a ſhort tube, through which by means of a funnel with a long pipe, the matter to be diſtilled may be introduced into the cucurbit. This is to be exactly cloſed with a glaſs ſtopple, the ſurface whereof muſt be made to fit the inſide of the tube in every point, by rubbing thoſe two pieces well together with emery.

Another ſort of alembic hath alſo been invented, which may be uſed with advantage when cohobation is required; that is, when the liquor obtained by diſtillation is to be returned upon the matter in the cucurbit; and eſpecially when it is intended that this cohobation ſhall be repeated a great number of times. The veſſel we are ſpeaking of is conſtructed exactly in the ſame manner as that laſt deſcribed; except that its beak, inſtead of being in a ſtreight line as in the other alembics, forms a circular arch, and re-enters the cavity of the cucurbit, in order to convey back again the liquor collected in the head. This inſtrument hath commonly two beaks oppoſite to each other, both turned in this manner, and is called a *pelican:* It ſaves the artiſt the trouble of frequently unluting and reluting his veſſels, as well as the loſs of a great many vapours.

There are certain ſubſtances which in diſtillation afford matters in a concrete form, or riſe wholly in the form of a very light powder, called *flowers*. When ſuch ſubſtances are to be diſtilled, the cucurbit which contains them is covered with a head without a noſe, which is named a *blind-head*.

When the flowers riſe in great quantities and very high, a number of heads is employed to collect them; or rather a number of a kind of pots, conſiſting of a body only without any bottom, which fitting one into the other form a canal, that may be lengthened or ſhortened at pleaſure, according as the flowers to be ſublimed are more or leſs volatile. The laſt of the heads, which terminates the canal, is quite cloſe at one end, and makes a true blind-head. Theſe veſſels are called *aludels*: they are uſually of earthen or ſtone ware.

All the veſſels above mentioned are fit only for diſtilling ſuch light volatile matters as can be eaſily raiſed and brought over; ſuch as phlegm, eſſential oils, fragrant waters, acid oily ſpirits, volatile alkalis, *&c.* But when the point is to procure, by diſtillation, principles that are much leſs volatile, and incapable of riſing high, ſuch as the thick fetid oils, the vitriolic, the nitrous, and the marine acids, *&c.* we are under a neceſſity of having recourſe to other veſſels, and another manner of diſtilling.

It is eaſy to imagine, that ſuch a veſſel muſt be much lower than the alembic. It is indeed no more than a hollow globe, whoſe upper part degenerates into a neck or

or tube, that is bent into a horizontal poſition; for which reaſon this inſtrument is called a *retort:* It is always of one ſingle piece.

The matter to be diſtilled is introduced into the body of the retort by means of a ladle with a long tubular ſhank. Then it is ſet in a furnace built purpoſely for this uſe, and ſo that the neck of the retort coming out of the furnace may, like the the noſe of the alembic, ſtand in a ſloping poſition, to facilitate the egreſs of the liquors, which by its means are conveyed to a receiver, into which it is introduced, and with which it is luted. This way of diſtilling, in which the vapours ſeem rather to be driven out of the veſſel horizontally and laterally, than raiſed up and ſublimed, is for that reaſon called diſtillation *per latus.*

Retorts are, of all the inſtruments of diſtillation, thoſe that muſt ſuſtain the greateſt heat, and reſiſt the ſtrongeſt ſolvents; and therefore they muſt not be made of metal. Some, however, which are made of iron may do well enough on certain occaſions: The reſt are either of glaſs or earth. Thoſe of glaſs, for the reaſons above given, are preferable to the other ſort, in all caſes where they are not to be expoſed to ſuch a force of fire as may melt them. The beſt glaſs, that which ſtands both heat and ſolvents beſt, is that in which there are feweſt alkaline ſalts: Of this ſort is the green German glaſs: The beautiful white cryſtal glaſs is far from being equally ſerviceable.

Retorts, as well as alembics, may be of different forms. For example, ſome matters are apt to ſwell and riſe over the neck of the retort in ſubſtance without ſuffering any decompoſition; when ſuch matters are to be diſtilled in a retort, it is proper that the body of the veſſel, inſtead of being globular, be drawn out into the form of a pear, ſo as nearly to reſemble that of a cucurbit. In a retort of this kind, the diſtance between the bottom and the neck being much greater than in thoſe whoſe bodies are ſpherical, the matters contained have much more room for expanſion; ſo that the inconvenience here mentioned is thereby prevented. Retorts of this form are called Engliſh retorts: as they hold the middle place between alembics and common retorts, they may be uſed to diſtill ſuch matters as have a mean degree of volatility between the greateſt and the leaſt.

It is moreover proper to have in a laboratory ſundry retorts with necks of different diameters. Wide necks will be found the fitteſt for conveying thick matters, and ſuch as readily become fixed; for inſtance, ſome very thick fetid oils, butter of antimony, *&c.* for as theſe matters acquire a conſiſtence as ſoon as they are out of the reach of a certain degree of heat, they would ſoon choak up a narrow neck, and by ſtopping the vapours, which riſe at the ſame time from the retort, might occaſion the burſting of the veſſels.

Some retorts are alſo made with an opening on their upper ſide, like that of tubulated glaſs alembics, which is to be cloſed in the ſame manner with a glaſs ſtopple. Theſe retorts are alſo called *tubulated retorts*, and ought always to be uſed whenever it is neceſſary to introduce freſh matter into the retort during the operation; ſeeing it may be done by means of this invention, without unluting and reluting the veſſels; which ought always to be avoided as much as poſſible

One of the things that moſt perplexes the chemiſts is, the prodigious elaſticity of many different vapours, which are frequently diſcharged with impetuoſity during the diſtillation, and are even capable of burſting the veſſels with exploſion, and with danger to the artiſt. On ſuch occaſions it is abſolutely neceſſary to give theſe vapours vent, as we ſhall direct in its proper place: But as that can never be done without loſing a great many of them; as ſome of them in particular are ſo elaſtic, that ſcarce any at all would remain in the veſſel; for inſtance, thoſe of the ſpirit of nitre, and eſpecially thoſe of the ſmoking ſpirit of ſalt; the practice is to make uſe of very large receivers, of about eighteen or twenty inches diameter, that the vapours may have ſufficient room to circulate in, and, by applying to the wide ſurface preſented them by the extenſive inſide of ſuch a large veſſel, may be condenſed into drops. Theſe huge receivers are commonly in the form of hollow globes, and are called *ballons.*

To give theſe vapours ſtill more room, ballons have been contrived with two open gullets in each, diametrically oppoſite to one another; whereof one admits the neck of the retort, and the other is received by one of the gullets of a ſecond ballon of the ſame form, which is joined in like manner to a third, and ſo on. By this artifice the ſpace may be enlarged at pleaſure. Theſe ballons with two necks are called *adopters.*

Operations on bodies that are abſolutely fixed, as metals, ſtones, ſand, *&c.* require only ſuch veſſels as are capable of containing thoſe bodies and reſiſting the force of fire. Theſe veſſels are little hollow pots, of different dimenſions, which are called crucibles. Crucibles can hardly be made of any thing but earth; they ought to have a cover of the ſame material fitted to ſhut them cloſe. The beſt earth we know is that whereof thoſe pots are made in which butter is brought from Bretagne: Theſe pots themſelves are exceeding good crucibles; and they are almoſt the only ones that are capable of holding glaſs of lead in fuſion, without being penetrated by it.

For the roaſting of ores, that is, freeing them by the help of fire from their ſulphureous and arſenical parts, little cups made of the ſame material with crucibles are uſed; but they are made flat, ſhallow, and wider above than below, that theſe volatile matters may the more freely exhale. Theſe veſſels are called *teſts*, or *ſcorifiers:* They are ſcarce uſed but in the docimaſtic art, that is, in making ſmall aſſays of ores.

The Theory of conſtructing the Furnaces moſt commonly uſed in Chemiſtry.

Skill in conducting and applying fire properly, and determining its different degrees, is of very great conſequence to the ſucceſs of chemical operations.

As it is exceeding difficult to govern and moderate the action of fire, when the veſſels in which any operation is performed are immediately expoſed to it, chemiſts have contrived to convey heat to their veſſels, in nice operations, through different mediums, which they place occaſionly between thoſe veſſels and the fire.

Thoſe

Thoſe intermediate ſubſtances in which they plunge their veſſels are called *baths*. They are either fluid or ſolid: The fluid baths are water, or its vapours. When the diſtilling veſſel is ſet in water, the bath is called *balneum mariæ*, or the water-bath; and the greateſt degree of heat of which it is ſuſceptible is that of boiling water. When the veſſel is expoſed only to the vapours which exhale from water, this forms the vapour-bath: the heat of which is nearly the ſame with that of the *balneum mariæ*. Theſe baths are uſeful for diſtilling eſſential oils, ardent ſpirits, ſweet-ſcented waters; in a word, all ſuch ſubſtances as cannot bear a greater heat without prejudice either to their odour, or to ſome of their other qualities.

Baths may alſo be made of any other fluids, ſuch as oils, mercury, *&c.* which are capable of receiving and communicating much more heat; but they are very ſeldom uſed. When a more conſiderable degree of heat is required, a bath is prepared of any ſolid matter reduced to a fine powder, ſuch as ſand, aſhes, filings of iron, *&c.* The heat of theſe baths may be puſhed ſo far as to make the bottom of the veſſel become faintly red. By plunging a thermometer into the bath, by the ſide of the veſſel, it is eaſy to obſerve the preciſe degree of heat applied to the ſubſtance on which you are working. It is neceſſary that the thermometers employed on this occaſion be conſtructed on good principles, and ſo contrived as to be eaſily compared with thoſe of the moſt celebrated natural philoſophers. Thoſe of the illuſtrious Reaumur are moſt uſed and beſt known, ſo that it would not be amiſs to give them the preference. When a greater heat is required than any of thoſe baths can give, the veſſels muſt be ſet immediately on live-coals, or in a flaming fire: this is called working with a naked fire; and in this caſe it is much more difficult than in the other to determine the degrees of heat.

There are ſeveral ways of applying a naked fire. When the heat or flame is reflected upon the upper part of the veſſel which is expoſed to the fire, this is called a reverberated heat. A melting heat is that which is ſtrong enough to fuſe moſt bodies. A forging heat is that of a fire which is forcibly excited by the conſtant blaſt of a pair of bellows, or more.

There is alſo another ſort of fire which ſerves very commodiouſly for many operations, becauſe it does not require to be fed or frequently mended: This is afforded by a lamp with one or more wicks, and may be called a lamp-heat. It is ſcarce ever employed but to heat baths, in operations which require a gentle and long continued warmth: if it hath any fault, it is that of growing gradually hotter.

All theſe different ways of applying fire require furnaces of different conſtructions: We ſhall therefore deſcribe ſuch as are of principal and moſt neceſſary uſe.

Furnaces muſt be divided into different parts or ſtories, each of which has its particular uſe and name.

The lower part of the furnace deſigned for receiving the aſhes, and giving paſſage to the air, is called the aſh-hole. The aſh-hole is terminated above by a grate, the uſe of which is to ſupport the coals and wood, which are to be burnt thereon: This part is called the fire-place. The fire-place is in like manner terminated above by ſeveral iron bars, which lie quite a-croſs it from right to left, in lines parallel to each other: The uſe of theſe bars is to ſuſtain the veſſels in which the operations are to be performed. The ſpace above theſe bars to the top of the furnace is the upper ſtory, and may be called the laboratory of the furnace. Laſtly, ſome furnaces are quite covered above, by means of a kind of vaulted roof called the dome.

Furnaces have moreover ſeveral apertures: one of theſe is at the aſh-hole, which gives paſſage to the air, and through which the aſhes that fall through the grate are raked out; this aperture is called the aſh-hole door: another is at the fire-place, through which the fire is ſupplied with fuel, as occaſion requires; this is called the mouth or door of the fire-place, or the ſtoke-hole: there is a third in the upper ſtory, through which the neck of the veſſel paſſes; and a fourth in the dome, for carrying off the fuliginoſities of combuſtible matters, which is called the chimney.

To conclude, there are ſeveral other openings in the ſeveral parts of the furnace, the uſe whereof is to admit the air into thoſe places, and alſo, as they can be eaſily ſhut, to incite or ſlacken the activity of the fire, and ſo to regulate it; which has procured them the title of *regiſters*. All the other openings of the furnace ſhould be made to ſhut very cloſe, the better to aſſiſt in governing the fire; by which means they likewiſe do the office of regiſters.

In order to our forming a juſt and general idea of the conſtruction of furnaces, and of the diſpoſition of the ſeveral apertures in them, with a view to increaſe or diminiſh the activity of the fire, it will be proper to lay down, as our ground-work, certain principles of natural philoſophy, the truth of which is demonſtrated by experience.

And firſt, every body knows that combuſtible matters will not burn or conſume unleſs they have a free communication with the air; inſomuch that if they be deprived thereof, even when burning moſt rapidly, they will be extinguiſhed at once: that conſequently combuſtion is greatly promoted by the frequent acceſſion of freſh air; and that a ſtream of air, directed ſo as to paſs with impetuoſity through burning fuel, excites the fire to the greateſt poſſible activity.

Secondly, It is certain that the air which touches or comes near ignited bodies is heated, rarefied, and rendered lighter than the air about it; that is, further diſtant from the centre of heat; and conſequently that this air ſo heated and become lighter is neceſſarily determined thereby to aſcend and mount aloft, in order to make room for that which is leſs heated and not ſo light, which by its weight and elaſticity tends to occupy the place quitted by the other. Another conſequence hereof is, that if fire be kindled in a place incloſed every where but above and below, a current of air will be formed in that place, running in a direction from the bottom to the top; ſo that if any light bodies be applied to the opening below, they will be carried up towards the fire; but, on the contrary, if they be held at the opening above, they will be impelled by a force which will drive them up and carry them away from the fire.

Thirdly,

Thirdly, and lastly, it is a truth demonstrated in hydraulics, that the velocity of a given quantity of any fluid, determined to flow in any direction whatever, is so much the greater, the narrower the channel is to which that fluid is confined; and consequently that the velocity of a fluid will be increased by making it run from a wider through a narrower passage.

These principles being established, it is easy to apply them to the construction of furnaces. First, if a fire be kindled in the fire-place of a furnace, which is open on all sides, it burns nearly as if it were in the open air. It has with the surrounding air a free communication; so that fresh air is continually admitted to facilitate the entire combustion of the inflammable matters employed as fuel. But there being nothing to determine that air to pass with rapidity through the fire in this case, it does not at all augment the activity thereof, but suffers it to waste away quietly.

Secondly, If the ash-hole or dome of a furnace in which a fire is burning be shut quite close, then there is no longer any free communication between the air and the fire; if the ash-hole be shut, the air is debarred from having free access to the fire; if the dome be stopt, the egress of the air rarefied by the fire is prevented; and consequently the fire must in either case burn very faintly and slowly, gradually die away, and at last go quite out.

Thirdly, If all the openings of the furnace be wholly closed, it is evident that the fire will be very quickly extinguished.

Fourthly, If only the lateral openings of the fire-place be shut, leaving the ash-hole and upper part of the furnace open; it is plain that the air entering by the ash-hole will necessarily be determined to go out at top, and that consequently a current of air will be formed, which will pass through the fire, and make it burn briskly and vigorously.

Fifthly, If both the ash-hole and the upper story of the furnace be of some length, and form canals either cylindric or prismatic, then the air being kept in the same direction through a longer space, the course of its stream will be both stronger and better determined, and consequently the fire will be more animated by it.

Sixthly, and lastly, if the ash hole and the upper part of the furnace, instead of being cylindric or prismatic canals, have the form of truncated cones or pyramids, standing on their bases, and so ordered that the upper opening of the ash-hole adjoining to the fire-place may be wider than the base of the superior cone or pyramid; then the stream of air, being forced to pass incessantly from a larger channel through a smaller, must be considerably accelerated, and procure to the fire the greatest activity which it can receive from the make of a furnace.

The materials fittest for building furnaces are, 1. Bricks, joined together with potters clay mixed with sand, and moistened with water. 2. Potters clay mingled with potsherds, moistened with water, and baked in a violent fire. 3. Iron; of which all furnaces may be made; with this precaution, that the inside be provided with a great many prominent points, as fastenings for a coat of earth, with which the internal parts of the furnace must necessarily be covered to defend it from the action of the fire.

The reverberating furnace is one of those that are most employed in chemistry; it is proper for distillations by the retort, and should be constructed in the following manner.

First, The use of the ash-hole being, as was said, to give passage to the air, and to receive the ashes, no bad consequence can attend its being made pretty high: It may have from twelve to twenty or twenty-four inches in heighth. Its aperture should be wide enough to admit billets of wood when a great fire is to be made.

Secondly, The ash-hole must be terminated at its upper part by an iron grate, the bars of which should be very substantial, that they may resist the action of the fire: this grate is the bottom of the fire-place, and destined to support the coals. In the lateral part of the fire-place, and nearly about the same height with the grate, there should be a hole of such a size that it may easily admit charcoal, as well as little tongs and shovels for managing the fire. This aperture or mouth of the fire-place should be perpendicularly over the mouth of the ash-hole.

Thirdly, from six to eight or ten inches high above the grate, over the ash-hole, little apertures must be made in the walls of the furnace, of eight or ten lines in diameter, an inch from one another, and those in one side must be diametrically opposite to those in the other. The use of these holes is to receive bars of iron for the retort to rest on; which should be, as was said, at different heights, in order to accommodate retorts of different sizes. At the upper extremity of this part of the furnace, which reaches from the iron bars to the top, the heighth whereof should be somewhat less than the width of the furnace, must be cut a semi-circular aperture for the neck of the retort to come through. This hole must by no means be over the doors of the fire-place and ash-hole; for then, as it gives passage to the necks of the retorts, it must of course be opposite to the receiver, and in that case the receiver itself would stand over against those two apertures; which would be attended with this double inconvenience, that the receiver would not only grow very hot, but greatly embarrass the operator, whose free access to the fire-place and ash-hole would be thereby obstructed. It is proper therefore, that the semi-circular cut we are speaking of be so placed, that, when the greatest ballons are luted to the retort, they may leave an open passage to the fire-place or ash-hole.

Fourthly, in order cover in the laboratory of the reverberating furnace, there must be a roof made for it in the form of a cupola, or concave hemisphere, having the same diameter as the furnace. This dome should have a semi-circular cut in its rim answering to that above-directed to be made in the upper extremity of the furnace, so that, when adjusted to each other, the two together may form a circular hole for the neck of the retort to pass through. At the top of this dome there must also be a circular hole of three or four inches diameter, carrying a short tapering funnel of the same diameter, and three inches high, which will serve for a chimney

chimney to carry off all fuliginofities, and accelerate the current of the air. This paffage may be fhut at pleafure with a flat cover. Moreover, as it is neceffary that the dome fhould be taken off and put on with eafe, it fhould have two ears or handles for that purpofe: a portative or moveable furnace fhould alfo have a pair of handles fixed oppofite to each other between the afh-hole and the fire place.

Sixthly and laftly, a conical canal muft be provided of about three foot long, and fufficiently wide at its lower end to admit the funnel of the aperture at the top of the dome. This conical tube is to be applied to the dome when the fire is required to be extremely active: it tapers gradually from its bafe upwards, and breaks off as if truncated at top, where it fhould be about two inches wide.

Befides the apertures already mentioned as neceffary to a reverberating furnace, there muft alfo be many other fmaller holes made in its afh-hole, fire-place, laboratory, and dome, which muft all be fo contrived as to be eafily opened and fhut with ftopples of earth: thefe holes are the regifters of the furnace, and ferve to regulate the activity of the fire according to the principles before laid down.

When the action of the fire is required to be exactly uniform and very brifk, it is neceffary to ftop carefully with moift earth all the little chinks in the juncture of the dome with the furnace, between the neck of the retort and the circular hole through which it paffes, and which it never fills exactly, and laftly the holes which receive the iron bars that fuftain the retort.

It is proper to have in a laboratory feveral reverberating furnaces of different magnitudes; becaufe they muft be proportioned to the fize of the retorts employed. The retort ought to fill the furnace, fo as to leave only the diftance of an inch between it and the infide of the furnace.

Yet when the retort is to be expofed to a moft violent fire, and efpecially when it is required that the heat fhall act with equal force on all parts of the furnace, and as ftrongly on its vault as on its bottom, a greater diftance muft be left between the retort and the infide of the furnace; for then the furnace may be filled with coals, even to the upper part of the dome. If moreover fome pieces of wood be put into the afh-hole, the conical canal fitted on to the funnel of the dome, and all the apertures of the furnace exactly clofed, except the afh-hole and the chimney, the greateft heat will then be excited that this furnace can produce.

The furnace now defcribed may alfo be employed in many other chemical operations. If the dome be laid afide, an alembic may very well be placed therein: but then the fpace, which will be left between the body of the alembic and the top of the upper part of the furnace, muft be carefully filled up with Windfor-loam moiftened; for without that precaution the heat would foon reach the very head, which ought to be kept as cool as poffible, in order to promote the condenfation of the vapours.

On this occafion therefore it will be proper to leave no holes open in the fire-place, but the lateral ones; of which alfo thofe over againft the receiver muft be ftopped.

A pot or broad-brimmed earthen pan may be placed over this furnace, and being fo fitted to it as to clofe the upper part thereof accurately, and filled with fand, may ferve for a fand-heat to diftill with.

The bars defigned to fupport diftilling veffels being taken out, a crucible may ftand therein, and many operations be performed that do not require the utmoft violence of fire. In a word, this furnace is one of the moft commodious that can be, and more extenfively ufeful than any other.

The melting furnace is defigned for applying the greateft force of heat to the moft fixed bodies, fuch as metals and earths. It is never employed in diftilling: it is of no ufe but for calcination and fufion; and confequently need not admit any veffels but crucibles.

The afh-hole of this furnace differs from that of the reverberating furnace only in this, that it muft be higher, in order to raife the fire-place to a level with the artift's hand; becaufe in that all the operations of this furnace are performed. The afh-hole therefore muft be about three foot high: and this height procures it moreover the advantage of a good draught of air. For the fame reafon, and in confequence of the principles we laid down, it fhould be fo built that its width leffening infenfibly from the bottom to the top, it may be narrower where it opens into the fire-place than any where below.

The afh-hole is terminated at its upper end, like that of the reverberating furnace, by a grate which ferves for the bottom of the fire-place, and ought to be very fubftantial that it may refift the violence of the fire. The infide of this furnace is commonly an elliptic curve; becaufe it is demonftrated by mathematicians, that furfaces having that curvature reflect the rays of the fun, or of fire, in fuch a manner, that, meeting in a point or a line, they produce there a violent heat. But to anfwer this purpofe, thofe furfaces muft be finely polifhed; an advantage hardly procureable to the internal furface of this furnace, which can be made of nothing but earth: befides, if it were poffible to give it a polifh, the violent action of the fire that muft be employed in this furnace would prefently deftroy it. Yet the elliptical figure muft not be entirely difregarded: for, if care be taken to keep the internal furface of the furnace as fmooth as poffible, it will certainly reflect the heat pretty ftrongly, and collect it about the center.

The fire-place of this furnace ought to have but four apertures.

Firft, that of the lower grate, which communicates with the afh-hole.

Secondly, a door in its fore-fide, through which may be introduced coals, crucibles, and tongs for managing them: this aperture fhould be made to fhut exactly with a plate of iron, having its infide coated with earth, and turning on two hinges fixed to the furnace.

Thirdly, over this door a hole flanting downwards towards the place where the crucible is to ftand. The ufe of this hole is to give the operator an opportunity of examining

amining the condition of the matters contained in his crucible, without opening the door of the fire-place: this hole ſhould be made to open and ſhut eaſily, by means of a ſtopple of earth.

Fourthly, a circular aperture of about three inches wide in the upper part or vault of the furnace, which ſhould gradually leſſen and terminate, like that of the dome of the reverberating furnace, in a ſhort conical funnel of abount three inches long, and fitted to enter the conical pipe before deſcribed, which is applied when the activity of the fire is to be increaſed.

When this furnace is to be uſed, and a crucible to be placed in it, care muſt be taken to ſet on the grate a cake of baked earth ſomewhat broader than the foot of the crucible. The uſe of this ſtand is to ſupport the crucible, and raiſe it above the grate, for which purpoſe it ſhould be two inches thick. Were it not for this precaution, the bottom of the crucible, which would ſtand immediately on the grate, could never be thoroughly heated, becauſe it would be always expoſed to the ſtream of cold air which enters by the aſh-hole. Care ſhould alſo be taken to heat this earthen bottom red-hot before it be placed in the furnace, in order to free it from any humidity, which might otherwiſe happen to be driven againſt the crucible during the operation, and occaſion its breaking.

We omitted to take notice, in ſpeaking of the aſh hole, that, beſides its door, it ſhould have about the middle of its height a ſmall hole, capable of receiving the noſel of a good perpetual bellows, which is to be introduced into it and worked, after the door is exactly ſhut, when it is thought proper to excite the activity of the fire to the utmoſt violence.

The forge is only a maſs of bricks of about three foot high, along whoſe upper ſurface is directed the noſe or pipe of a pair of large perpetual bellows, ſo placed that the operator may eaſily blow the fire with one hand. The coals are laid on the hearth of the forge near the noſe of the bellows; they are confined, if neceſſary, to prevent their being carried away by the wind of the bellows, within a ſpace incloſed by bricks; and then by pulling the bellows the fire is continually kept up in its greateſt activity. The forge is of uſe when there is occaſion to apply a great degree of heat ſuddenly to any ſubſtance, or when it is neceſſary that the operator be at liberty to handle frequently the matters which he propoſes to fuſe or calcine.

The cupelling furnace is that in which gold and ſilver are purified, by the means of lead, from all alloy of other metallic ſubſtances. This furnace muſt give a heat ſtrong enough to vitrify lead, and therewith all the alloy which the perfect metals may contain. This furnace is to be built in the following manner.

Firſt, of thick iron-plates, or of ſome ſuch compoſition of earth as we recommended for the conſtruction of furnaces, muſt be formed a hollow quadrangular priſm, whoſe ſides may be about a foot broad, and from ten to eleven inches high; and extending from thence upwards may converge towards the top, ſo as to form a pyramid truncated at the height of ſeven or eight inches, and terminated by an aperture of the width of ſeven or eight inches every way. The lower part of the priſm is terminated and cloſed by a plate of the ſame materials of which the furnace is conſtructed.

Secondly, in the fore-ſide or front of this priſm there is an opening of three or four inches in height by five or ſix inches in breadth: this opening, which ſhould be very near the bottom, is the door of the aſh-hole. Immediately over this opening is placed an iron grate, the bars of which are quadrangular priſms of half an inch ſquare, laid parallel to each other, and about eight or nine inches aſunder, and ſo diſpoſed that two of their angles are laterally oppoſite, the two others looking one directly upwards, and the other downwards. As in this ſituation the bars of the grate preſent to the fire-place very oblique ſurfaces, the aſhes and very ſmall coals do not accumulate between them, or hinder the free entrance of the air from the aſh-hole. This grate terminates the aſh-hole at its upper part, and ſerves for the bottom of the fire-place.

Thirdly, three inches, or three and a half, above the grate, there is in the fore-ſide of the furnace another opening terminated by an arch for its upper part, which conſequently has the figure of a ſemi-circle: it ought to be four inches wide at bottom, and three inches and an half high at its middle. This opening is the door of the fire-place; yet it is not intended for the ſame uſes as the door of the fire-place in other furnaces: the purpoſe for which it is actually deſtined ſhall be explained when we come to ſhew how the furnace is to be uſed. An inch above the door of the fire-place, ſtill in the foreſide of the furnace, are two holes of about an inch diameter, and at the diſtance of three inches and a half from each other, to which anſwer two other holes of the ſame ſize, made in the hinder part, directly oppoſite to theſe. There is, moreover, a fifth hole of the ſame width about an inch above the door of the fire-place. The deſign of all theſe holes ſhall be explained when we deſcribe the manner in which theſe furnaces are to be uſed.

Fourthly, the fore-part of the furnace is bound by three iron braces, one of which is fixed juſt below the door of the aſh hole; the ſecond occupies the whole ſpace between the aſh-hole door and the door of the fire-place, and has two holes in it, anſwering to thoſe which we directed to be made in the furnace itſelf about this place; and the third is placed immediately over the door of the fire-place. Theſe braces muſt extend from one corner of the front of the furnace to the other, and be faſtened thereto with iron pins, in ſuch a manner that their ſides next to the doors may not lie quite cloſe to the body of the furnace, but form a kind of grooves for the iron plates to ſlide in, that are deſigned to ſhut the two doors of the furnace when it is neceſſary. Each of theſe iron plates ſhould have a handle, by which it may be conveniently moved; and to each door there ſhould be two plates, which meeting each other, and joining exactly in the middle of the door-place, may ſhut it very cloſe. Each of the two plates belonging to the door of the fire-place ought to have a hole in its upper part; one of theſe holes ſhould be a ſlit of about two lines wide, and half an inch long; the other may be a ſemi-circular opening of one inch in height and two in breadth.

breadth. These holes should be placed so that neither of them may open into the fire-place when the two plates are joined together in the middle of the door to shut it close.

Fifthly, to terminate the furnace above, there must be a pyramid, formed of the same materials with the furnace, hollow, quadrangular, three inches high, on a base of seven inches, which base must exactly fit the upper opening of the furnace: the top of this pyramidal cover must end in a tube of three inches in diameter and two in height, which must be almost cylindrical, and yet a little inclining to the conical form. This tube serves, as in the furnaces already described, to carry the conical funnel, which is fitted to the upper part when a fire of extraordinary activity is wanted.

The furnace thus constructed is fit to serve all the purposes for which it is designed; yet, before it can be used, another piece must be provided, which, though it does not properly belong to the furnace, is nevertheless necessary in all the operations performed by it; and that is a piece contrived to contain the cupels, or other vessels which are to be exposed to the fire in this furnace. It is called a *muffle*, and is made in the following manner.

On an oblong square, of four inches in breadth, and six or seven in length, a concave semi-cylinder is erected, in the form of a vault, which makes a semi-circular canal, open at both ends. One of these is almost entirely closed, except that near the bottom two small semi-circular holes are left. In each of its sides likewise two such holes are made, and the other end is left quite open.

The muffle is intended to bear and communicate the fiercest heat; and therefore it must be made thin, and of an earth that will resist the violence of fire, such as that of which crucibles are made. The muffle being thus constructed, and then well baked, is fit for use.

When it is to be used, it must be put into the furnace by the upper opening, and set upon two iron bars, introduced through the holes made for that purpose below the door of the fire-place. The muffle must be placed on these bars in the fire-place, in such a manner that its open end shall stand next to and directly against the door of the fire-place, and may be joined to it with lute. Then the cupels are ranged in it, and the furnace is filled up, to the height of two or three inches above the muffle, with small coals not bigger than a walnut, to the end that they may lie close round the muffle, and procure it an equal heat on every side. The chief use of the muffle is to prevent the coals and ashes from falling into the cupels, which would be very prejudicial to the operations carrying on in them: for the lead would not vitrify as it ought, because the immediate contact of the coals would continually restore its phlogiston; or else the glass of lead, which ought to penetrate and pass through the cupels, would be rendered incapable of so doing; because the ashes mixing therewith would give it such a consistence and tenacity as would destroy that property, or at least considerably lessen it. The openings, therefore, which are left in the lower part of the muffle, should not be so high as to admit coals or ashes to get into the cupels; the use of them is to procure an easier passage for the heat and the air to those vessels. The muffle is left quite open in its fore-part, that the operator may be at liberty to examine what passes in the cupels, to stir their contents, to remove them from one place to another, to convey new matters into them, *&c.* and also to promote the free access of the air, which must concur with the fire towards the evaporation necessary to the vitrification of lead; which air, if fresh were not often enough admitted, would be incapable of producing that effect; because it would soon be loaded with such a quantity of vapours that it could not take up any more.

The government of the fire in this furnace is founded on the general principles above laid down for all furnaces. Yet as there are some little differences, and as it is very essential to the success of the operations for which this furnace is intended, that the artist should be absolutely master of his degree of heat, we shall in few words shew how that may be raised or lowered.

When the furnace is filled with coals and kindled, if the door of the ash-hole be set wide open, and that of the fire-place shut very close, the force of the fire is increased; and if, moreover, the pyramidal cover be put on the top, and the conical funnel added to it, the fire will become still more fierce.

Seeing the matters contained in this furnace are encompassed with fire on all sides, except in the fore part opposite to the door of the fire-place, and as there are occasions which require that the force of the fire should be applied to this part also, an iron box, of the shape and size of the door, hath been contrived to answer that purpose. This box is filled with lighted coals, and applied immediately to the door-place, by which means the heat there is considerably augmented. This help may be made use of at the beginning of the operation, in order to accelerate it, and bring the heat sooner to the desired degree; or in case a very fierce heat be required; or at a time when the air being hot and moist will not make the fire burn with the necessary vigour.

The heat may be lessened, by removing the iron box, and shutting the door of the fire-place quite close. It may be still further and gradually diminished, by taking off the conical funnel from the top; by shutting the door of the fire-place with one of its plates only, that which has the least, or that which has the greatest aperture in it; by taking off the pyramidal cover; by shutting the ash-hole door wholly or in part; and lastly, by setting the door of the fire-place wide open: but, in this last case, the cold air penetrates into the cavity of the muffle, and refrigerates the cupels more than is almost ever necessary. If it be observed, during the operation, that the muffle grows cold in any particular part, it is a sign there is a vacuity left by the coals in that place: in this case an iron wire must be thrust into the furnace, through the hole which is over the door of the fire-place, and the coals stirred therewith, so as to make them fall into their places and fill up the vacant interstices.

It is proper to observe, that, besides what has been said concerning the ways of increasing the activity of the fire in the cupelling furnace, several other causes also may concur to procure to the matters contained in the muffle a greater degree of heat: for example, the smaller the muffle is, the wider and more numerous the holes in it are;

are; the nearer to its bottom, or further end, the cupels are placed, the more will the matters therein contained be affected with heat.

Besides the operations to be performed by the cupel, this furnace is very useful, and even necessary, for many chemical experiments; such, for instance, as those relating to sundry vitrifications and enamelling. As it is pretty low, the best way is to place it, when it is to be used, on a base of brick-work that may raise it to a level with the operator's hand.

A lamp-furnace is exceeding useful for all operations that require only a moderate, but long continued degree of heat. The furnace for working with a lamp heat is very simple: it consists only of a hollow cylinder, from fifteen to eighteen inches high, and five or six in diameter, having at its bottom an aperture large enough for a lamp to be introduced and withdrawn with ease. The lamp must have three or four wicks, to the end that by lighting more or fewer of them a greater or less degree of heat may be produced. The body of the furnace must moreover have several small holes in it, in order to supply the flame of the lamp with air enough to keep it alive.

On the top of this furnace stands a bason five or six inches deep, which ought to fill the cavity of the cylinder exactly, and to be supported at its circumference by a rim which may entirely cover and close the furnace: The use of this bason is to contain the sand through which the lamp-heat is usually conveyed.

Besides this, there must be a kind of cover or dome made of the same material with the furnace, and of the same diameter with the sand-bath, without any other opening than a hole, nearly circular, cut in its lower extremity. This dome is a sort of reverberatory, which serves to confine the heat and direct it towards the body of the retort; for it is used only when something is to be distilled in a vessel of this fashion; and then the hole at its bottom serves for a passage to the neck of the retort. This dome should have an ear or handle, for the conveniency of putting it on and taking it off with ease.

Of Lutes.

Chemical vessels, especially such as are made of glass, and the earthen vessels commonly called stone-ware, are very subject to break when exposed to sudden heat or cold; whence it comes that they often crack when they begin to heat, and also when being very hot they happen to be cooled, either by fresh coals thrown into the furnace, or by the access of cold air. There is no way to prevent the former of these accidents, but by taking the pains to warm your vessel very slowly, and by almost insensible degrees. The second may be avoided by coating the body of the vessel with a paste or lute, which being dried will defend it against the attacks of cold.

The fittest stuff for coating vessels is a composition of fat earth, Windsor-loam, fine sand, filings of iron, or powdered glass, and chopped cow's hair, mixed and made into a paste with water. This lute serves also to defend glass vessels against the violence of the fire, and to prevent their melting easily.

In almost all distillations it is of great consequence, as hath been said, that the neck of the distilling vessel be exactly joined with that of the receiver into which it is introduced, in order to prevent the vapours from escaping into the air and so being lost: And this junction is effected by means of a lute.

A few slips of paper, applied round the neck of the vessels with common size, will be sufficient to keep in such vapours as are aqueous, or not very spirituous.

If the vapours are more acrid and more spirituous, recourse may be had to slips of bladder long steeped in water, which, containing a sort of natural glue, close the junctures of the vessels very well.

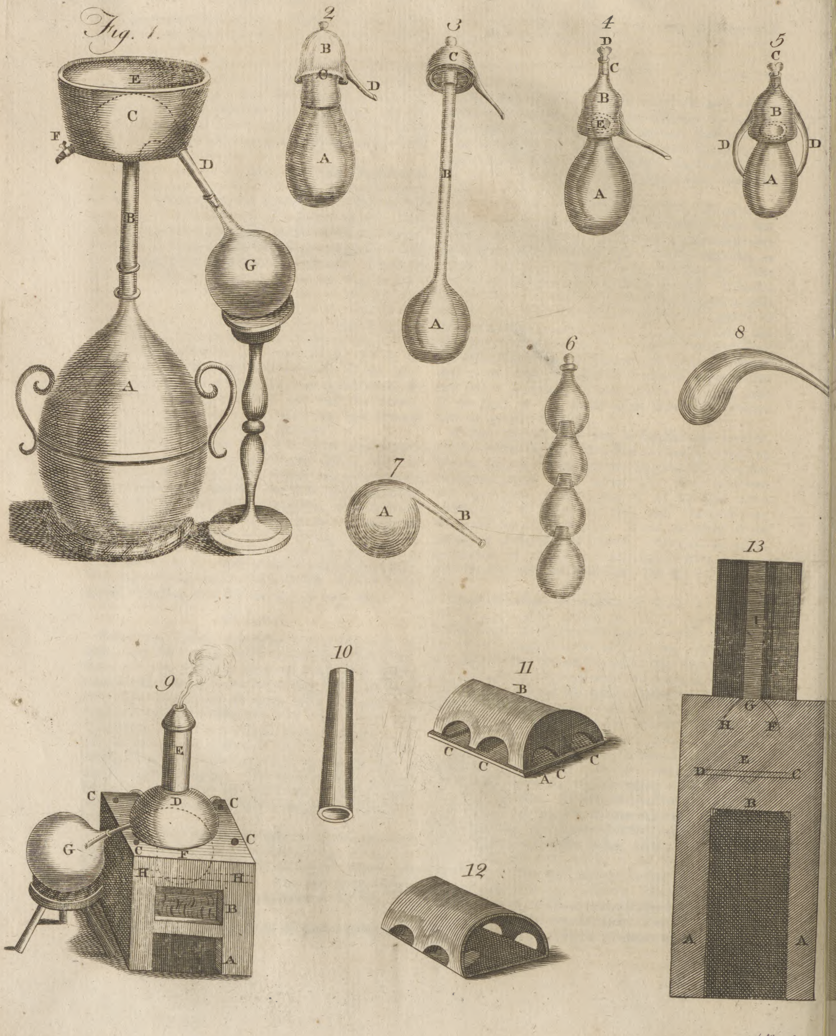
If it be required to confine vapours of a still more penetrating nature, it will be proper to employ a lute that quickly grows very hard; particularly a paste made with quick-lime and any sort of jelly, whether vegetable or animal; such as the white of an egg, stiff size, *&c.* This is an excellent lute, and not easily penetrated. It is also used to stop any cracks or fractures that happen to glass vessels. But it is not capable of resisting the vapours of mineral acid spirits, especially when they are strong and smoking: For that purpose it is necessary to incorporate the other ingredients thoroughly with fat earth softened with water; and even then it frequently happens that this lute is penetrated by acid vapours, especially those of the spirit of salt, which of all others are confined with the greatest difficulty.

In such cases its place may be supplied with another, which is called fat lute, because it is actually worked up with fat liquors. This lute is composed of a very fine cretaceous earth, called tobacco-pipe clay, moistened with equal parts of the drying oil of lint-seed, and a varnish made of amber and gum copal It must have the consistence of a stiff paste. When the joints of the vessels are closed up with this lute, they may, for greater security, be covered over with slips of linen smeared with the lute made of quick-lime and the white of an egg.

Chemical vessels are liable to be broken in an operation by other causes besides the sudden application of heat or cold. It frequently happens that the vapours of the matters, exposed to the action of fire, rush out with such impetuosity, and are so elastic, that finding no passage through the lute with which the joints of the vessels are closed, they burst the vessels themselves, sometimes with explosion and danger to the operator.

To prevent this inconvenience, it is necessary, that in every receiver there be a small hole, which being stopped only with a little lute may easily be opened and shut again as occasion requires. It serves for a vent-hole to let out the vapours, when the receiver begins to be too much crowded with them. Nothing but practice can teach the artist when it is requisite to open this vent. If he hits the proper time, the vapours commonly rush out with rapidity, and a considerable hissing noise; and the vent should be stopped again as soon as the hissing begins to grow faint. The lute employed to stop this small hole ought always to be kept so ductile, that by taking the figure of the hole exactly it may entirely stop it. Besides, if it should harden upon the glass, it would stick so fast, that it would be very difficult to remove it without breaking

Plate. LXIV



A.B. Sc.

ing the veſſel. This danger is eaſily avoided by making uſe of the fat lute, which continues pliant for a long time, when it is not expoſed to an exceſſive heat.

This way of ſtopping the vent-hole of the receiver has yet another advantage: For if the hole be of a proper width, as a line and half, or two lines, in diameter, then when the vapours are accumulated in too great a quantity, and begin to make a great effort againſt the ſides of the receiver, they puſh up the ſtopple, force it out, and make their way through the vent-hole: So that by this means the breaking of the veſſels may always be certainly prevented. But great care muſt be taken that the vapours be not ſuffered to eſcape in this manner, except when abſolute neceſſity requires it; for it is generally the very ſtrongeſt and moſt ſubtile part of a liquor which is thus diſſipated and loſt.

Heat being the chief cauſe that puts the elaſticity of the vapours in action, and prevents their condenſing into a liquor, it is of great conſequence in diſtillation that the receiver be kept as cool as poſſible. With this view a thick plank ſhould be placed between the receiver and the body of the furnace, to intercept the heat of the latter, and prevent its reaching the former. As the vapours themſelves riſe very hot from the diſtilling veſſel, they ſoon communicate their heat to the receiver, and eſpecially to its upper part, againſt which they ſtrike firſt. For this reaſon it is proper, that linen cloths dipt in very cold water be laid over the receiver, and frequently ſhifted. By this means the vapours will be conſiderably cooled, their elaſticity weakened, and their condenſation promoted.

By what hath been ſaid in this firſt part, concerning the properties of the principal agents in chemiſtry, the conſtruction of the moſt neceſſary veſſels and furnaces, and the manner of uſing them, we are ſufficiently prepared for proceeding directly to the operations, without being obliged to make frequent and long ſtops, in order to give the neceſſary explanations on thoſe heads.

Nevertheleſs, we ſhall take every proper occaſion to extend the theory here laid down, and to improve it by the addition of ſeveral particulars, which will find their places in our treatiſe of chemical operations.

Explanation *of* PLATE LXIV.

Fig. 1. *A copper alembic.* A, The cucurbit or body. B, the neck. C, The head. D, The beak, noſe, or ſpout. E, The refrigeratory, or cooler. F, Its cock. G, The receiver.

Fig. 2. *A glaſs alembic.* A, The cucurbit. B, The head. C, The gutter within the head. D, The beak.

Fig. 3. *A long-necked glaſs alembic.* A, The body of the matraſs. B, The neck. C, The head.

Fig. 4. *A glaſs alembic of one piece.* A, The cucurbit. B, The head. C, The aperture in the head. D, Its ſtopple. E, The mouth of the cucurbit.

Fig. 5. *A pelican.* A, The cucurbit. B, The head. C, The aperture in the head, with its ſtopple. D D, The two curved ſpouts.

Fig. 6. *A row of aludels.*

Fig. 7. *A retort.* A, Its bowl. B, Its neck.

Fig. 8. *An Engliſh retort.*

Fig. 9. *A reverberating furnace.* A, The aſh-hole door. B, The fire-place door. C C C C, Regiſters. D, The dome, or reverberatory. E, The conical funnel. F, The retort in the furnace. G, The receiver. H H, Iron bars to ſuſtain the retort.

Fig. 10. *The conical furnace by itſelf.*

Fig. 11. *Back-view of a muffle.* A, The bottom of the muffle. B, Its arch. C C C, Lateral apertures.

Fig. 12. *Fore-view of a muffle.*

Fig. 13. *A melting furnace.* A A, The baſe of the furnace. B, The aſh-hole. C D, The grate for the fire. E, The fire-place. F G H, Curvature of the inſide of the upper part of the fire-place. I, The ſhaft, or chimney.

Plate LXV. Fig. 1. *A cupelling furnace.* A, The aſh-hole. B B, Its ſliding doors. C, The fire-place. D D, Its ſliding doors. E F, Small apertures in the ſliders. G G, Holes for bars to bear the muffles. H H H, Iron braces in the fore-part of the furnace, which form grooves for the doors of the fire-place and aſh-hole to ſlide in. I, The upper pyramidal part of the furnace. K, An aperture therein for managing the coals. L, The opening at top. M, The pyramidal cover. N, The chimney, or end of the ſhaft, on which the conical funnel may be fitted. O O O O, Handles for moving the ſliding-doors. P P, Ears of the pyramidal covers.

PART II. PRACTICE of CHEMISTRY.

Of the Vitriolic Acid.

To extract Vitriol from the Pyrites.

Take any quantity you pleaſe of iron pyrites; leave them for ſome time expoſed to the air: They will crack, ſplit, loſe their brightneſs, and fall into powder. Put this powder into a glaſs cucurbit, and pour upon it twice its weight of hot water; ſtir the whole with a ſtick, and the liquor will grow turbid. Pour it while it is yet warm into a glaſs funnel lined with brown filtering paper; and having placed your funnel over another glaſs cucurbit, let the liquor drain into it. Pour more hot water on the powdered pyrites, filter as before, and ſo go on, every time leſſening the quantity of water, till that which comes off the pyrites appears to have no aſtringent vitriolic taſte.

twice its weight of hot water; evaporate and cryſtalliſe as before. Repeat the ſame operation till the liquor will yield no more cryſtals: it will then be very thick, and goes by the name of *mother of nitre.*

Earths and ſtones that have been impregnated with animal or vegetable juices ſuſceptible of putrefaction, and have been long expoſed to the air, but ſheltered from the ſun and rain, are thoſe which yield the greateſt quantity of nitre. But all ſorts of earths and ſtones are not equally fit to produce it. None is ever found in flints or ſands of a cryſtalline nature.

Some earths and ſtones abound ſo with nitre, that it effloreſces ſpontaneouſly on their ſurface, in the form of a cryſtalline down. This nitre may be collected with brooms, and accordingly has the name of *ſalt-petre ſweepings.* Some of this ſort is brought from India.

The proceſs by which our ſalt-petre makers extract nitre in quantities, out of rubbiſh and nitrous earths, is very nearly the ſame with that here ſet down: ſo that we ſhall not enter into a particular account of it. We ſhall only take notice of one thing, which it is of ſome conſequence to know; namely, that there is no nitrous earth which does not contain ſea ſalt alſo. The greateſt quantities of this ſalt are to be found in thoſe earths which have been drenched with urine or other animal excrements. Now, as the rubbiſh of old houſes in great cities is in this claſs, it comes to paſs, that when the ſalt-petre workers evaporate a nitrous lixivium drawn from that rubbiſh, as ſoon as the evaporation is brought to a certain pitch, a great many little cryſtals of ſea-ſalt form in the liquor, and fall to the bottom of the veſſel.

The ſalt-petre workers in France call theſe ſaline particles *the grain*, and take great care to ſeparate them from the liquor, (which as long as it continues hot keeps the ſalt-petre diſſolved) before they ſet it to cryſtalliſe. This fact ſeems a little ſingular, conſidering that ſea-ſalt diſſolves in water more eaſily than ſalt-petre, and cryſtalliſes with more difficulty.

In order to diſcover the cauſe of this phenomenon, we muſt recollect, firſt, that water can keep but a determinate quantity of any ſalt in ſolution, and that if water fully ſaturated with a ſalt be evaporated, a quantity of ſalt will cryſtalliſe in proportion to the quantity of water evaporated. Secondly, that thoſe ſalts which are the moſt ſoluble in water, particularly thoſe which run in the air, will diſſolve in cold and in boiling water equally; whereas much greater quantities of the other ſalts will diſſolve in hot and boiling water than in cold water. Theſe things being admitted, when we know that ſea-ſalt is one of the firſt ſort, and ſalt-petre of the ſecond, the reaſon why ſea-ſalt precipitates in the preparation of ſalt-petre appears at once. For,

When the ſolution of ſalt-petre and ſea ſalt comes to be evaporated to ſuch a degree that it contains as much ſea ſalt as it poſſibly can, this ſalt muſt begin to cryſtalliſe, and continue to do ſo gradually as the evaporation advances. But becauſe at the ſame time it does not contain as much ſalt-petre as it can hold, ſeeing it is capable of diſſolving a much greater quantity thereof when it is boiling hot than when it is cold, this laſt named ſalt will not cryſtalliſe ſo ſoon. If the evaporation were continued till the caſe of the ſalt-petre came to be the ſame with that of the ſea ſalt, then the ſalt-petre alſo would begin to cryſtalliſe gradually in proportion to the water evaporated, and the two ſalts would continue cryſtalliſing promiſcuouſly together: but it is never carried ſo far; nor is it ever neceſſary; for as the water cools it becomes more and more incapable of holding in ſolution the ſame quantity of ſalt-petre as when it was boiling hot.

And then comes the very reverſe, with regard to the cryſtalliſing of the two ſalts; for then the ſalt-petre ſhoots, and not the ſea-ſalt. The reaſon of this fact alſo is founded on what has juſt been ſaid. The ſea-ſalt, of which cold water will diſſolve as much as boiling water, and which owed its cryſtalliſing before only to the evaporation, now ceaſes to cryſtalliſe as ſoon as the evaporation ceaſes; while the ſalt-petre, which the water kept diſſolved only becauſe it was boiling hot, is forced to cryſtalliſe merely by the cooling of the water.

When the ſolution of ſalt-petre has yielded as many cryſtals of that ſalt as it can yield by cooling, it is again evaporated, and being then ſuffered to cool yields more cryſtals And thus they continue evaporating and cryſtalliſing till the liquor will afford no more cryſtals. It is plain, that as the ſalt-petre cryſtalliſes, the proportion of ſea-ſalt to the diſſolving liquor increaſes; and as a certain quantity of water evaporates alſo during the time employed in cryſtalliſing the ſalt-petre, a quantity of ſea-ſalt, proportioned to the water ſo evaporating, muſt cryſtalliſe in that time: and this is the reaſon why ſalt-petre is adulterated with a mixture of ſea-ſalt. It likewiſe follows, that the laſt cryſtals of nitre, obtained from a ſolution of ſalt-petre and ſea-ſalt, contain much more ſea-ſalt than the firſt.

From all that has been ſaid concerning the cryſtalliſation of ſalt-petre and ſea-ſalt, it is eaſy to deduce the proper way of purifying the former of theſe two ſalts from a mixture of the latter. For this purpoſe the ſalt-petre to be refined need only be diſſolved in fair water. The proportion between the two ſalts in this ſecond ſolution is very different from what it was in the former; for it contains no more ſea-ſalt than what had cryſtalliſed along with the ſalt-petre under favour of the evaporation, the reſt having been left diſſolved in the liquor that refuſed to yield any more nitrous cryſtals.

As there is therefore a much greater quantity of ſalt-petre than of ſea-ſalt in this ſecond ſolution, it is eaſy to evaporate it to ſuch a degree that a great deal of ſalt-petre ſhall cryſtalliſe, while much more of the water muſt neceſſarily be evaporated before any of the ſea-ſalt will cryſtalliſe.

However, the ſalt-petre is not yet entirely freed from all mixture of ſea ſalt by this firſt purification; for the the cryſtals obtained from this liquor, in which ſea-ſalt is diſſolved, are ſtill incruſted, and, as it were, infected therewith: hence it comes, that, to refine the ſalt-petre thoroughly, theſe cryſtalliſations muſt be repeated four or five times.

The ſalt-petre men commonly content themſelves with cryſtalliſing it thrice, and call the produce ſalt-petre of the firſt, ſecond, or third ſhoot, according to the number of cryſtalliſations it has undergone. But their beſt

refined

refined salt-petre, even that of the third shooting, is not yet sufficiently pure for chemical experiments that require much accuracy: so that it must be further purified, but still by the same method.

The nitrous acid is not pure in the earths and stones from which it is extracted. It is combined partly with the very earth in which it is formed, and partly with the volatile alkali produced by the putrefaction of the vegetable or animal matters that concurred to its generation. A fixed alkali and quick-lime are added to the lixivium of a nitrous earth, in order to decompose the nitrous salts formed in that earth, and to separate the acid from the volatile alkali and the absorbent earth with which it is united: thence comes that copious sediment which appears in the lye at the beginning of the evaporation. These matters form with that acid a true nitre, much more capable than the original nitrous salts of crystallisation, detonation, and the other properties which are essential thereto. The basis of nitre is therefore a fixed alkali mixed with a little lime.

The mother of nitre, which will yield no more crystals, is brown and thick: by evaporation over a fire it is further inspissated, and becomes a dry, solid body; which however being left to itself soon gives, and runs into a liquor. This water still contains a good deal of nitre, sea-salt, and the acids of these salts united with an absorbent earth. It contains moreover a great deal of a fat, viscid matter, which prevents its crystallising.

All saline solutions in general, after having yielded a certain quantity of crystals, grow thick, and refuse to part with any more, though they still contain much salt. They are all called *mother-waters*, as well as that which hath yielded nitre. The mother-waters of different salts may prove the subjects of curious and useful enquiries.

If a fixed alkali be mixed with the mother of nitre, a copious white precipitate immediately falls, which being collected and dried is called *magnesia*. This precipitate is nothing but the absorbent earth that was united with the nitrous acid, together with a good deal of the lime that was added, and was also united with that acid, from which they are now separated by the fixed alkali, according to the usual laws of affinities or elective attractions.

The vitriolic acid poured upon mother of nitre causes many acid vapours to rise, which are a compound of the nitrous and marine acids, that is, an *aqua regia*. On this occasion also there falls a large quantity of a white powder, which is still called *magnesia*; yet it differs from the former in that it is not, like it, a pure absorbent earth, but combined with the vitriolic acid.

An *aqua regis* may also be drawn from nitrous earths by the force of fire only, without the help of any additament.

To decompose Nitre by means of the Phlogiston. Nitre fixed by Charcoal. Clyssus *of Nitre.* Sal Polychrestum.

Take the purest salt-petre in powder; put it into a large crucible, which it may but half fill; set the crucible in a common furnace, and surround it with coals. When it is red-hot the nitre will melt, and become as fluid as water. Then throw into the crucible a small quantity of charcoal-dust: the nitre and the charcoal will immediately deflagrate with violence; and a great commotion will be raised, accompanied with a considerable hissing, and abundance of black smoke. As the charcoal wastes, the detonation will abate, and cease entirely as soon as the coal is quite consumed.

Then throw into the crucible the same quantity of charcoal-dust as before, and the same phenomena will be repeated. Let this coal also be consumed: then add more, and go on in the same manner till you can excite no further deflagration; always observing to let the burning coal be entirely consumed before you add any fresh. When no deflagration ensues, the matter contained in the crucible will have lost much of its fluidity.

Nitre will not take fire, unless the inflammable matter added to it be actually burning, or the nitre itself red hot, and so thoroughly ignited as immediately to kindle it. Therefore, if you would procure the detonation of nitre with charcoal, and make use of cold charcoal, as in the process, the nitre in the crucible must be red hot, and in perfect fusion: but you may also use live coals, and then the nitre need not be red-hot.

The matter remaining in the crucible after the operation, is a very strong fixed alkali. Being exposed to the air, it quickly extracts the moisture thereof, and runs into a liquor. It is called *alkalizated nitre*, or to distinguish it from nitre alkalizated by other inflammable matters, *nitre fixed by charcoal.*

The nitrous acid is not only dissipated during the deflagration of the nitre, but is even destroyed, and perfectly decomposed. The smoke that rises during the operation has not the least odour of an acid.

In order to collect the vapours discharged by the deflagration of nitre, fit to a tubulated earthen retort two or three large adopters: set the retort in a furnace; and under it make a fire sufficient to keep its bottom moderately red. Then take a small quantity, two or three pinches for example, of a mixture of three parts of nitre with one of charcoal-dust, and drop it into the retort through its tube, which must be uppermost, and immediately stopped close. A detonation instantly ensues, and the vapours that rise from the inflammed mixture of nitre and charcoal, passing out through the neck of the retort into the adopters,, circulate therein for a while, and at last condense into a liquor.

When the detonation is over, and the vapours condensed, or nearly so, drop into the retort another equal quantity of the mixture; and repeat this till you find there is liquor enough in the recipients to be examined with ease and accuracy. This liquor is almost insipid, and shews no tokens of acidity; or at most but very slight ones. It is called *clyssus* of nitre.

Nitre is also decomposed and takes fire by the means of sulphur; but the circumstances and the result differ widely from those produced therewith by charcoal or any other inflammable body.

Nitre deflagrates with sulphur on account of the phlogiston which the latter contains. If one part of sulphur be mixed with two or three parts of nitre, and the mixture thrown by little and little into a red-hot crucible, upon

upon every projection there arises a detonation accompanied with a vivid flame.

The vapours discharged on this occasion have the mingled smell of a sulphureous spirit and spirit of nitre; and if they be collected by means of a tubulated retort, and such an apparatus of vessels as was used in the preceding experiment, the liquor contained in the recipients is found to be an actual mixture of the acid of sulphur, the sulphureous spirit, and the acid of nitre; the first being of greater quantity than the other two, and the second greater than the last.

Nor is the remainder after detonation a fixed alkali, as in the former experiments; but a neutral salt, consisting of the acid of sulphur combined with the alkali of nitre; a sort of vitriolated tartar, known in medicine by the name of *sal polychrestum*.

To decompose Nitre by means of the Vitriolic Acid. The Smoking Spirit of Nitre. Sal de duobus. *The Purification of Spirit of Nitre.*

Take equal parts of well purified nitre and green vitriol: dry the nitre thoroughly, and bruise it to a fine powder. Calcine the vitriol to redness: reduce it likewise to a very fine powder; and mingle these two substances well together. Put the mixture into an earthen long neck, or a good glass retort coated, of such a size that it may be but half full.

Set this vessel in a reverberating furnace covered with its dome; apply a large glass receiver, having a small hole in its body, stopped with a little lute. Let this receiver be accurately luted to the retort with the fat lute, and the joint covered with a slip of canvas smeared with lute made of quick-lime and the white of an egg. Heat the vessels very gradually. The receiver will soon be filled with very dense red vapours, and drops will begin to distill from the nose of the retort.

Continue the distillation, increasing the fire a little when you observe the drops to follow each other but slowly, so that above two thirds of a minute passes between them; and, in order to let out the redundant vapours, open the small hole in the receiver from time to time. Towards the end of the operation raise the fire so as to make the retort red. When you find that, even when the retort is red-hot, nothing more comes over, unlute the receiver, and without delay pour the liquor it contains into a crystal bottle, and close it with a crystal stopple rubbed in its neck with emery. This liquor will be of a reddish yellow colour, smoking exceedingly, and the bottle containing it will be constantly filled with red fumes like those observed in the receiver.

By the process here delivered, a very strong, perfectly dephlegmated, and vastly smoking spirit of nitre is obtained.

When the operation is over, you will find a red mass at the bottom of the retort, cast as it were in a mould. This is a neutral salt of the nature of vitriolated tartar, resulting from the union of the acid of the vitriol with the alkaline basis of the nitre.

The ferruginous basis of the vitriol, which is mixed with this salt, gives it the red colour. To separate it therefrom, you must pulverise it, dissolve it in boiling water, and filter the solution several times through brown paper; because the ferruginous earth of the vitriol is so fine, that some of it will pass through the first time. When the solution is very clear, and deposites no sediment, let it be set to shoot, and it will yield crystals of vitriolated tartar; to which chemists have given the peculiar title of *sal de duobus*.

Nitre may also be decomposed, and its acid obtained, by the interposition of any of the other vitriols, alums, gypsums, boles, clays; in short, by means of any compound in which the vitriolic acid is found, provided it have not a fixed alkali for its basis.

The distillers of *aqua fortis*, who make large quantities at a time, and who use the least chargeable methods, do their business by the means of earths impregnated with the vitriolic acid; such as clays and boles. With these earths they accurately mix the nitre from which they intend to draw their spirit: this mixture they put into large oblong earthen pots, having a very short curved neck, which enters a recipient of the same matter and form. These vessels they place in two rows opposite to each other in long furnaces, and cover them over with bricks cemented with Windsor-loam, which serves for a reverberatory: then they light the fire in the furnace, making it at first very small, only to warm the vessels; after which they throw in wood, and raise the fire till the pots grow quite red-hot, in which degree they keep it up till the distillation is entirely finished.

Most experiments require the spirit of nitre to be absolutely pure; and if it be intended for such, it must be perfectly cleansed from the vitriolic taint.

This is easily effected by mixing your spirit with very pure nitre, and distilling it a second time. The vitriolic acid, with which this spirit of nitre is adulterated, coming in contact with a great quantity of undecomposed nitre, unites with its alkaline basis, and expels a proportionable quantity of the nitrous acid.

Of the Marine Acid.

To extract Sea-salt from Sea-water, and from Brine-springs. Epsom Salt.

Filter the salt-water from which you intend to extract the salt; evaporate it by boiling, till you see on its surface a dark pellicle: this consists wholly of little crystals of salt just beginning to shoot: now slacken the fire, that the brine may evaporate more slowly, and without any agitation. The crystals, which at first were very small, will become larger, and form hollow truncated pyramids, the apices whereof will point downwards, and their bases be even with the surface of the liquor.

These pyramidal crystals are only collections of small cubical crystals concreted into this form. When they have acquired a certain magnitude they fall to the bottom of the liquor. When they come to be in such heaps as almost to reach the surface of the liquor, decant it from them, and continue the evaporation till no more crystals of sea-salt will shoot

The acid of sea salt is scarce ever found either in sea-water or in the earth, otherwise than united with a fixed alkali

alkali of a particular kind, which is its natural basis; and consequently it is in the form of a neutral salt. This salt is plentifully dissolved in the waters of the ocean, and when obtained therefrom bears the name of *sea-salt*. It is also found in the earth in vast crystalline masses, and is then called *sal-gem*; so that sea-salt and sal-gem are but one and the same sort of salt differing very little from each other, except as to the places where they are found.

In the earth are also found springs and fountains, whose waters are strong brines, a great deal of sea-salt being dissolved in them. These springs either rise directly from the sea, or run through some mines of salgem, of which they take up a quantity in their passage.

As the same, or at least nearly the same quantity of sea-salt will continue dissolved in cold water as boiling water will take up, it cannot shoot, as nitre does, by the mere cooling of the water in which it is dissolved: it crystallises only by the means of evaporation, which continually lessens the proportion of the water to the salt; so that it is always capable of containing just so much the less sea-salt the more there is crystallised.

The brine should not boil after you perceive the pellicle of little crystals beginning to form on its surface; for the calmness of the liquor allows them to form more regularly, and become larger. Nor after this should the evaporation be hurried on too fast; for a saline crust would form on the liquor, which, by preventing the vapours from being carried off, would obstruct the crystallisation.

If the evaporation be continued after the liquor ceases to yield any crystals of sea-salt, other crystals will be obtained of an oblong four-sided form, which have a bitter taste, and are almost always moist. This sort of salt is known by the name of *Epsom salt*, which it owes to a salt spring in England, from the water of which it was first extracted. This salt, or rather saline compound, is a congeries of Glauber's salt and sea-salt, in a manner confounded together, and mixed with some of the mother of sea-salt, in which is contained a kind of bituminous matter. These two neutral salts, which constitute the Epsom salt, may be easily separated from each other, by means of crystallisation only. Epsom salt is purgative and bitter; and therefore named *sal catharticum amarum*, or bitter purging salts.

There are different methods used in great works for obtaining sea-salt out of water in which it is dissolved. The simplest and easiest is that practised in France, and in all those countries which are not colder. On the seashore they lay out a sort of broad shallow pits, pans, or rather ponds, which the sea fills with the tide of flood. When the ponds are thus filled, they stop their communication with the sea, and leave the water to evaporate by the heat of the sun; by which means all the salt contained in it necessarily crystallises. These pits are called *salt ponds*. Salt can be made in this way in the summertime only, at least in France, and other countries of the same temperature; for during the winter, when the sun has less power, and rains are frequent, this method is not practicable.

For this reason, as it often rains in the province of Normandy, the inhabitants take another way to extract salt from sea-water. The labourers employed for this purpose raise heaps of sand on the shore, so that the tide waters and drenches them when it flows, and leaves the sand dry when it ebbs. During the interval between two tides of flood the sun and the air easily carry off the moisture that was left, and so the sand remains impregnated with all the salt that was contained in the evaporated water. Thus they let it acquire as much salt as it can by several returns of flood, and then wash it out with fresh water, which they evaporate over a fire in leaden boilers.

To obtain the salt from brine-springs, the water need only be evaporated: but as several of these springs contain too little salt to pay the charges that would be incurred, if the evaporation were effected by the force of fire only, the manufacturers have fallen upon a less expensive method of getting rid of the greatest part of the water, and preparing the brine for crystallisation, in much less time, and with much less fire, than would otherwise have been necessary.

The method consists in making the water fall from a certain height on a great many small spars of wood, which divide it into particles like rain. This is performed under sheds open to all the winds, which pass freely through this artificial shower. By this means the water presents to the air a great extent of surface, being indeed reduced almost entirely to surface, and the evaporation is carried on with great ease and expedition. The water is raised by pumps to the height from which it is intended to fall.

Experiments concerning the decomposition of Sea-salt, by means of the phlogiston. Kunckel's *Phosphorus.*

" Of pure urine that has fermented five or six days take a quantity in proportion to the quantity of phosphorus you intend to make: it requires about one third part of a hogshead to make a dram of phosphorus. Evaporate it in iron pans, till it become clotted, hard, black, and nearly like chimney-soot; at which time it will be reduced to about a sixtieth part of its original weight before evaporation.

" When the urine is brought to this condition, put it in several portions into so many iron pots, under which you must keep a pretty brisk fire so as to make their bottoms red, and stir it incessantly till the volatile salt and the fetid oil be almost wholly dissipated, till the matter cease to emit any smoke, and till it smell like peach-blossoms. Then put out the fire, and pour on the matter, which will now be reduced to a powder, somewhat more than twice its weight of warm water. Stir it about in this water, and leave it to soak therein for twenty-four hours. Pour off the water by inclination; dry the drenched matter, and pulverise it. The previous calcination carries off from the matter about a third of its weight, and the lixiviation washes out half the remainder.

" With what remains thus calcined, washed, and dried, mix half its weight of gravel, or yellow free-stone rasped, having sifted out and thrown away all the finest particles. River-sand is not proper on this occasion, because it flies in a hot fire. Then add to this mixture

mixture a ſixteenth part of its weight of charcoal, made of beech, or of any other wood except oak, becauſe that alſo flies. Moiſten the whole with as much water as will bring it to a ſtiff paſte, by working and kneading it with your hands: Now introduce it into your retort, taking care not to daub its neck. The retort muſt be of the beſt earth, and of ſuch a ſize, that when your matter is in it, a full third thereof ſhall ſtill be empty.

"Place your retort, thus charged, in a reverberating furnace, ſo proportioned, that there may be an interval of two inches all round between the ſides of the furnace and the bowl of the retort, even where it contracts to form the neck, which ſhould ſtand inclined at an angle of ſixty degrees. Stop all the apertures of the furnace, except the doors of the fire-place and aſh-hole.

"Fit on to the retort a large glaſs ballon two thirds full of water, and lute them together, as in diſtilling the ſmoking ſpirit of nitre. In the hinder part of this ballon, a little above the ſurface of the water, a ſmall hole muſt be bored. This hole is to be ſtopped with a ſmall peg of birch-wood, which muſt ſlip in and out very eaſily, and have a ſmall knob to prevent its falling into the ballon. This peg is to be pulled out from time to time, that by applying the hand to the hole it may be known whether the air rarefied by the heat of the retort, iſſues out with too much or too little force.

"If the air ruſhes out with too much rapidity, and with a hiſſing noiſe, the door of the aſh-hole muſt be entirely ſhut, in order to ſlacken the fire. If it do not ſtrike pretty ſmartly againſt the hand, that door muſt be opened wider, and large coals thrown into the fire-place to quicken the fire immediately.

"The operation uſually laſts four and twenty hours; and the following ſigns ſhew that it will ſucceed, provided the retort reſiſt the fire.

"You muſt begin the operation with putting ſome unlighted charcoal in the aſh-hole, and a little lighted charcoal at the door thereof, in order to warm the retort very ſlowly. When the whole is kindled, puſh it into the aſh-hole, and cloſe the door thereof with a tile. This moderate heat brings over the phlegm of the mixture. The ſame degree of heat muſt be kept up four hours, after which ſome coals may be laid on the grate of the fire-place, which the fire underneath will kindle by degrees. With this ſecond heat brought nearer the retort, the ballon grows warm, and is filled with white vapours which have the ſmell of fetid oil. In four hours after, this veſſel will grow cool and clear; and then you muſt open the door of the aſh-hole one inch, throw freſh coals into the fire-place every three minutes, and every time ſhut the door of it, leſt the cold air from without ſhould ſtrike againſt the bottom of the retort and crack it

"When the fire has been kept up to this degree for about two hours, the inſide of the ballon begins to be netted over with a volatile ſalt of a ſingular nature, which cannot be driven up but by a very violent fire, and which ſmells pretty ſtrong of peach-kernels. Care muſt be taken that this concrete ſalt do not ſtop the little hole in the ballon: for in that caſe it would burſt, the retort being then red-hot, and the air exceedingly rarefied. The water in the ballon, being heated by the vicinity of the furnace, exhales vapours which diſſolve this ſprigged ſalt, and the ballon clears up in half an hour after it has ceaſed riſing.

"In about three hours from the firſt appearance of this ſalt, the ballon is again filled with new vapours, which ſmell like ſal ammoniac thrown upon burning coals. They condenſe on the ſides of the receiver into a ſalt which is not branched like the former, but appears in long perpendicular ſtreaks, which the vapours of the water do not diſſolve. Theſe white vapours are the fore-runners of the phoſphorus; and a little before they ceaſe to riſe they loſe their firſt ſmell of ſal ammoniac, and acquire the odour of garlick.

"As they aſcend with great rapidity, the little hole muſt be frequently opened, to obſerve whether the hiſſing be not too ſtrong; for in that caſe it would be neceſſary to ſhut the door of the aſh-hole quite cloſe. Theſe white vapours continue two hours. When you find they ceaſe riſing, make a ſmall paſſage through the dome, by opening ſome of its regiſters, that the flame may juſt begin to draw. Keep up the fire in this mean ſtate till the firſt volatile phoſphorus begin to appear.

"This appears in about three hours after the white vapours firſt begin to riſe. In order to diſcover it, pull out the little birchen peg once every minute, and rub it againſt ſome hot part of the furnace, where it will leave a trail of light, if there be any phoſphorus upon it.

"Soon after you obſerve this ſign, there will iſſue out through the little hole of the ballon a ſtream of bluiſh light, which continues of a greater or ſhorter extent to the end of the operation. This ſtream or ſpout of light does not burn. If you hold your finger againſt it for twenty or thirty ſeconds, the light will adhere to it; and if you rub that finger over your hand, the light will beſmear it, and render it luminous.

"But from time to time this ſtreamer darts out to the length of ſeven or eight inches, ſnapping and emitting ſparks of fire; and then it burns all combuſtible bodies that come in its way. When you obſerve this, you muſt manage the fire very warily, and ſhut the door of the aſh-hole quite cloſe, yet without ceaſing to throw coals into the fire-place every two minutes.

"The volatile phoſphorus continues two hours; after which the little ſpout of light contracts to the length of a line or two: And now is the time for puſhing your fire to the utmoſt: Immediately ſet the door of the aſh-hole wide open, throw billets of wood into it, unſtop all the regiſters of the reverberatory, ſupply the fire-place with large coals every minute: In ſhort, for ſix or ſeven hours all the inſide of the furnace muſt be kept of a white heat, ſo that the retort ſhall not be diſtinguiſhable.

"In this fierce extremity of heat the true phoſphorus diſtills like an oil, or like melted wax: One part thereof floats on the water in the recipient, the other falls to the bottom. At laſt the operation is known to be quite over when the upper part of the ballon, in which the volatile phoſphorus appears condenſed in a blackiſh film, begins to grow red: For this ſhews that the phoſphorus is burnt where the red ſpot appears. You muſt now ſtop all the regiſters, and ſhut all the doors of the furnace, in order to ſmother the fire; and then cloſe up the little hole in

in the ballon with fat lute or bees-wax. In this condition the whole muſt be left for two days; becauſe the veſſels muſt not be ſeparated till they are perfectly cold, leſt the phoſphorus ſhould take fire.

"As ſoon as the fire is out, the ballon, which is then in the dark, preſents a moſt agreeable object: All the empty part thereof above the water ſeems filled with a beautiful blue light; which continues for ſeven or eight hours, or as long as the ballon keeps warm, never diſappearing till it is cooled.

"When the furnace is quite cold, take out the veſſels, and ſeparate them from each other as neatly as poſſible. With a linen cloth wipe away all the black ſtuff you find in the mouth of the ballon; for if that filth ſhould mix with the phoſphorus, it would hinder it from being tranſparent when moulded. This muſt be done with great expedition: After which pour into the ballon two or three quarts of cold water, to accelerate the precipitation of the phoſphorus that ſwims at top. Then agitate the water in the ballon, to rinſe out all the phoſphorus that may ſtick to the ſides; pour out all the water thus ſhaken and turbid, into a very clean earthen pan, and let it ſtand till it grows clear. Then decant this firſt uſeleſs water, and on the blackiſh ſediment left at the bottom of the pan pour ſome boiling water to melt the phoſphorus; which thereupon unites with the fuliginous matter, or volatile phoſphorus, that precipitated with it, both together forming a maſs of the colour of ſlate. When this water in which you have melted the phoſphorus is cool enough, take out the phoſphorus, throw it into cold water, and therein break it into little bits in order to mould it.

"Then take a matras, having a long neck ſomewhat wider next the body than at its mouth: Cut off half the body, ſo as to make a funnel of the neck-part, the ſmaller end of which muſt be ſtopped with a cork. The firſt mould being thus prepared, plunge it endwiſe, with its mouth uppermoſt, in a veſſel full of boiling water, and fill it with that water. Into this funnel throw the little bits of your ſlate-like maſs, which will melt again in this hot water, and fall ſo melted to the bottom of the tube. Stir this melted matter with an iron wire, to promote the ſeparation of the phoſphorus from the fuliginous matter with which it is fouled, and which, being leſs ponderous than the phoſphorus, will gradually riſe above it towards the upper part of the cylinder.

"Keep the water in the veſſel as hot as at firſt, till on taking out the tube you ſee the phoſphorus clean and tranſparent. Let the clear tube cool a little, and then ſet it in cold water, where the phoſphorus will congeal as it cools. When it is perfectly congealed, pull out the cork, and with a ſmall rod near as big as the tube, puſh the cylinder of phoſphorus towards the mouth of the funnel, where the feculency lies. Cut off the black part of the cylinder, and keep it apart: For when you have got a quantity thereof, you may melt it over again in the ſame manner, and ſeparate the clean phoſphorus which it ſtill contains. As to the reſt of the cylinder which is clean and tranſparent, if you intend to mould it into ſmaller cylinders, you may cut it in ſlices, and melt it again by the help of boiling water in glaſs tubes of ſmaller dimenſions."

It is proper to obſerve, in the firſt place, that one of the moſt uſual cauſes of miſcarriage in this operation is a defect of the requiſite qualities in the retort employed. It is abſolutely neceſſary to have that veſſel made of the beſt earth, and ſo well made that it ſhall be capable of reſiſting the utmoſt violence of fire, continued for a very long time.

We ſhall, in the ſecond place, obſerve with M. Hellot, "that, before you ſet your retort in the furnace, it is proper to make an eſſay of your matter, to ſee if there be reaſon to hope for ſucceſs. For this purpoſe put about an ounce thereof into a ſmall crucible, and heat it till the veſſel be red. The mixture, after having ſmoked, ought to chop and crack without puffing up, or even riſing in the leaſt. From theſe cracks will iſſue undulated flames, white and bluiſh, darting upwards with rapidity. This is the firſt volatile phoſphorus, which occaſions all the danger of the operation. When theſe firſt flaſhes are over, increaſe the heat of your matter by laying a large live coal upon the crucible. You will then ſee the ſecond phoſphorus, like a luminous, ſteady vapour, of a colour inclining to violet, covering the whole ſurface of the matter: It continues for a very long time, and diffuſes a ſmell of garlick, which is the diſtinguiſhing odour of the phoſphorus you are ſeeking.

"When this luminous vapour is entirely gone, pour the red-hot matter out of the crucible upon an iron plate. If you do not find one drop of ſalt in fuſion, but that, on the contrary, the whole falls readily into powder, it is a proof that your matter was ſufficiently lixiviated, and that it contains no more fixed ſalt, or ſea-ſalt, if you will, than is requiſite. If you find on the plate a drop of ſalt coagulated, it ſhews that there is too much left in it, and that there is danger of your miſcarrying in the operation; becauſe the redundant ſalt would corrode and eat through the retort. In this caſe your matter muſt be waſhed again, and then ſufficiently dried."

The furnace muſt be ſo conſtructed, that within a narrow compaſs it may give a heat at leaſt equal to that of a glaſs-houſe furnace, or rather greater, eſpecially during the laſt ſeven or eight hours of the operation. M. Hellot, in his Memoir, gives an exact deſcription of ſuch a furnace.

"As certain accidents may happen in the courſe of the operation, ſome precautions are to be taken againſt them. For inſtance, if the ballon ſhould break while the phoſphorus is diſtilling, and any of it ſhould fall on combuſtible bodies, it would ſet them on fire, and probably burn the laboratory, becauſe it is not to be diſtinguiſhed without the greateſt difficulty. The furnace muſt therefore be erected under ſome vault, or upon a bed of brick-work, raiſed under ſome chimney that draws well: Nor muſt any furniture or utenſil of wood be left near it. If a little flaming phoſphorus ſhould fall on a man's legs or hands, in leſs than three minutes it would burn its way to the very bone. In ſuch a caſe nothing but urine will ſtop its progreſs.

"If the retort crack while the phoſphorus is diſtilling, there

there is an unſucceſsful end of your operation. It is eaſy to perceive this by the ſtink of garlick which you will ſmell about the furnace; and moreover, the flame that iſſues through the apertures of the reverberatory will be of a beautiful violet colour. The acid of ſea-ſalt always gives this colour to the flame of ſuch matters as are burnt along with it. But if the retort break before the phoſphorus hath made its appearance, its contents may be ſaved by throwing a number of cold bricks into the fire-place, and upon them a little water to quench the fire at once." All theſe uſeful obſervations we owe alſo to M. Hellot.

The phoſphorus here deſcribed was firſt diſcovered by a citizen of Hamburg named Brandt, who worked upon urine in ſearch of the philoſopher's ſtone. Afterwards two other ſkilful chemiſts, who knew nothing more of the proceſs than that phoſphorus was obtained from urine, or in general from the human body, likewiſe endeavoured to diſcover it; and each of them ſeparately did actually make the diſcovery. Theſe two chemiſts were Kunckel and Boyle.

The former perfected the diſcovery, and found out a method of making it in conſiderable quantities at a time; which occaſioned it to be called *Kunckel's phoſphorus*. The other, who was an Engliſh gentleman, had not time to bring his diſcovery to perfection, and contented himſelf with lodging a voucher of his having diſcovered it in the hands of the ſecretary of the Royal Society of London, who gave him a certificate thereof.

" Though Brandt, who had before this ſold his ſecret to a chemiſt named Krafft, ſold it afterwards to ſeveral other perſons, and even at a very low rate: and though Mr Boyle publiſhed the proceſs for making it; yet it is extremely probable that both of them kept in their own hands the maſter-key; I mean, *the particular management neceſſary to make the operation ſucceed:* For till Kunckel found it out, no other chemiſt ever made any conſiderable quantity thereof, except Mr Godfrey Hanwitz, an Engliſh chemiſt, to whom Mr Boyle revealed the whole myſtery.

" And thus it came to paſs, that, after Kunckel and Boyle died, M. Godfrey Hankwitz was the only chemiſt that could ſupply Europe therewith; on which account it is likewiſe very well known by the name of *Engliſh phoſphorus*."

Almoſt all the chemiſts conſider phoſphorus as a ſubſtance conſiſting of the acid of ſea-ſalt combined with the phlogiſton, in the ſame manner as ſulphur conſiſts of the vitriolic acid combined with the phlogiſton. This opinion is founded on the following principles.

Firſt, urine abounds with ſea-ſalt, and contains alſo a great deal of phlogiſton: now theſe are the ingredients of which they conjecture phoſporus to be compoſed.

Secondly, phoſphorus has many of the properties of ſulphur; ſuch as being ſoluble in oils; melting with a gentle heat; being very combuſtible; burning without any ſoot; giving a vivid and bluiſh flame; and laſtly, leaving an acid liquor when burnt: ſenſible proofs that it differs from ſulphur in nothing but the nature of its acid.

Thirdly, this acid of phoſphorus, being mixed with a ſolution of ſilver in ſpirit of nitre, precipitates the ſilver; and this precipitate is a true *luna cornea*, which appears to be more volatile even than the common ſort. This fact proves more inconteſtably that the acid of phoſphorus is of the ſame nature with that of ſea-ſalt.

Fourthly, M. Stahl obſerves, that if ſea-ſalt be caſt on live coals, they inſtantly burn with great activity; that they emit a vivid flame, and are much ſooner conſumed than if none of this ſalt had touched them; that ſea-ſalt in ſubſtance, which will bear the violence of fire a conſiderable time when fuſed in a crucible, without ſuſtaining any ſenſible diminution, yet evaporates very quickly, and is reduced to white flowers, by the immediate contact of burning coals; and laſtly, that the flame which riſes on this occaſion is of a blue colour inclining to violet, eſpecially if it be not thrown directly on the coals themſelves, but kept in fuſion amidſt burning coals, in a crucible ſo placed that the vapour of the ſalt may join with the inflamed phlogiſton as it riſes from the coals.

Theſe experiments of Mr Stahl's prove, that the phlogiſton acts upon the acid of ſea-ſalt, even while it is combined with its alkaline baſis. The flame that appears on this occaſion may be conſidered as an imperfect phoſphorus: and indeed its colour is exactly like that of phoſphorus.

All the facts above related evince, that the acid of phoſphorus is akin to that of ſea-ſalt; or rather, that it is the very ſame. But there are other facts which prove, that this acid undergoes ſome change at leaſt, ſome peculiar preparation, before it enters into the compoſition of a true phoſphorus; and that, when extricated therefrom by burning, it is not a pure acid of ſea-ſalt, but is ſtill adulterated with a mixture of ſome other ſubſtance, which makes it conſiderably different from that acid. For theſe obſervations we are obliged to M. Marggraff.

M. Marggraff hath alſo publiſhed a proceſs for making phoſphorus, and aſſures us, that by means thereof we may obtain in leſs time, with leſs heat, leſs trouble, and leſs expence, a greater quantity of phoſphorus than by any other method. His operation is this:

He takes two pounds of ſal ammoniac in powder, which he mixes accurately with four pounds of minium. This mixture he puts into a glaſs retort, and with a graduated fire draws off a very ſharp, volatile, urinous ſpirit.

We obſerved in Part I. that ſome metallic ſubſtances have the property of decompoſing ſal ammoniac, and ſeparating its volatile alkali. Minium, which is a calx of lead, is one of thoſe metallic ſubſtances. In this experiment it decompoſes the ſal ammoniac, and ſeparates its volatile alkali: what remains in the retort is a combination of the minium with the acid of ſal ammoniac, which is well known to be the ſame with the marine acid; and conſequently the reſidue of this operation is a ſort of *plumbum corneum*.

The quantity thereof is four pounds eight ounces. Of this he mixes three pounds with nine or ten pounds of urine, that has ſtood putrefying for two months, evaporated to the conſiſtence of honey. Theſe he mixes by

by little and little in an iron pan over the fire, ſtirring the mixture from time to time. Then he adds half a pound of charcoal duſt, and evaporates the matter, kept continually ſtirring, till the whole be brought to a black powder. He next diſtills the mixture in a glaſs retort with degrees of fire, which he raiſes towards the end ſo as to make the retort red-hot, in order to expel all the urinous ſpirit, ſuperfluous oil, and ammoniacal ſalt. The diſtillation being finiſhed, there remains nothing in the retort but a very friable *caput mortuum*.

This remainder he pulveriſes again, and throws a pinch of it on live coals to diſcover whether or no the matter be rightly prepared for yielding phoſphorus. If it be ſo, it preſently emits an arſenical odour, and a blue undulating flame, which paſſes over the ſurface of the coals like a wave.

Being thus aſſured of the ſucceſs of his operation, he puts one half of his matter, in three equal parts, into three ſmall earthen German retorts, capable of holding about eighteen ounces of water a-piece. Theſe three retorts, none of which is above three quarters full, he places together in one reverberatory furnace, built much like thoſe we have deſcribed, except that it is ſo conſtructed as to hold the three retorts diſpoſed in one line. To each retort he lutes a recipient ſomething more than half full of water, ordering the whole in ſuch a manner, that the noſes of his retorts almoſt touch the ſurface of the water.

He begins the diſtillation with warming the retorts ſlowly, for about an hour, by a gentle heat. When that time is elapſed he raiſes the fire gradually, ſo that in half an hour more the coals begin to touch the bottoms of the retorts. He continues throwing coals into the furnace by little and little, till they riſe half way the height of the retorts; and in this he employs another half hour. Laſtly, in the next half hour he raiſes the coals above the bowels of the retorts.

Then the phoſphorus begins to aſcend in clouds: on this he inſtantly increaſes the heat of the fire as much as poſſible, filling the ſurface quite up with coals, and making the retorts very red. This degree of fire cauſes the phoſphorus to diſtill in drops which fall to the bottom of the water. He keeps up this intenſe heat for an hour and half, at the end of which the operation is finiſhed; ſo that it laſts but four hours and a half in all: In the ſame manner he diſtills the ſecond moiety of his mixture in three other ſuch retorts.

He purifies and moulds his phoſphorus much in the ſame manner as M. Hellot does. From the quantity of ingredients above-mentioned, he obtains two ounces and a half fine cryſtalline moulded phoſphorus.

The acid of phoſphorus ſeems to be more fixed than any other: and therefore if you would ſeparate it by burning from the phlogiſton with which it is united, there is no occaſion for ſuch an apparatus of veſſels as is employed for obtaining the ſpirit of ſulphur. For this acid will remain at the bottom of the veſſel in which you burn your phoſphrus: indeed, if it be urged by the force of fire, its moſt ſubtile part evaporates, and the remainder appears in the form of a vitrified matter.

This acid effervesces with fixed and volatile alkalis, and therewith forms neutral ſalts; but very different from ſea-ſalt, and from ſal ammoniac. That which has a fixed alkali for its baſis does not crackle when thrown on burning coals; but ſwells and vitrifies like borax. That which has a volatile alkali for its baſis ſhoots into long pointed cryſtals; and, being urged by fire in a retort, lets go its volatile alkali, a vitrified matter remaining behind.

We ſhall conclude this article with an account of certain properties of phoſporus which have not yet been mentioned.

Phoſphorus diſſolves by lying expoſed to the air. What water cannot effect, ſays M. Hellot, or at leaſt requires eight or ten years to bring about, the moiſture of the air accompliſhes in ten or twelve days; whether it be that the phoſphorus takes fire in the air, and the inflammable part evaporating, almoſt entirely, leaves the acid of the phoſphorus naked, which like all other acids, when exceedingly concentrated, is very greedy of moiſture; or elſe that the moiſture of the air, being water divided into infinitely fine particles, is ſo ſubtile as to find its way through the pores of the phoſphorus, into which the groſſer particles of common water can by no means inſinuate themſelves.

Phoſphorus heated by the vicinity of fire, or by being any way rubbed, ſoon takes fire and burns fiercely. It is ſoluble in all oils, and in æther, giving to thoſe liquors the property of appearing luminous, when the bottle containing the ſolution is opened. Being boiled in water, it likewiſe communicates thereto this luminous quality.

The late Mr Groſſe obſerved, that phoſphorus being diſſolved in eſſential oils cryſtalliſes therein. Theſe cryſtals take fire in the air, either when thrown into a dry veſſel, or wrapt up in a piece of paper. If they be dipped in ſpirit of wine, and taken out immediately, they do not afterwards take fire in the air: they ſmoke a little, and for a very ſhort time, but hardly waſte at all. Though ſome of them were left in a ſpoon for a fortnight, they did not ſeem to have loſt any thing of their bulk: but when the ſpoon was warmed a little they took fire, juſt like common phoſphorus that had never been diſſolved and cryſtalliſed in an eſſential oil.

M. Marggraff, having put a dram of phoſphorus with an ounce of highly concentrated ſpirit of nitre into a glaſs retort, obſerved, that, without the help of fire, the acid diſſolved the phoſphorus; that part of the acid came over into the recipient which was luted to the retort; that at the ſame time the phoſphorus took fire, burnt furiouſly, and burſt the veſſels with exploſion. Nothing of this kind happens when any of the other acids, though concentrated, are applied to phoſphorus.

To decompoſe Sea-ſalt by means of the Vitriolic Acid. Glauber's Salt. The Purification and Concentration of Spirit of Salt.

Put the ſea-ſalt from which you mean to extract the acid into an unglazed earthen pipkin, and ſet it amidſt live coals. The ſalt will decrepitate, grow dry, and fall into a powder. Put this decrepitated ſalt into a tubulated glaſs retort, leaving two thirds thereof empty. Set the retort in a reverberating furnace; apply a receiver

ceiver like that ufed in diftilling the fmoking fpirit of nitre, and lute it on in the fame manner, or rather more exactly if poffible. Then through the hole in the upper convexity of the retort pour a quantity of highly concentrated oil of vitriol, equal in weight to about a third part of your falt, and immediately fhut the hole very clofe with a glafs ftopple, firft rubbed therein with emery fo as to fit it exactly.

As foon as the oil of vitriol touches the falt, the retort and receiver will be filled with abundance of white vapours; and foon after, without lighting any fire in the furnace, drops of a yellow liquor will diftil from the nofe of the retort. Let the diftillation proceed in this manner without fire, as long as you perceive any drops come; afterwards kindle a very fmall fire under the retort, and continue diftilling and raifing the fire by very flow degrees, and with great caution, to the end of the diftillation; which will be finifhed before you have occafion to make the retort red-hot. Unlute the veffels, and without delay pour the liquor, which is a very fmoking fpirit of falt, out of the receiver into a cryftal bottle, like that directed for the fmoking fpirit of nitre.

When the operation is finifhed, we find a white, faline mafs at the bottom of the retort as in a mould. If this mafs be diffolved in water, and the folution cryftallized, it yields a confiderable quantity of fea-falt that hath not been decompofed, and a neutral falt confifting of the vitriolic acid united with the alkaline bafis of that part which hath been decompofed. This neutral falt, which bears the name of *Glauber* its inventor, differs from vitriolated tartar, or the *Sal de duobus*, which remains after diftilling the nitrous acid, efpecially in that it is more fufible, more foluble in water, and hath its cryftals differently figured. But as in thefe two falts the acid is the fame, the differences that appear between them muft be attributed to the peculiar nature of the bafis of fea-falt.

Spirit of falt drawn by the procefs above defcribed is tainted with a fmall mixture of the vitriolic acid, carried up by the force of fire before it had time to combine with the alkali of the fea-falt; which happens likewife to the nitrous acid procured in the fame manner. If you defire to have it pure, and abfolutely free from the acid of vitriol, it muft be diftilled a fecond time from fea-falt, as the acid of nitre was before directed to be diftilled again from frefh nitre, in order to purify it from any vitriolic taint.

To decompofe Sea-falt by means of the Nitrous Acid. Aqua regis. *Quadrangular Nitre.*

Take dried fea-falt: bruife it to powder: put it into a glafs retort, leaving one half of the veffel empty. Pour upon it a third of its weight of good fpirit of nitre. Place your retort in the fand-bath of a reverberating furnace; put on the dome; lute to the retort a receiver having a fmall hole in it, and heat the veffels very flowly. There will come over into the receiver fome vapours, and an acid liquor. Increafe the fire gradually till nothing more rifes. Then unlute the veffels, and pour the liquor out of the receiver into a cryftal bottle, ftopped like others containing acid fpirits.

The nitrous acid hath a greater affinity than the marine acid with fixed alkalis. When therefore fpirit of nitre and fea-falt are mixed together, the fame confequences will follow as when the vitriolic acid is mixed with that falt; that is, the nitrous acid will, like the vitriolic, decompofe it, by diflodging its acid from its alkaline bafis, and affuming its place. But as the nitrous acid is confiderably weaker, and much lighter, than the vitriolic acid, a good deal of it rifes along with the acid of fea-falt during the operation. The liquor found in the receiver is therefore a true *aqua regis*.

If decrepitated falt, and a right fmoking fpirit of nitre, be employed in this procefs, the *aqua regis* obtained will be very ftrong.

The operation being finifhed, there is left in the retort a faline mafs, containing fea-falt not decompofed, and a new fpecies of nitre, which having for its bafis the alkali of fea-falt, that is, an alkali of a peculiar nature, differs from the common nitre, 1. In the figure of its cryftals; which are folids of four fides, formed like lozenges: 2. In that it cryftallizes with more difficulty, retains more water in its cryftals, attracts the moifture of the air, and diffolves in water with the fame circumftances as fea falt.

Of Borax.

To decompofe Borax by the means of Acids, and to feparate from it the Sedative Salt by Sublimation and by Cryftallifation.

Reduce to a fine powder the borax from which you intend to extract the fedative falt. Put this powder into a wide-necked glafs retort. Pour upon it an eighth part of its weight of common water, to moiften the powder; and then add concentrated oil of vitriol, to the weight of fomewhat more than a fourth part of the weight of the borax. Set the retort in a reverberatory, make a moderate fire at firft, and augment it gradually till the retort become red-hot.

A little phlegm will firft come over, and then, with the laft moifture that the heat expels, the fedative falt will rife; by which means fome of it will be diffolved in this laft phlegm, and pafs therewith into the receiver; but moft of it will adhere in the form of faline flowers to the fore-part of the neck of the retort, juft where it is clear of the groove of the furnace. There they collect into a heap, which the fucceeding flowers pufh infenfibly forward till they flightly ftop the paffage. Thofe which rife after the neck is thus ftopped ftick to the after part of it which is hot, vitrify in fome meafure, and form a circle of fufed falt. In this ftate the flowers of the fedative falt feem to iffue out of the circle, as from their bafis: They appear like very thin, light, fhining fcales, and muft be brufhed off with a feather.

At the bottom of the retort will be left a faline mafs: Diffolve this in a fufficient quantity of hot water; filter the folution, in order to free it from a brown earth which it depofites; fet the liquor to evaporate, and cryftals of fedative falt will form in it.

Though borax is of great ufe in many chemical operations, efpecially in the fufion of metals, as we fhall have

have occafion to fee, yet, till of late years, chemifts were quite ignorant of its nature, as they ftill are of its origin; concerning which we know nothing with certainty, but that it comes rough from the Eaft Indies, and is purified by the Dutch.

Of Operations on METALS.

Of GOLD.

To feparate Gold, by Amalgamation with Mercury, from the Earths and Stones with which it is found mixed.

PULVERISE the earths and ftones containing gold. Put the powder into a little wooden tray; dip this tray in water, gently fhaking it and its contents. The water will grow muddy, by taking up the earthy parts of the ore. Continue wafhing it in this manner till the water ceafe to appear turbid. Upon the ore thus wafhed pour ftrong vinegar, having firft diffolved therein, by the help of heat, about a tenth part of its weight of alum. The powder muft be quite drenched and covered with this liquor, and fo left to ftand for twice twenty-four hours.

Decant the vinegar, and wafh your powder with warm water, till the laft that comes off hath no tafte: then dry it, and put it into an iron mortar, with four times its weight of quick-filver: triturate the whole with a heavy wooden peftle, till all the powder be of a blackifh colour: then pour in a little water, and continue rubbing for fome time longer. More earthy and heterogeneous particles will be feparated from the metalline parts by means of this water, which will look dirty: it muft then be decanted, and more fair water added. Repeat this feveral times; then dry what remains in the mortar with a fponge, and by the help of a gentle heat; you will find it an almalgam of the mercury with the gold.

Put this almalgam into a chamoy bag: tie a knot on its neck, and fqueeze it hard between your fingers, over fome wide-mouthed veffel; there will iffue through the pores of the leather numberlefs little jets of mercury, forming a fort of fhower, that will collect into large globules in the veffel placed underneath. When you can force out no more mercury by this means, open the bag, and in it you will find the amalgam freed from the fuperfluous mercury; the gold retaining only about as much thereof as nearly equals itfelf in weight.

Put this amalgam into a glafs retort: fet this retort in the fand-bath of a reverberating furnace; cover it quite over with fand; apply a glafs receiver half full of of water, fo that the nofe of the retort may be under the water. The receiver need not be luted to the retort. Give a gradual heat, and raife the fire till drops of the fublimed mercury appear in the neck of the retort, and fall into the water with a hiffing noife. If you hear any noife in the retort, flacken your fire a little. Laftly, when you obferve, that, though you raife the fire ftill higher than before, nothing more will come over, take out your retort, break it, and there you will find the gold, which muft be melted in a crucible with borax.

To diffolve Gold in Aqua regis, *and by that means to feparate it from Silver.*

TAKE gold that is perfectly pure, or alloyed with filver only. Reduce it to little thin plates, by hammering it on an anvil. If it be not fufficiently tough, neal it till it be red in a moderate, clear fire, quite free from fmoking coals, and then let it cool gradually, which will reftore its ductility.

When the plates are thin enough, make them red-hot once more, and cut them into fmall bits with a pair of fheers. Put thefe bits into a tall, narrow-mouthed cucurbit, and pour on them twice their weight of good *aqua regis*, made of one part fal-ammoniac, or fpirit of falt, and four parts fpirit of nitre. Set the cucurbit in a fand-bath moderately heated, ftopping its orifice flightly with a paper coffin, to prevent any dirt from falling in. The *aqua regis* will prefently begin to fmoke. Round the little bits of gold will be formed an infinite number of fmall bubbles, which will rife to the furface of the liqnor. The gold will totally diffolve, if it be pure, and the folution will be of a beautiful yellow colour: if the gold be alloyed with a fmall quantity of filver, the latter will remain at the bottom of the veffel in the form of a white powder. If the gold be alloyed with much filver, when the gold is diffolved the filver will retain the form of the little metalline plates put into the veffel.

When the diffolution is completed, gently pour off the liquor into another low, wide-mouthed, glafs cucurbit, taking care that none of the filver, which lies at the bottom in the form of a powder efcape with the liquor. On this powder of filver pour as much frefh *aqua regis* as will cover it entirely; and repeat this till you are fure that nothing more can be taken up by it. Laftly, having decanted the *aqua regis* from the filver, wafh the filver with a little fpirit of falt weakened with water, and add this fpirit of falt to the *aqua regis* in which your gold is diffolved. Then to the body containing thefe liquors fit a head and a receiver, and diftill with a gentle heat, till the matter contained in the cucurbit become dry.

Mix together equal parts of common brimftone, and a very ftrong fixed alkali; for inftance, nitre fixed by charcoal. Put them in a crucible, and melt the mixture, ftirring it from time to time with a fmall rod. There is no occafion to make the fire very brifk, becaufe the fulphur facilitates the fufion of the fixed alkali. Some fulphureous vapours will rife from the crucible: the two fubftances will mix intimately together, and form a reddifh compound. Then throw into the crucible fome little pieces of gold beat into thin plates, fo that the whole do not exceed in weight one third part of the liver of fulphur: raife the fire a little. As foon as the liver of fulphur is perfectly melted, it will begin to diffolve the gold with ebullition; and will even emit fome flafhes of fire. In the fpace of a few minutes the gold will be entirely diffolved, efpecially if it was cut and flatted into fmall thin leaves.

The procefs here delivered is taken from M. Stahl. The defign of his inquiries was to difcover how Mofes could burn the golden calf, which the Ifraelites had fet up and worfhipped while he was on the mount; how he could afterwards reduce that calf to powder, throw it into the water which the people ufed, and make all who had apoftatized drink thereof, as related in the book of Exodus,

Exodus; and he concludes, that Mofes muft have performed this operation by means of liver of fulphur.

To feparate Gold from all other metallic Subftances by means of Antimony.

Having put the gold you intend to purify into a crucible, fet it in a melting furnace, cover it, and make the gold flow. When the metal is in fufion, caft upon it, by a little at a time, twice its weight of pure crude antimony in powder, and after each projection cover the crucible again immediately: this done keep the matter in fufion for a few minutes. When you perceive that the metallic mixture is perfectly melted, and that its furface begins to fparkle, pour it out into a hollow iron cone, previoufly heated, and fmeared on the infide with tallow. Immediately ftrike with a hammer the floor on which the cone ftands; and when all is cold, or at leaft fufficiently fixed, invert the cone and ftrike it: the whole metallic mafs will fall out, and the under part thereof, which was at the point of the cone, will be a regulus more or lefs yellow as the gold was more or lefs pure. On ftriking the metallic mafs, the regulus will freely part from the fulphureous cruft at top.

Return this regulus into the crucible, and melt it. Lefs fire will do now than was required before. Add the fame quantity of antimony, and proceed as at firft. Repeat the fame operation a third time, if your gold be very impure.

Then put your regulus into a good crucible, much larger than is neceffary to hold it. Set your crucible in a melting furnace, and heat the matter but juft enough to make it flow, with a fmooth, brilliant furface. When you find it thus conditioned, point towards it the nofe of a long-fnouted pair of bellows, and therewith keep gently and conftantly blowing. There will arife from the crucible a confiderable fmoke, which will abate greatly when you ceafe to blow, and increafe as foon as you begin again. You muft raife the fire gradually as you approach towards the end of the operation. If the furface of the metal lofe its brilliant polifh, and feem covered with a hard cruft, it is a fign the fire is too weak; in which cafe it muft be increafed, till the furface recover its fhining appearance. At laft, when no more fmoke rifes, and the furface of the gold looks neat and greenifh, caft on it, by little and little, fome pulverized nitre, or a mixture of nitre and borax. The matter will fwell up. Continue thus adding more nitre gradually, till no commotion is thereby produced in the crucible; and then let the whole cool. If you find, when the gold is cold, that it is not tough enough, melt it over again; when it begins to melt caft it in the fame falts as before; and repeat this till it be perfectly ductile.

To feparate Silver from its Ore, by means of Scorification with Lead.

Beat to powder in an iron mortar the ore from which you mean to feparate the filver, having firft roafted it well in order to free it from all the fulphur and arfenic that it may contain. Weigh it exactly: then weigh out by itfelf eight times as much granulated lead. Put one half of this lead into a teft, and fpread it equally thereon: upon this lead lay your ore, and cover it quite over with the remaining half of the lead.

Place the teft thus loaded under the further end of the muffle in a cupelling furnace. Light your fire, and increafe it by degrees. If you look through one of the apertures in the door of the furnace, you will perceive the ore, covered with calcined lead, fwim upon the melted lead. Prefently afterwards it will grow foft, melt, and be thrown towards the fides of the veffel, the furface of the lead appearing in the midft thereof bright and fhining like a luminous difc: the lead will then begin to boil, and emit fumes. As foon as this happens, the fire muft be a little checked, fo that the ebullition of the lead may almoft entirely ceafe for about a quarter of an hour. After this it muft be excited to the degree it was at before, fo that the lead may begin again to boil and fmoke. Its fhinning furface will gradually leffen, and be covered with *fcoriæ*. Stir the whole with an iron hook, and draw in towards the middle what you obferve towards the fides of the veffel; to the end that, if any part of the ore fhould ftill remain undiffolved by the lead, it may be mixed therewith.

When you perceive that the matter is in perfect fufion, that the greateft part of what fticks to the iron hook, when you dip it in the melted matter, feparates from it again, and drops back into the veffel; and that the extremity of this inftrument, when grown cold, appears varnifhed over with a thin, fmooth, fhining cruft; you may look on thefe as marks that the bufinefs is done; and the more uniform and evenly the colour of the cruft is, the more perfect may you judge the fcorification to be.

Matters being brought to this pafs, take the teft with a pair of tongs from under the muffle, and pour its whole contents into an iron cone, firft heated and greafed with tallow. This whole operation lafts about three quarters of an hour. When all is cold, the blow of a hammer will part the regulus from the fcoria; and as it is not poffible, how perfect foever the fcorification be, to avoid leaving a little lead containing filver in the fcoria, it is proper to pulverife this fcoria, and feparate therefrom whatever extends under the hammer, in order to add it to the regulus.

The refining of Silver by the Cupel.

Take a cupel capable of containing one third more matter than you have to put into it: fet it under the muffle of a furnace like that defcribed in our theoretical elements, as peculiarly appropriated to this fort of operation. Fill the furnace with charcoal; light it; make the cupel red-hot, and keep it fo till all its moifture be evaporated; that is, for about a good quarter of an hour, if the cupel be made wholly of the afhes of burnt bones; and for a whole hour, if there be any wafhed wood-afh in its compofition.

Reduce the regulus which remained after the preceding operation to little thin plates, flatting them with a fmall hammer, and feparating them carefully from all the adherent fcoria. Wrap thefe in a bit of paper, and with a fmall pair of tongs put them gently into the cupel. When the paper is confumed, the regulus will foon melt,

and

and the ſcoria, which will be gradually produced by the lead as it turns to litharge, will be driven to the ſides of the cupel, and immediately abſorbed thereby. At the ſame time the cupel will aſſume a yellow, brown, or blackiſh colour, according to the quantity and nature of the ſcoria imbibed by it.

When you ſee the matter in the cupel in a violent ebullition, and emitting much ſmoke, lower the fire by the methods formerly preſcribed. Keep up ſuch a degree of heat only that the ſmoke which aſcends from the matter may not riſe very high, and that you may be able to diſtinguiſh the colour which the cupel acquires from the ſcoria.

Increaſe the fire by degrees, as more and more litharge is formed and abſorbed. If the regulus examined by this aſſay contain no ſilver, you will ſee it turn wholly into ſcoria, and at laſt diſappear. When it contains ſilver, and the quantity of lead is much diminiſhed, you will perceive little vivid iriſes, or beautiful rain-bow colours, ſhooting ſwiftly along its ſurface, and croſſing each other in many different directions. At laſt, when all the lead is deſtroyed, the thin dark ſkin, that is continually protruded by the lead while it is turning into litharge, and which hitherto covered the ſilver, ſuddenly diſappears; and, if at this moment the fire happen not to be ſtrong enough to keep the ſilver in fuſion, the ſurface of that metal will at once dart out a dazzling ſplendor; but, if the fire be ſtrong enough to keep the ſilver in fuſion, though freed from all mixture of lead, this change of colour, which is called its *fulguration*, will not be ſo perceptible, and the ſilver will appear like a bead of fire.

Theſe phenomena ſhew that the operation is finiſhed. But the cupel muſt ſtill be left a minute or two under the muffle, and then drawn ſlowly out with the iron hook towards the door of the furnace. When the ſilver is ſo cooled as to be but moderately red, you may take the cupel from under the muffle with your little tongs, and in the middle of its cavity you will find an exceeding white bead of ſilver, the lower part whereof will be unequal, and full of little pits.

To purify Silver by Nitre.

Granulate the ſilver you intend to purify, or reduce it to thin plates; put it into a good crucible; add thereto a fourth part in weight of very dry pulveriſed nitre, mixed with half the weight of the nitre of calcined wine-lees, and about a ſixth part of the ſame weight of common glaſs in powder. Cover this crucible with another crucible inverted; which muſt be of ſuch a ſize that its mouth may enter a little way into that of the lower one, and have its bottom pierced with a hole of about two lines in diameter. Lute the two crucibles together with clay and Windſor-loam. When the lute is dry, place the crucibles in a melting furnace. Fill the furnace with charcoal, taking care however that they do not riſe above the upper crucible.

Kindle the fire, and make your veſſels of a middling red heat. When they are ſo, take up with the tongs a live coal, and hold it over the hole of the upper crucible. If you immediately perceive a vivid ſplendor round the coal, and at the ſame time hear a gentle hiſſing noiſe, it is a ſign that the fire is of a proper ſtrength; and it muſt be kept up at the ſame degree till this phenomenon ceaſe.

Then increaſe the fire to the degree requiſite to keep pure ſilver in fuſion; and immediately take your veſſels out of the furnace. You will find the ſilver at the bottom of the lower crucible covered with a maſs of alkaline ſcoria of a greeniſh colour. If the metal be not rendered perfectly pure and ductile by this operation, it muſt be repeated a ſecond time.

To diſſolve Silver in Aqua Fortis, *and thereby ſeparate it from every other metalline Subſtance.*

The ſilver you intend to diſſolve being beaten into thin plates, put it into a glaſs cucurbit; pour on it twice its weight of good precipitated *aqua fortis*; cover the cucurbit with a paper, and ſet it on a ſand-bath moderately heated. The *aqua fortis* will begin to diſſolve the ſilver as ſoon as it comes to be a little warm. Red vapours will riſe; and from the upper ſurfaces of the ſilver there will ſeem to iſſue ſtreams of little bubbles, aſcending to the top of the liquor, between which and the ſilver they will form, as it were, a number of fine chains: This is a ſign that the diſſolution proceeds duly, and that the degree of heat is ſuch as it ought to be. If the liquor appear to boil and be agitated, a great many red vapours riſing at the ſame time, it is a ſign that the heat is too great, and ſhould be leſſened till it be reduced to the proper degree indicated above: having obtained that, keep it equally up till no more bubbles or red vapours appear.

If your ſilver be alloyed with gold, the gold will be found, when the diſſolution is finiſhed, at the bottom of the veſſel in the form of a powder. The ſolution muſt now be decanted while it is yet warm: on the powder pour half as much freſh *aqua fortis* as before, and make it boil; again decant this ſecond *aqua fortis*, and repeat the ſame a third time; then with fair water waſh the remaining powder well: It will be of a brown colour inclining to red.

To ſeparate Silver from the Nitrous Acid by Diſtillation. Cryſtals of Silver. The Infernal Stone.

Into a large, low, glaſs body, put the ſolution of ſilver from which you intend to ſeparate the ſilver by diſtillation. To this body fit a tubulated head provided with its ſtopple. Set this alembic in a ſand-bath, ſo that the body may be almoſt covered with ſand: apply a receiver, and diſtill with a moderate heat, ſo that the drops may ſucceed each other at the diſtance of ſome ſeconds. If the receiver grow very hot, check the fire. When red vapours begin to appear, pour into the alembic, through the hole in its head, a freſh quantity of your ſolution of ſilver, firſt made very hot. Continue diſtilling in this manner, and repeating the addition of freſh liquor, till all your ſolution be put into the alembic. When you have no more freſh ſolution to put in, and when, the phlegm being all come over, red vapours begin again to appear, convey into the alembic half a dram or a dram of tallow, and diſtill to drineſs; which

being

being done, increaſe your fire ſo as to make the veſſel containing the ſand-bath red-hot. In the alembic you will find a calx of ſilver, which muſt be melted in a crucible with ſome ſoap and calcined wine-lees.

If the diſtillation be ſtopped when part of the phlegm is drawn off, and the liquor be then ſuffered to cool, many cryſtals will ſhoot therein, which are a neutral ſalt conſtituted of the nitrous acid and ſilver. If the diſtillation be carried further, and ſtopped when near its concluſion, the liquor being then ſuffered to cool will wholly coagulate into a blackiſh maſs called the *infernal ſtone*.

To ſeparate Silver from the nitrous Acid by Precipitation. Luna Cornea. Luna Cornea *reduced.*

INTO your ſolution of ſilver pour about a fourth part in weight of ſpirit of ſalt, ſolution of ſea-ſalt, or ſolution of ſal ammoniac. The liquor will inſtantly become turbid and milky. Add twice or thrice its weight of fair water, and let it ſtand ſome ſome hours to ſettle. It will depoſite a white powder. Decant the clear liquor, and on the precipitate pour freſh *aqua fortis*, or ſpirit of ſalt, and warm the whole on a ſand-bath with a gentle heat for ſome time. Pour off this ſecond liquor, and boil your precipitate in pure water, ſhifting it ſeveral times, till the precipitate and the water be both quite inſipid. Filter the whole, and dry the precipitate, which will be a *luna cornea*, and muſt be reduced in the following manner.

Smear the inſide of a good crucible well with ſoap. Put your *luna cornea* into it; cover it with half its weight of ſalt of tartar, thoroughly dried and pulveriſed; preſs the whole hard down; pour thereon as much oil, or melted tallow, as the powder is capable of imbibing; ſet the crucible thus charged, and cloſe covered, in a melting furnace, and, for the firſt quartet of an hour, kindle no more fire than is neceſſary to make the crucible moderately red; after that raiſe it ſo as to melt the ſilver and the ſalt, throwing into the crucible from time to time little bits of tallow. When it ceaſes to ſmoke, let the whole cool; or pour it into a hollow iron cone, warmed and tallowed.

To diſſolve Silver, and ſeparate it from Gold, by Cementation.

MIX thoroughly together fine brick-duſt four parts, vitriol calcined to redneſs one part, and ſea-ſalt or nitre one part. Moiſten this powder with a little water. With this cement cover the bottom of a crucible half an inch thick; on this firſt bed lay a thin plate of the maſs of gold and ſilver you intend to cement, and which you muſt previouſly take care to beat into ſuch thin plates. Cover this plate with a ſecond layer of cement, of the ſame thickneſs as the former; on this ſecond bed lay another plate of your metal; cover it in like manner with cement; and ſo proceed till the crucible be filled to within half an inch of its brim. Fill up the remaining ſpace with cement, and cloſe the crucible with a cover, luted with a paſte made of Windſor-loam and water: Set your crucible thus charged in a furnace, whoſe fire-place is deep enough to let it be entirely furrounded with coals, quite up to its mouth. Light ſome coals in the furnace, taking care not to make the fire very briſk at firſt; increaſe it by degrees, but only ſo far as to make the crucible moderately red; keep up the fire in this degree for eighteen or twenty hours: Then let the fire go out; open the crucible when it is cold, and ſeparate the cement from your plates of gold. Boil the gold repeatedly in fair water, till the water come off quite inſipid.

Of COPPER.

To ſeparate Copper from its Ore.

BEAT your copper ore to a fine powder, having firſt freed it as accurately as poſſible, by waſhing and roaſting, from all ſtony, earthy, ſulphureous, and arſenical parts. Mix your ore thus pulveriſed with thrice its weight of the black flux; put the mixture into a crucible; cover it with common ſalt to the thickneſs of half an inch, and preſs the whole down with your finger. With all this the crucible muſt be but half full. Set it in a melting furnace; kindle the fire by degrees, and raiſe it inſenſibly till you hear the ſea-ſalt crackle. When the decrepitation is over, make the crucible moderately red-hot for half a quarter of an hour. Then give a conſiderable degree of heat, exciting the fire with a pair of good perpetual bellows, ſo that the crucible may become very red-hot, and be perfectly ignited. Keep the fire up to this degree for about a quarter of an hour; then take out the crucible, and with a hammer ſtrike a few blows on the floor on which you ſet it. Break it when cold. If the operation hath been rightly and ſucceſsfully performed, you will find at the bottom of the veſſel a hard regulus, of a bright yellow colour, and ſemi-malleable; and over it a ſcoria of a yellowiſh brown colour, hard, and ſhining, from which you may ſeparate the regulus with a hammer.

To purify black Copper, and render it malleable.

BREAK into ſmall bits the black copper you intend to purify; mix therewith a third part in weight of granulated lead, and put the whole into a cupel ſet under the muffle in a cupelling furnace, and previouſly heated quite red. As ſoon as the metals are in the cupel raiſe the fire conſiderably, making uſe, if it be needful, of a pair of perpetual bellows, to melt the copper ſpeedily. When it is thoroughly melted, lower the fire a little, and continue it juſt high enough to keep the metalline maſs in perfect fuſion. The melted matter will then boil, and throw up ſome ſcoriæ, which will be abſorbed by the cupel.

When moſt of the lead is conſumed, raiſe the fire again till the face of the copper become bright and ſhining, thereby ſhewing that all its alloy is ſeparated. As ſoon as your copper comes to this ſtate, cover it with charcoal duſt conveyed into the cupel with an iron laddle: Then take the cupel out of the furnace, and let it cool.

To deprive Copper of its Phlogiſton by Calcination.

PUT your copper in filings into a teſt, and ſet it under the muffle of a cupelling furnace; light the fire, and keep up ſuch a degree of heat as may make the whole quite

quite red, but not enough to melt the copper. The surface of the copper will gradually lose its metalline splendor, and put on the appearance of a reddish earth. From time to time stir the filings with a little rod of copper or iron, and leave your metal exposed to the same degree of fire till it be always calcined.

To resuscitate the Calx of Copper, and reduce it to Copper, by restoring its Phlogiston.

Mix the calx of copper with thrice as much of the black flux; put the mixture into a good crucible, so as to fill two thirds thereof, and over it put a layer of sea-salt a finger thick. Cover the crucible, and set it in a melting furnace; heat it gradually, and keep it moderately red till the decrepitation of the sea-salt be over. Then raise the fire considerably by means of a good pair of perpetual bellows; satisfy yourself that the matter is in perfect fusion, by dipping into the crucible an iron wire; continue the fire in this degree for half a quarter of an hour. When the crucible is cold, you will find at its bottom a button of very fine copper, which will easily separate from the saline scoria at top.

To dissolve Copper in the Mineral Acids.

On a sand-bath, in a very gentle heat, set a matras containing some copper filings; pour on them twice their weight of oil of vitriol. That acid will presently attack the copper. Vapours will rise, and issue out of the neck of the matras. A vast number of bubbles will ascend from the surface of the metal to the top of the liquor, and the liquor will acquire a beautiful blue colour. When the copper is dissolved, put in a little and a little more, till you perceive the acid no longer acts upon it. Then decant the liquor, and let it stand quiet in a cool place. In a short time great numbers of beautiful blue crystals will shoot in it. These crystals are called *vitriol of copper*, or *blue vitriol*. They dissolve easily in water.

Of Iron.

To separate Iron from its Ore.

Pound into a coarse powder the martial stones or earths out of which you design to extract the iron: Roast this powder in a test under the muffle for some minutes, and let your fire be brisk. Then let it cool, beat it very fine, and roast it a second time, keeping it under the muffle till it emit no more smell.

Then mix with this powder a flux composed of three parts of nitre fixed with tartar, one part of fusile glass, and half a part of borax and charcoal-dust. The dose of this reducing flux must be thrice the weight of the ore.

Put this mixture into a good crucible; cover it with about half a finger thick of sea-salt; over the crucible put its cover, and lute it on with Windsor-loam made into a paste with water. Having thus prepared your crucible, set it in a melting furnace, which you must fill up with charcoal. Light the fire, and let it kindle by gentle degrees, till the crucible become red-hot. When the decrepitation of the sea-salt is over, raise your fire to the highest by the blast of a pair of perpetual bellows, or rather several. Keep up this intense degree of heat for three quarters of an hour, or a whole hour, taking care that during all this time the furnace be kept constantly filling up with fresh coals as the former consume. Then take your crucible out of the furnace; strike the pavement on which you set it several times with a hammer, and let it stand to cool: Break it, and you will find therein a regulus of iron covered with slag.

In smelting-houses iron ore is fused amidst charcoal, the phlogiston of which combines with the martial earth, and gives it the metalline form. The iron thus melted runs down to the bottom of the furnace, from whence it is let out into large moulds, in which it takes the shape of oblong blocks, called *pigs* of iron. This iron is still very impure, and quite unmalleable. Its want of ductility after the first melting arises partly from hence, that, notwithstanding the previous roasting which the ore underwent, there still remains, after this first fusion, a considerable quantity of sulphur or arsenic combined with the metal.

A certain quantity of quick lime, or of stones that will burn to lime, is frequently mixed with iron ore on putting it into the smelting furnace. The lime being an absorbent earth, very apt to unite with sulphur and arsenic, is of use to separate those minerals from the iron.

It is also of use to mix some such matters with the ore, when the stones or earths which naturally accompany it are very fusible; for, as the iron is of difficult fusion, it may happen that the earthy matters mixed with the iron shall melt as easily as the metal, or perhaps more easily. In such a case there is no separation of the earthy from the metalline part, both of which melt and precipitate together promiscuously: Now quick-lime, being extremely refractory, serves on this occasion to check the melting of those matters which are too fusible.

Yet quick-lime, notwithstanding its refractory quality, may sometimes be of use as a flux for iron: This is the case when the ore happens to be combined with substances which, being united with lime, render it fusible: Such are all arsenical matters, and even some earthy matters, which, being combined with quick-lime, make a fusible compound.

When the ore of an iron mine is found difficult to reduce, it is usually neglected even though it be rich; because iron being very common, people chuse to work those mines only whose ores are smelted with the most ease, and require the least consumption of wood.

Yet refractory ores are not to be altogether rejected, when another iron ore of a different quality is found near them. For it often happens, that two several iron ores, which being worked separately are very difficult to manage, and yield at last but bad iron, become very tractable, and yield excellent iron, when smelted together: And accordingly such mixtures are often made at iron-works.

The iron obtained from ores by the first fusion may be divided into two sorts. The one, when cold, resists the hammer, doth not easily break, and is in some measure extensible on the anvil; but if struck with a hammer, when red-hot, flies into many pieces: This sort of iron hath always

always a mixture of fulphur in it. The other fort, on the contrary, is brittle when cold, but fomewhat ductile when red-hot. This iron is not fulphurated, is naturally of a good quality, and its brittlenefs arifes from its metalline parts not being fufficiently compacted together.

Iron abounds fo much, and is fo univerfally diffufed through the earth, that it is difficult to find a body in which there is none at all: And this hath led feveral chemifts into the error of thinking, that they had tranfmuted into iron feveral forts of earths in which they fufpected no iron, by combining them with an inflammable matter; whereas, in fact, all they did was to give the metalline form to a true martial earth which happened to be mixed with other earths.

To render Pig-iron and brittle Iron malleable.

INTO an earthen veffel widening upwards, put fome charcoal-duft, and thereon lay the pig-iron which you propofe to render ductile; cover it all over with a quantity of charcoal; excite the fire violently with a pair, or more, of perpetual bellows till the iron melt. If it do not readily flow and form a great deal of flag on its furface, add fome flux, fuch as a very fufible fand.

When the matter is in fufion, keep ftirring it from time to time, that all the parts thereof may be equally acted on by the air and the fire. On the furface of the melted iron *fcoriæ* will be formed, which muft be taken off as they appear. At the fame time you will fee a great many fparkles darted up from the furface of the metal, which will form a fort of fiery fhower. By degrees, as the iron grows purer, the number of thefe fparkles diminifhes, though they never vanifh entirely. When but few fparkles appear, remove the coals which cover the iron, and let the flag run out of the veffel; whereupon the metal will grow folid in a moment. Take it out while it is ftill red-hot, and give it a few ftrokes with a hammer, to try if it be ductile. If it be not yet malleable, repeat the operation a fecond time, in the fame manner as before. Laftly, when it is thus fufficiently purified by the fire, work it for a long time on the anvil, extending it different ways, and making it red-hot as often as there is occafion. Iron thus brought to the neceffary degree of ductility, fo as to yield to the hammer, and fuffer itfelf to be extended every way, either hot or cold, without breaking to bits, or even cracking in the leaft, is very good and very pure If it cannot be brought to this degree by the method here prefcribed, it is a proof, that the ore from which this iron was extracted, ought to be mixed with other ores; but it frequently requires a great number of trials to obtain an exact knowledge of the quality and proportion of thofe other ores with which it is to be mixed.

To convert Iron into Steel.

TAKE fmall bars of the beft iron; that is, of fuch as is malleable both hot and cold; fet them on their ends in a cylindrical earthen veffel, whofe depth is equal to the length of the bars, and in fuch a manner that they may be an inch diftant from each other, and from the fides of the crucible. Fill the veffel with a cement compounded of two parts of charcoal, on part of bones burnt in a clofe veffel till they become very black, and one half part of the afhes of green wood; having firft pulverifed and thoroughly mixed the whole together. Take care to lift up the iron bars a little, to the end that the cement may cover the bottom of the veffel, and fo that there be about the depth of half an inch thereof under every bar: Cover the crucible and lute on the cover.

Set the crucible thus prepared in a furnace, fo contrived, that the crucible may be furrounded with coals from top to bottom: For eight or ten hours keep up fuch a degree of fire that the veffel may be moderately red; after this take it out of the furnace; plunge your little iron bars into cold water; and you will find them converted into fteel.

The principal difference between iron and fteel confifts in this, that the latter is combined with a greater quantity of phlogifton than the former.

It appears by this experiment, that, to make iron unite with an inflammable matter, it is neceffary it fhould be in fufion; it is fufficient that it be fo red-hot as to be opened and foftened by the fire.

Every kind of charcoal is fit to be an ingredient in the compofition of the cement employed to make fteel, provided it contain no vitriolic acid. However, it hath been obferved, that animal coals produce a fpeedier effect than others: for which reafon it is proper to mix fomething of that kind with charcoal-duft, as above directed.

The following figns fhew that the operation hath fucceeded, and that the iron is changed into good fteel.

This metal being quenched in cold water as propofed above, acquires fuch an extraordinary degree of hardnefs, that it will by no means yield to any impreffion of the file or hammer, and will fooner break in pieces than ftretch upon the anvil. And here it is proper to obferve, that the hardnefs of fteel varies with the manner in which it is quenched. The general rule is, that the hotter the fteel is when quenched, and the colder the water is in which you quench it, the harder it becomes. It may be deprived of the temper thus acquired, by making it red-hot, and letting it cool flowly; for it is thereby foftened, rendered malleable, and the file will bite upon it. For this reafon the artifans who work in fteel begin with untempering it, that they may with more eafe fhape it into the tool they intend to make. They afterwards new-temper the tool when finifhed. and by this fecond temper the fteel recovers the fame degree of hardnefs it had acquired by the firft temper.

The colour of fteel is not fo white as that of iron, but darker, and the grains. facets, or fibres, which appear on breaking it, are finer than thofe obferved in iron.

If the bars of iron thus cemented, in order to convert them into fteel, be too thick, or not kept long enough in cementation, they will not be turned into fteel throughout their whole thicknefs: their furfaces only will be fteel to a certain depth, and the centre will be mere iron; becaufe the phlogifton will not have thoroughly penetrated them. On breaking a bar of this fort, the difference in colour and grain between the fteel and the iron is very vifible.

It is eafy to deprive fteel of the fuperabundant quantity of

of phlogiſton which conſtitutes it ſteel, and thereby reduce it to iron. For this purpoſe it need only be kept red-hot for ſome time, obſerving that no matter approach it all the while that is capable of refunding to it the phlogiſton which the fire carries off. The ſame end is ſtill ſooner obtained by cementing it with meagre hungry matters, capable of abſorbing the phlogiſton; ſuch as bones calcined to whiteneſs, and cretaceous earths.

The Calcination of Iron. Sundry Saffrons of Mars.

Take filings of iron, what quantity you pleaſe; put them into a broad unglazed earthen veſſel, ſet under the muffle of a cupelling furnace: make it red-hot; ſtir the filings frequently; and keep up the ſame degree of fire till the iron be wholly turned into a red powder.

Iron eaſily loſes its phlogiſton by the action of fire. The calx that remains after its calcination is exceeding red; which makes this be thought the natural colour of the earth of that metal. It hath accordingly been obſerved, that all the earths and ſtones which either are naturally red, or acquire that colour by calcination, are ferruginous.

The yellowiſh red colour which every calx of iron hath, in whatever manner it be prepared, hath procured the name of *crocus*, or *ſaffron*, to every preparation of this kind. That made in the manner above directed is called in medicine *crocus martis aſtringens*.

The ruſt produced on the ſurface of iron, is a ſort of calx of iron made by the way of diſſolution. The moiſture of the air acts upon the metal, diſſolves it, and robs it of ſome of its phlogiſton. This ruſt is called in medicine *crocus martis aperiens*; becauſe it is thought that the ſaline parts, by means whereof the humidity diſſolves the iron, remain united with the metal after its diſſolution, and give it an aperitive virtue. The apothecaries prepare this ſort of ſaffron of mars by expoſing iron filings to the dew till they be turned entirely to ruſt; which is then called *ſaffron of mars by dew*.

Another ſaffron of mars is alſo prepared in a much ſhorter manner, by mixing filings of iron with pulveriſed ſulphur, and moiſtening the mixture, which after ſome time ferments and grows hot. It is then ſet on the fire; the ſulphur burns away, and the maſs is kept ſtirring till it become a red matter. This ſaffron is nothing but iron diſſolved by the acid of ſulphur, which is known to be of the ſame nature with that of vitriol; and conſequently this ſaffron of mars is no way different from vitriol calcined to redneſs.

Iron diſſolved by the mineral Acids.

Put any mineral acid whatever into a matras with ſome water; ſet the matras on a ſand-bath gently heated; drop into the veſſel ſome filings of iron: the phenomena which uſually accompany metalline diſſolutions will immediately appear. Add more filings, till you obſerve the acid hath loſt all ſenſible action upon them: then remove your matras from the ſand-bath; you will find in it a ſolution of iron.

Of Tin.

To extract Tin from its Ore.

Break your tin ore into a coarſe powder, and by waſhing carefully, ſeparate from it all the heterogeneous matters and ores of a different kind that may be mixed therewith. Then dry it, and roaſt it in a ſtrong degree of fire, till no more arſenical vapour riſe from it. When the ore is roaſted, reduce it to a fine powder, and mix it thoroughly with twice its weight of the black flux well dried, a fourth part of its weight of clean iron filings, together with as much borax and pitch: put the mixture into a crucible; over all put ſea-ſalt to the thickneſs of four fingers, and cover the crucible cloſe.

Set the crucible thus prepared in a melting furnace: apply at firſt a moderate and ſlow degree of fire, till the flame of the pitch, which will eſcape through the joint of the cover, diſappear entirely. Then ſuddenly raiſe your fire, and urge it with rapidity to the degree neceſſary for melting the whole mixture. As ſoon as the whole is in fuſion, take the crucible out of the furnace, and ſeparate the regulus from the ſcoria.

All tin ores contain a conſiderable quantity of arſenic, and no ſulphur at all, or at moſt very little. Hence, though tin be the lighteſt of all metals, its ore is nevertheleſs much heavier than any other; arſenic being much heavier than ſulphur, of which the ores of every other kind always contain a pretty large proportion. This ore is moreover very hard, and is not brought to a fine powder with ſo much eaſe as the reſt.

Theſe properties of tin ore furniſh us with the means of ſeparating it eaſily by lotion, not only from earthy and ſtony parts, but even from the other ores which may be mixed with it. And this is of the greater advantage on two accounts, *viz.* becauſe tin cannot endure, without the deſtruction of a great part thereof, the degree of fire neceſſary to ſcorify the refractory matters which accompany its ore; and again, becauſe this metal unites ſo eaſily with iron and copper, the ores of which are pretty commonly blended with tin ore, that after the reduction it would be found adulterated with a mixture of theſe two metals, if they were not ſeparated from it before the fuſion.

Into an unvarniſhed earthen diſh put the quantity of tin you intend to calcine; melt it, and keep ſtirring it from time to time. Its ſurface will be covered with a greyiſh white powder: Continue the calcination till all your tin be converted into ſuch a powder, which is the *calx of tin*.

The diſſolution of Tin by Acids.

Put into a glaſs veſſel what quantity you pleaſe of fine tin cut into little bits. Pour on it thrice as much *aqua regis*, compounded of two parts *aqua fortis* weakened with an equal quantity of very pure water, and one part ſpirit of ſalt. An ebullition will ariſe, and the tin will be very rapidly diſſolved; eſpecially if the quantities of metal and of *aqua regis* be conſiderable.

To

To extract Lead from its Ore.

Having roafted your lead-ore, reduce it to a fine powder; mix it with twice its weight of the black flux, and one fourth of its weight of clean iron filings and borax; put the whole into a crucible capable of containing at leaft thrice as much; over all put fea-falt four fingers thick; cover the crucible; lute the juncture; dry the whole with a gentle heat, and fet it in a melting furnace.

Make the crucible moderately red: yon will hear the fea-falt decrepitate, and after the decrepitation a fmall hiffing in the crucible. Keep up the fame degree of fire till that be over.

Then throw in as many coals as are neceffary to complete the operation entirely, and raife the fire fuddenly, fo as to bring the whole mixture into perfect fufion. Keep up this degree of fire for a quarter of an hour, which is time fufficient for the precipitation of the regulus.

When the operation is finifhed, which may be known by the quietnefs of the matter in the crucible, and by a bright vivid flame that will rife from it, take the crucible out of the furnace, and feparate the regulus from the fcoria.

To feparate Lead from Copper.

With luting earth and charcoal duft make a flat veffel, widening upwards, and large enough to contain your metalline mafs. Set it fhelving downwards from the back towards the fore-part; and in the fore-part, at the bottom, make a little gutter communicating with another veffel of the fame nature, placed near the former and a little lower. Let the mouth of the gutter withinfide the upper veffel be narrowed, by means of a fmall iron plate fixed acrofs it, while the loam is yet foft; fo as to leave a very fmall appertnre in the lower part of this canal fufficient to difcharge the lead as it melts. Dry the whole by placing lighted coals round it.

When this apparatus is dry, put your mixed mafs of copper and lead into the upper veffel: both in that, and in the other veffel, light a very gentle fire of wood or charcoal, fo as not to exceed the degree of heat neceffary to melt lead. In fuch a degree of heat the lead contained in the mixed mafs will melt, and you will fee it run out of the upper veffel into the lower; at the bottom of which it will unite into a regulus. When in this degree of heat no more lead flows, increafe the fire a little, fo as to make the veffel moderately red.

When no more will run, collect the lead contained in the lower veffel. Melt it over again in an iron ladle, with a degree of fire fufficient to make the ladle red; throw into it a little tallow or pitch, and while it burns keep ftirring the metal, in order to reduce any part of it that may be calcined. Remove the pellicle or thin cruft which will form on the furface; fqueeze out all the lead it contains, and then put it to the mafs of copper left in the upper veffel. Check the fire, and in the fame manner take off a fecond fkin that will form on the furface of the lead. Laftly, when the metal is ready to fix, take off the fkin that will then appear on it. The lead remaining after this will be very pure, and free from all alloy of copper.

With regard to the copper itfelf, you will find it in the upper veffel covered with a thin coat of lead, and if the lead mixed with it was in the proportion of a fourth or a fifth part only, and the fire applied was gentle and flow, it will retain nearly the fame form after the operation that the mixed mafs had before.

The Calcination of Lead.

Take what quantity of lead you pleafe; melt it in one or more unglazed earthen pans: a dark grey powder will be found on its furface. Keep ftirring the metal inceffantly till it be wholly converted into fuch a powder, which is the *calx of lead.*

In the calcination of all metals, and particularly in this of lead, there appears a fingular phenomenon which is not eafily accounted for. It is this: though thefe matters lofe a great deal of their fubftance, either by the diffipation of their phlogifton, or becaufe fome of the metal perhaps exhales in vapours, yet, when the calcination is over, their calxes are found to be encreafed in weight, and this increafe is very confiderable. An hundred pounds of lead, for example, converted into minium, which is nothing but a calx of lead brought to a red colour by continuing the calcination, are found to gain ten pounds weight; fo that for an hundred pounds of lead we have one hundred and ten pounds of minium: a prodigious and almoft incredible augmentation, if it be confidered that, far from adding any thing to the lead, we have on the contrary diffipated part of it.

To prepare Glafs of Lead.

Take two parts of litharge, and one part of pure cryftalline fand; mingle them together as exactly as poffible, adding a little nitre and fea-falt: put this mixture into a crucible of the moft folid and moft compact earth. Shut the crucible with a cover that may perfectly clofe it.

Set the crucible thus prepared in a melting furnace; fill the furnace with coals; light the fire gradually, fo that the whole may be flowly heated: Then raife the fire fo as to make the crucible very red, and bring the matter it contains into fufion; keep it thus melted for a quarter of an hour.

Then take the crucible out of the furnace, and break it: in the bottom thereof you will moft commonly find a fmall button of lead, and over it a tranfparent glafs of a yellow colour nearly refembling that of amber. Separate this glafs from the little button of metal, and from the faline matters which you will find above it.

Lead diffolved by the Nitrous Acid.

Put into a matras fome *aqua fortis* precipitated like that ufed to diffolve filver; weaken it by mixing therewith an equal quantity of common water; fet the matras in a hot fand-bath; throw into it, little by little, fmall bits of lead, till you fee that no more will diffolve. *Aqua fortis* thus lowered will diffolve about a fourth of its weight of lead.

There is gradually formed upon the lead, as it diffolves, firft a grey powder, and afterwards a white cruft, which

which at laſt hinder the ſolvent from acting on the remaining part of the metal; and therefore the liquor ſhould be made to boil, and the veſſel ſhould be ſhaken to remove thoſe impediments, by which means all the lead will be diſſolved.

Of MERCURY.

To extract Mercury from its Ore, or to revivify it from Cinabar.

PULVERIZE the cinabar from which you would extract the mercury; with this powder mix an equal part of clean iron filings; put the mixture into a retort of glaſs or iron, leaving at leaſt one third part thereof empty. Set the retort thus prepared in a ſand-bath, ſo that its body may be quite buried in the ſand, and its neck decline conſiderably downwards: fit on a receiver half filled with water, and let the noſe of the retort enter about half an inch into the water.

Heat the veſſel ſo as to make the retort moderately red. The mercury will riſe in vapours, which will condenſe into little drops, and fall into the water in the receiver. When you ſee that nothing more comes over with this degree of heat, increaſe it, in order to raiſe what mercury may ſtill be left. When all the mercury is thus brought over, take off the receiver, pour out the water contained in it, and collect the mercury.

Mercury is never mineralized in the bowels of the earth by any thing but ſulphur: with which it forms a compound of a browniſh red colour, known by the name of *Cinabar*.

The oldeſt and richeſt mine of mercury is that of Almaden in Spain. It is a ſingular property of that mine, that though the mercury found in it is combined with ſulphur, and in the form of cinabar, yet no additament is required to procure the ſeparation of theſe two; the earthy and ſtony matter, with which the particles of the ore are incorporated, being itſelf an excellent abſorbent of ſulphur.

In the quick-ſilver works carried on at this mine they make no uſe of retorts. They place lumps of the ore on an iron grate, which ſtands immediately over the furnace. The furnaces which ſerve for this operation are cloſed at the top by a ſort of dome, behind which ſtands the ſhaft of a chimney that communicates with the fire-place, and gives vent to the ſmoke. Theſe furnaces have in their fore-ſide ſixteen apertures, to each of which is luted an aludel in a horizontal poſition, communicating with a long row of other aludels placed likewiſe in an horizontal direction; which aludels ſo connected together form one long pipe or canal, the further end whereof opens into a chamber deſtined to receive and condenſe all the mercurial vapours. Theſe rows of aludels are ſupported from end to end by a terraſs, which runs from the body of the building, wherein the furnaces are erected, to that where the chambers are built that perform the office of receivers.

This a very ingenious contrivance, and ſaves much labour, expence, and trouble, that would be unavoidable if retorts were employed.

That part of the furnace which contains the lumps of ore, ſerves for the body of the retort; the row of aludels for its neck; and the little chambers in which theſe canals terminate are actual receivers. The terraſs of of communication, which reaches from the one building to the other, is formed of two inclined planes, the lower edges of which, meeting in the middle of the terraſs, riſe from thence inſenſibly; the one quite to the building where the furnaces are, and the other to that which forms the recipient chambers. By this means, when any mercury eſcapes through the joints of the aludels, it naturally runs down along theſe inclined planes, and ſo is collected in the middle of the terraſs, where the inferior ſides of the planes meeting together form a ſort of canal, out of which it is eaſily taken up.

To give Mercury, by the action of Fire, the appearance of a Metalline Calx.

Put mercury into ſeveral little glaſs matraſſes with long and narrow necks. Stop the matraſſes with a little paper, to prevent any dirt from falling into them. Set them all in one ſand-bath, ſo that they may be ſurrounded with ſand as high as two thirds of their length. Apply the ſtrongeſt degree of heat that mercury can bear without ſubliming: continue this heat without interruption, till all the mercury be turned to a red powder. The operation laſts about three months.

Mercury thus converted to a red powder is known in chemiſtry and medicine by the name of *mercury precipitated per ſe*.

To diſſolve Mercury in the Vitriolic Acid. Turbith mineral.

Put mercury into a glaſs retort, and pour on it thrice its weight of good oil of vitriol. Set the retort in a ſand-bath; fit on a recipient; warm the bath by degrees till the liquor juſt ſimmer. With this heat the mercury will begin to diſſolve. Continue the fire in this degree till all the mercury be diſſolved.

The vitriolic acid diſſolves mercury pretty well: but for this purpoſe the acid muſt be very hot, or even boil; and then too it is a very long time before the diſſolution is completed. We have directed the operation to be performed in a retort; becauſe this ſolution is uſually employed to make another preparation called *turbith mineral*, which requires that as much as poſſible of the acid ſolvent be abſtracted by diſtillation. Having therefore diſſolved your mercury in the vitriolic acid, if you will now prepare the turbith, you muſt, by continuing to heat the retort, drive over all the liquor into the receiver, and diſtill till nothing remains but a white powdery matter: then break the retort; pulveriſe its contents in a glaſs mortar, and thereon pour common water, which will immediately turn the white matter of a lemon-colour; waſh this yellow matter in five or ſix warm waters, and it will be what is called in medicine *turbith mineral*; that is, a combination of the vitriolic acid with mercury, five or ſix grains whereof is a violent purgative, and alſo an emetic; qualities which it poſſeſſes in

common with the vegetable turbith, whofe name it hath therefore taken.

To combine Mercury with fulphur. Æthiops Mineral.

Mix a dram of fulphur with three drams of quickfilver, by triturating the whole in a glafs mortar with a glafs peftle. By degrees, as you triturate, the mercury will difappear, and the matter will acquire a black colour. Continue the triture till you cannot perceive the leaft particle of running mercury. The black matter you will then have in the mortar is known in medicine by the name of *æthiops mineral.* An æthiops may alfo be made by fire in the following manner.

In a fhallow unglazed earthen pan melt one part of flowers of fulphur: add three parts of running mercury, making it fall into the pan in the form of fmall rain, by fqueezing it through chamoy leather. Keep ftirring the mixture with the fhank of a tobacco-pipe all the while the mercury is falling: you will fee the matter grow thick and acquire a black colour. When the whole is thoroughly mixed, fet fire to it with a match, and let as much of the fulphur burn away as will flame.

To fublime the combination of Mercury and Sulphur into Cinabar.

Grind to powder æthiops mineral prepared by fire. Put it into a cucurbit; fit thereto a head; place it in a fand-bath, and begin with applying fuch a degree of heat as is requifite to fublime fulphur. A black matter will rife, and adhere to the fides of the veffel. When nothing more will rife with this degree of heat, raife the fire fo as to make the fand and the bottom of the cucurbit red; and then the remaining matter will fublime in the form of a brownifh red mafs, which is true *cinabar.*

To diffolve Mercury in the Nitrous acid. Sundry Mercurial Precipitates.

Put into a matras the quantity of mercury you intend to diffolve: pour on it an equal quantity of good fpirit of nitre, and fet the matras in a fand-bath moderately heated. The mercury will diffolve with the phenomena that ufually attend the diffolutions of metals in this acid. When the diffolution is completed, let the liquor cool. You will know that the acid is perfectly faturated, if there remain at the bottom of the veffel, notwithftanding the heat, a little globule of mercury that will not diffolve.

Mercury diffolves in the nitrous acid with much more facility, and in much greater quantity, than in the vitriolic; fo that it is not neceffary, on this occafion, to make the liquor boil. This folution when cold yields cryftals, which are a nitrous mercurial falt. If you defire to have a clear limpid folution of mercury, you muft employ an *aqua fortis* that is not tainted with vitriolic or marine acid: for, the affinity of thefe two acids with mercury being greater than that of the nitrous acid, they precipitate it in the form of a white powder, when they are mixed with the folvent.

Mercury thus precipitated in a white powder, out of a folution thereof in the fpirit of nitre, is ufed in medicine. To obtain this precipitate, which is known by the name of the *white precipitate*, fea-falt, diffolved in water, together with a little fal ammoniac is ufed; and the precipitate is wafhed feveral times in pure water, without which precaution it would be corrofive, on account of the great quantity of the marine acid which it would contain.

The preparation known by the name of *red precipitate*, is alfo obtained from our folution of mercury in fpirit of nitre. It is made by abftracting all the moifture of the folution, either by diftillation in a retort, or by evaporation in a glafs bafon fet on a fand-bath. When it begins to grow dry, it appears like a white ponderous mafs. Then the fire is made ftrong enough to drive off almoft all the nitrous acid, which, being now concentrated, rifes in the form of red vapours. If thefe vapours be catched in a receiver, they condenfe into a liquor, which is a very ftrong and vaftly fmoking fpirit of nitre.

By degrees, as the nitrous acid is forced up by the fire, the mercurial mafs lofes its white colour, and becomes firft yellow, and at laft very red. When it is become entirely of this laft colour, the operation is finifhed. The red mafs remaining is a mercury that contains but very little acid, in comparifon of what it did while it was white: and indeed the firft white mafs is fuch a violent corrofive, that it cannot be ufed in medicine; whereas, when it is become red, it makes an excellent efcharotic, which thofe who know how to ufe it properly apply with very great fuccefs, particularly to venereal ulcers.

To combine Mercury with the Acid of Sea-falt. Corrofive Sublimate.

Evaporate a folution of mercury in the nitrous acid till there remain only a white powder, as mentioned in our obfervations on the preceding procefs. With this powder mix as much green vitriol calcined to whitenefs, and decrepitated fea-falt, as there was mercury in the folution. Triturate the whole carefully in a glafs mortar. Put this mixture into a matras, fo that two thirds thereof may remain empty, having firft cut off the neck to half its length; or inftead thereof you may ufe an apothecary's phial. Set your veffel in a fand-bath, and put fand round it as high as the contents reach. Apply a moderate fire at firft, and raife it by flow degrees. Vapours will begin to afcend. Continue the fire in the fame degree till they ceafe. Then ftop the mouth of the veffel with paper, and increafe the fire till the bottom of the fand-bath be red-hot. With this degree of heat a fublimate will rife, and adhere to the infide and upper part of the veffel, in the form of white, femi-tranfparent cryftals. Keep up the fire to the fame degree till nothing more fublimes. Then let the veffel cool; break it, and take out what is fublimed, which is *corrofive fublimate.*

Sweet Sublimate.

Take four parts of corrofive fublimate; pulverife it in a glafs or marble mortar; add by little and little three parts of mercury revivified from cinabar; triturate the whole carefully, till the mercury be perfectly killed, fo that

that no globule thereof can be perceived. The matter will then be grey. Put this powder into an apothecary's phial, or into a matras, whofe neck is not above four or five inches long, leaving two thirds thereof empty. Set the veffel in a fand-bath, and put fand round it to one third of its height. Apply a moderate fire at firft; and afterwards raife it gradually till you perceive that the mixture fublimes. Keep it up to this degree till nothing more will rife, and then break the veffel. Reject, as ufelefs, a fmall quantity of earth which you will find at the bottom; feparate alfo what adheres to the neck of the veffel, and carefully collect the matter in the middle, which will be white. Pulverife it; fublime it a fecond time, in the fame manner as before; and in the fame manner feparate the earthy matter left at the bottom of the veffel, and what you find fublimed into the neck. Pulverife, and fublime a third time, the white matter you laft found in the middle. The white matter of this third fublimation is the *fweet fublimate*, called alfo *aquila alba*.

The Panacea of Mercury.

Pulverise fome fweet fublimate, and fublime it in the fame manner as you did thrice before. Repeat this nine times. After thefe fublimations it will make no impreffion on the tongue. Then pour on it aromatic fpirit of wine, and fet the whole in digeftion for eight days. After that decant the fpirit of wine, and dry what remains, which is the *panacea of mercury*.

Of Antimony.

To feparate Antimony from its Ore by Fufion.

Having drilled fome fmall holes, of about two lines diameter, in the bottom of a crucible, put into it your antimonial ore broken into little bits, about the fize of a hazel nut; lute on its cover; fet the crucible thus prepared in the mouth of another crucible, and clofe the joints with lute.

At the diftance of half a foot from this compound veffel place bricks all round, fo as to form a furnace; the fides of which muft rife as high as the brim of the uppermoft crucible.

Let the bottom of this furnace be filled with afhes, up to the top of the lower crucible, and the reft of the furnace with lighted coals. Blow the fire, if it be neceffary, with bellows, till the upper crucible become red. Keep it up in this degree for about a quarter of an hour. Then take your veffels out of the furnace, and you will find the antimony collected in the bottom of the lower crucible, having run through the holes of the upper one.

The common Regulus of Antimony.

Reduce crude antimony to powder. Mix it with three fourths of its weight of white tartar, and half its weight of refined falt-petre, both pulverifed. Into a large crucible, made red-hot in the fire, throw a fpoonfull of your mixture, and cover it. There will be a very confiderable detonation. When it is over, throw in a fecond fpoonfull of your mixture, and cover the crucible as before: this will produce a fecond detonation. Go on thus, till you have thrown in all your mixture.

When the whole has thus fulminated, increafe the fire fo as to bring the matter into fufion; that being done, take the crucible out of the furnace, and immediately pour its contents into an iron cone heated and greafed with tallow. Strike the floor and the cone fome gentle blows with a hammer, to make the regulus precipitate; and when the matter is fixed and cold, invert the cone, and turn it out. You will fee it confift of two diftinct fubftances; the uppermoft of which is a faline fcoria, and the undermoft the reguline part. Strike this mafs a blow with a hammer, in the place where thefe fubftances join, and you will by this means feparate the fcoria from the regulus; the latter of which will have the form of a metallic cone, on whofe bafe you will obferve the fignature of a bright ftar.

Regulus of Antimony precipitated by Metals.

Put one part of fmall iron nails into a crucible, and fet it amidft burning coals, in a melting furnace. When the iron is thoroughly red-hot, and begins to grow white, add thereto little by little, and at feveral times, two parts of crude antimony in powder. The antimony will immediately flow and unite with the iron. When the antimony is entirely melted, add thereto, at feveral times, the fourth of its weight of pulverifed nitre: a detonation will enfue, and the whole mixture will be in fufion.

After you have kept the matter in this condition for fome minutes, pour it into an iron cone, firft heated and tallowed. Strike the fides of the cone with a hammer, that the regulus may fall to the bottom; and, when all is cold, feparate it from the fcoria by a blow with a hammer. Melt this firft regulus again in another crucible, adding a fourth part of its weight of crude antimony. Keep the crucible clofe fhut, and give no more heat than is neceffary to melt the matter. When it is in perfect fufion, add to it at feveral times, as you did before, the fixth part of its weight of pulverifed nitre; and, in half a quarter of an hour after this, pour the whole into a cone as you did the firft time.

Laftly, Melt your regulus over again a third or even a fourth time, always adding a little nitre, which will detonate as before. If after all thefe fufions you pour the regulus into an iron cone, you will find it very beautiful, and the ftar well formed: it will be covered with a femi-tranfparent, lemon-coloured fcoria. This fcoria is extremely acrid and cauftic.

The Calcination of Antimony.

Take an unglazed earthen veffel, wider at top than at bottom; put into it two or three ounces of crude antimony finely pulverifed. Set this veffel over a weak charcoal-fire, and increafe the heat till you fee the antimony begin to fmoke a little. Continue the fire in this degree, and keep inceffantly ftirring the antimony with the fhank of a tobacco-pipe all the while it is upon the fire.

The powder of antimony, which, before calcination, was of a brilliant colour inclining to black, will become dull,

dull, and look like an earth. When it comes to have this appearance, raise your fire till the vessel be red-hot, and keep it up in this degree till the matter cease entirely to smoke.

Calx of Antimony reduced to a Regulus.

Mix the calx of antimony, which you intend to reduce, with an equal quantity of black soap. This mixture will make a thin paste. Put it little by little into a crucible, previously made red-hot amidst live coals. Thus let the soap burn, till it cease to emit an oily smoke. Then cover the crucible; make the fire strong enough to melt the matter, and you will hear it effervesce and boil. When this noise is over, let the crucible cool, and then break it: you will find in it a beautiful scoria, marked with circles of several colours; and under that a button of regulus, which is not yet quite pure, and must be purified in the following manner.

Pound this regulus, and mix it with half its weight of an antimonial calx as perfectly desulphurated as possible. Put it into a crucible, and cover it: melt the whole, so that the surface of the melted matter may be smooth and uniform. Let the crucible cool, and then break it: you will find in it a beautiful button of very pure regulus, covered with a scoria, having the appearance of an opaque glass, or a kind of greyish enamel, moulded on the finely radiated surface of the regulus.

Antimony calcined with Nitre. Liver of Antimony.

Pulverise and mix perfectly together equal parts of nitre and antimony: put the mixture into an iron mortar, and cover it with a tile, which however must not shut it quite close. With a live coal set fire to the matter in the mortar, and immediately withdraw it. The mixture will flame, with great detonation; which being over, and the mortar cooled, invert it, and strike its bottom to make all the matter fall out. Then, by a blow with a hammer, separate the scoria from the shining part, which is the *liver of antimony*.

Another Calcination of Antimony with Nitre. Diaphoretic Antimony.

Mix one part of antimony with three parts of nitre; project this mixture by spoonfulls into a crucible kept red hot in a furnace. Each projection will be attended with a detonation. Continue doing this till you have used all your mixture: then raise the fire, and keep it up for two hours; after which throw your matter into a pan full of hot water. Let it lie steeping in water kept hot for a whole day. Then pour off the liquor: wash the white powder you find at bottom in warm water; and repeat the ablutions till the powder become insipid. Dry it, and you have *diaphoretic antimony*.

Calx of Antimony vitrified.

Take any quantity you please of calx of antimony, made without addition; put it into a good crucible, which set in a melting furnace: kindle the fire gradually, and leave the crucible uncovered at the beginning.

A quarter of an hour after the matter is red-hot, cover the crucible, and excite the fire vigorously till the calx melt. You may know when it is thoroughly melted, by dipping into the crucible an iron wire, to the end of which a little knob of glass will adhere, if the matter be in perfect fusion. Keep it in fusion for a quarter of an hour, or rather longer if your crucible can bear it. Then take it out of the furnace, and immediately pour out the melted matter on a smooth stone, made very hot for the purpose: it will presently fix into a yellow glass.

Kermes Mineral.

Break any quantity you will of Hungarian antimony into little bits: put it into a good earthen coffee-pot: pour on it twice its weight of rain-water, and a fourth part of its weight of well filtered liquor of nitre fixed by charcoal. Boil the whole briskly for two hours, and then filter the liquor. As it cools it will acquire a red colour, grow turbid, and leave a red powder on the filter.

Return your antimony into the coffee-pot. Pour on it as much rain-water as before, and three fourths of the former quantity of the liquor of fixed nitre. Boil it again for two hours, and then filter the liquor. It will again deposite a red sediment. Return your antimony into the coffee pot: pour on it the same quantity of rain-water, and half the first quantity of the liquor of fixed nitre. Boil it again for two hours, and filter the liquor as formerly. Wash all these sediments with warm water, till they become insipid; then dry them, and you have the *kermes mineral*.

Regulus of Antimony dissolved in the Mineral Acids.

Compound an *aqua regis* by mixing together four measures of spirit of nitre, and one measure of spirit of salt: on a sand-bath moderately heated place a matras, into which pour sixteen times as much of this *aqua regis* as you have regulus to dissolve. Break your regulus in little bits; and throw them successively one after another into the matras, observing not to add a new one till that put in before is entirely dissolved: continue this till your regulus be all used. By degrees, as the dissolution advances, the liquor will acquire a beautiful golden colour; which however will insensibly disappear, as the white fumes that continually ascend from it evaporate.

Regulus of Antimony combined with the Acid of Sea-salt. Butter of Antimony. Cinabar of Antimony.

Pulverise and mix thoroughly six parts of regulus of antimony, and sixteen parts of corrosive sublimate. Put this mixture into a glass retort that hath a wide short neck, and let one half of its body at least be left empty. Set it in a reverberatory furnace, and having fitted a recipient thereto and luted the joint, make a very small fire at first to heat it slowly. Increase it afterwards by degrees, till you see a liquor ascend from the retort that grows thick as it cools. Keep up the fire to this degree as long as you see any of this matter come over.

When no more arises with this degree of fire, unlute your vessels, take off the receiver, and in its place substitute another filled with water. Then increase your fire by degrees till the retort be red hot. Some running

ning mercury will fall into the water, which you may dry and keep for ufe; it being very pure.

Soon after mixing the regulus with the corrofive fublimate, the matter fometimes grows confiderably hot: This is occafioned by the marine acid's beginning to act on the reguline part, and to defert its mercury.

The butter of antimony rifes with a very moderate heat; becaufe the acid of fea-falt hath the property of volatilizing, and carrying up along with it, the metallic fubftances with which it is combined: And for this reafon a very gentle heat only is required at the beginning of the operation.

It is abfolutely neceffary that the neck of the retort be wide and fhort: for otherwife, if the butter of antimony fhould fix and be accumulated therein, it might ftop up the paffage entirely, and occafion the burfting of the veffels. By this operation we obtain eight parts and three quarters of fine butter of antimony, and ten parts of running mercury; there being left in the retort one part and a half of a rarefied matter, black, white, and red. This is probably the moft earthy and moft impure part of the regulus of antimony.

If crude antimony, inftead of regulus of antimony, be mixed with corrofive fublimate, a butter of antimony will be obtained in the fame manner; but, inftead of having a running mercury after the butter, you will find a cinabar fublimed into the neck and upper concavity of the retort.

The reafon of this difference is eafily conceived: for, when the regulus is ufed, the mercury being deferted by its acid, finds no other fubftance to unite with, and fo rifes in the form of quick-filver; but when crude antimony is employed inftead of its regulus, as the reguline part thereof cannot combine with the acid without quitting its fulphur, fo this fulphur, being at liberty, unites with the mercury, which is fo likewife, and therewith forms a cinabar; which from its origin is named *cinabar of antimony*.

Butter of Antimony decompounded by means of Water only. The Pulvis Algaroth, *or* Mercurius Vitæ.

Melt with a gentle heat as much butter of antimony as you pleafe. When it is melted, pour it into a large quantity of warm water. The water will immediately grow turbid, but whitifh, and let fall a great quantity of white powder. When all the precipitate is fettled, decant the water: pour on frefh warm water; and having thus edulcorated it by feveral ablutions, dry it, and you have the *pulvis Algaroth*, or *mercurius vitæ*.

Bezoar Mineral.

Melt butter of antimony over warm afhes, and put it into a phial or matras. Gradually pour on it good fpirit of nitre, till the matter be entirely diffolved. This ufually requires as much fpirit of nitre as there is butter of antimony. During the diffolution fumes will rife, which muft be carefully avoided. Pour your folution, which will be clear and of a reddifh colour, into a glafs cucurbit, or a pan of ftone-ware; fet it in a fand-bath, and evaporate to drynefs with a moderate heat. There will be left a white mafs, weighing a fourth part lefs than the whole quantity ufed, both of butter and the fpirit of nitre. Let it cool, and again pour on it as much fpirit of nitre as you ufed the firft time. Place the veffel again in the fand-bath, and evaporate the moifture as before. You will have a white mafs that hath neither gained nor loft in weight. On this pour, for the third time, the fame quantity of fpirit of nitre as you did the firft time. Again evaporate the moifture to perfect drynefs: then increafe your fire, and calcine the matter for half an hour. You will have left a dry, friable, light, white matter, of an agreeable acid tafte; which will fall into a coarfe powder, and muft be kept in a phial carefully ftopt. This is Bezoar mineral: it is neither cauftic nor emetic, and has only a fudorific virtue. It obtained the name it bears, becaufe, like the animal bezoar, it was imagined to have the property of refifting poifon.

Flowers of Antimony.

Take an unglazed earthen pot, having an aperture in its fide, with a ftopple to fhut it clofe. Set this pot in a furnace, the cavity whereof it may fit as exactly as poffible; and fill up with lute the fpace, if any, left between the veffel and the furnace. Over this veffel fix three aludels with a blind-head at the top; and light a fire in the furnace under the pot.

When the bottom of the pot is thoroughly red, throw into the lateral aperture a fmall fpoonful of powdered antimony. Stir the matter immediately with an iron fpatula made a little bending, in order to fpread it over the bottom of the veffel, and then ftop the hole. The flowers will rife and adhere to the infides of the aludels. Keep up the fire fo that the bottom of the pot may always continue red; and, when nothing more fublimes, put in a like quantity of antimony, and operate as before. In this manner go on fubliming your antimony, till you have as many flowers as you want. Then let the fire go out; and when the veffels are cold, unlute them. You will find flowers adhering all round the infides of the aludels and the head, which you may collect with a feather.

Regulus of Antimony converted into Flowers.

Pulverise your regulus of antimony: put the powder into an unglazed earthen port: three or four fingers breadth above the powder, fit into the pot a little cover, made of the fame earth and having a fmall hole in its middle, fo that it may with eafe be placed in the pot and taken out when there is occafion: cover the mouth of the pot with a common lid; fet it in a furnace, and kindle a fire under it fufficient to make the bottom of the pot red and to melt the regulus. When it hath been thus kept in fufion for about an hour, let the fire go out and the whole cool. Then remove the two covers. You will find adhering to the furface of the regulus, which will be in a mafs at the bottom of the pot, white flowers refembling fnow, intermixed with beautiful, brilliant, filver coloured needles. Take them out, and you will find them make about one part in fixty-two of the whole regulus employed.

Put the covers again in their places, and proceed in the fame manner as before: When the veffels are cold,

cold, you will find half as many more flowers as you got the firſt time.

Proceed thus till you have converted all your regulus into flowers. This will require a cōnſiderable number of ſublimations, which, as you advance, will always yield you a greater portion of flowers; reſpect, however, being had to the quantity of regulus remaining in the pot.

Of Bismuth.

To extract Biſmuth from its Ore.

Break the ore of biſmuth into ſmall pieces, and therewith fill a crucible either of earth or iron. Set the the crucible in a furnace, and light ſuch a fire that the bits of ore may become moderately red. Stir the ore from time to time; and if you perceive it crackle and fly, keep the crucible covered. At the bottom you will find a button of biſmuth.

Biſmuth diſſolved by Acids. Magiſtery of Biſmuth. Sympathetic Ink.

Into a matras put biſmuth broken into little bits: pour on it, by little and little, twice as much *aqua fortis*. This acid will attack the ſemi-metal briſkly, and diſſolve it entirely, with heat, effervescence, vapours, and puffing up. The ſolution will be clear and limpid.

If you would have a magiſtery of biſmuth beautifully white, you muſt perform the diſſolution with an *aqua fortis* that is not tainted with any mixture of the vitriolic acid; for this gives the precipitate a dirty white colour, inclining to grey.

Biſmuth may alſo be precipitated by the means of fixed or volatile alkalis; but the precipitate is not of ſo fine a white as when procured by the means of pure water only.

A ſolution of biſmuth prepared with the proper quantity of *aqua fortis*, that is, with two parts of the acid to one of the ſemi metal, coaleſces into little cryſtals almoſt as ſoon as made.

Aqua fortis not only acts on biſmuth when ſeparated from its ore, and reduced to a regulus, but attacks it even in its ore, and likewiſe diſſolves at the ſame time ſome portion of the ore itſelf. With this ſolution of the ore of biſmuth Mr Hellot makes a very curious ſympathetic ink, differing from all that were known before.

Mr Hellot prepares the liquor in the following manner: "He bruiſes the ore of biſmuth to a coarſe powder. On two ounces of this powder he pours a mixture of five ounces of common water with five ounces of *aqua fortis*. He does not heat the veſſel till the firſt ebullitions are over. He then ſets it in a gentle ſand-heat, and lets it digeſt there till he ſees no more air-bubbles riſe. When none appear in this heat, he increaſes it ſo as to make the ſolvent boil ſlightly for a full quarter of an hour. It takes up a tincture nearly of the colour of brown beer. The ore that gives the *aqua fortis* this colour is the beſt. He then lets the ſolution cool, laying the matras on its ſide, that he may decant the liquor more conveniently when all is precipitated that is not taken up by the ſolvent.

"The ſecond veſſel, into which the liquor is firſt decanted, he alſo lays declining, that a new precipitation of the undiſſolved matters may be obtained; after which he pours the liquor into a third veſſel. This liquor muſt not be filtered, if you would have the reſt of the proceſs ſucceed perfectly; becauſe the *aqua fortis* would diſſolve ſome of the paper, and that would ſpoil the colour of your liquor.

"When this ſolution, which Mr Hellot calls the *impregnation*, is thoroughly clarified by being decanted three or four times, he puts it into a glaſs baſon with two ounces of very pure ſea-ſalt. The fine white ſalt made by the ſun ſucceeded beſt with Mr Hellot. If that cannot be had, common bay-ſalt purified by ſolution, filtration, and cryſtalliſation, may be uſed inſtead of it. But as it is rare to meet with any of the ſort that is not a little tainted with iron, the white bay ſalt is to be preferred. The glaſs baſon he ſets in a gentle ſand-heat, and keeps it there till the mixture be reduced by evaporation to an almoſt dry ſaline maſs.

"If you deſire to ſave the *aqua regis*, the impregnation muſt be put into a retort, and diſtilled with the gentle heat of a ſand-bath. But there is an inconvenience, as Mr Hellot obſerves, in employing a retort; which is, that, as the ſaline maſs cannot be ſtirred while it coagulates in the retort, it is reduced to a compact cake of coloured ſalt, which preſents but one ſingle ſurface to the water in which it muſt be diſſolved; ſo that the diſſolution thereof takes up ſometimes no leſs than five or ſix days. In the baſon, on the contrary, the ſaline maſs is eaſily brought to a granulated ſalt, by ſtirring it with a glaſs rod; and, when thus granulated, it has a great deal more ſurface; it diſſolves more eaſily, and yields its tincture to water in four hours time. Indeed one is more expoſed to the vapours of the ſolvent, which would be dangerous, if the operation were to be often performed, without proper precautions.

"When the baſon, or little veſſel containing the mixture of the impregnation and ſea ſalt, is heated, the liquor, which was of an orange-coloured red, becomes a crimſon red; and, when all the phlegm of the ſolvent is evaporated, it acquires a beautiful emerald colour. By degrees it thickens, and turns of the colour of a maſs of verdegris. It muſt then be carefully ſtirred with the glaſs rod, in order to granulate the ſalt, which muſt not be kept over the fire till it be perfectly dry: becauſe you run a riſk of loſing irrecoverably the colour you are ſeeking. You may be ſure you have loſt it, if by too much heat the ſalt that was of a green colour turn to a dirty yellow. If it be once brought to this ſtate, it will continue without changing when cold: but if care be taken to remove it from the fire while it is ſtill green, you will ſee it gradually grow pale, and become of a beautiful roſe-colour as it cools.

"Mr Hellot ſeparates it from this veſſel, and throws it into another containing diſtilled rain-water: and this ſecond veſſel he keeps in gentle digeſtion, till he obſerves that the powder which falls to the bottom is perfectly white. If, after three or four hours digeſting, this powder ſtill continues tinged with a roſe colour, it is a proof that water enough was not added to diſſolve all the ſalt

falt impregnated with the tincture of the folution. In this cafe, the firft tinged liquor muft be poured off, and frefh water added in proportion to the quantity of tinged falt that is fuppofed to remain mixed with the precipitate.

" When the ore is pure, and doth not contain a great deal of fufible ftone, commonly called *fluor*, or *quartz*, an ounce of it generally yields tincture enough for eight or nine ounces of water, and the liquor is of a beautiful colour, like that of the lilach or pipe-tree bloffom. In order to prove the effect of this tincture, you muft write with this lilach-coloured liquor on good well-gummed paper, that does not fink: or you may ufe it to fhade the leaves of fome tree or plant, having firft drawn the outlines thereof lightly with China ink or with a black lead pencil. Let this coloured drawing, or writing, dry in a warm air. You will perceive no colour while it is cold; but, if it be gently warmed before the fire, you will fee the writing, or the drawing, gradually acquire a blue or greenifh blue colour, which is vifible as long as the paper continues a little warm, and difappears entirely when it cools."

The fingularity of this fympathetic ink confifts in its property of difappearing entirely, and becoming invifible, though it be not touched with any thing whatever: and this diftinguifhes it from all others; which, when once rendered vifible by the application of proper means, do not again difappear, or at leaft not without touching the ftrokes on the paper with fome other liquor.

Of ZINC.

To extract Zinc from its Ore, or from Calamine.

TAKE eight parts of calamine reduced to a powder; mix this powder accurately with one part of fine charcoal duft, previoufly calcined in a crucible to free it from all moifture: put this mixture into a ftone retort coated with lute, leaving a third part of it empty: fet your retort in a reverberatory furnace, capable of giving a very fierce heat. To the retort apply a receiver, with a little water in it. Kindle the fire, and raife it by degrees till the heat be ftrong enough to melt copper. With this degree of fire the zinc being metallifed will feparate from the mixture, and fublime into the neck of the retort, in the form of metallic drops. Break the retort when it is cold, and collect the zinc.

Moft of the zinc we have comes from an ore of difficult fufion that is worked at Goflar, and yields, at one and the fame time, lead, zinc, and another metallic matter called *cadmia fornacum*, which alfo contains much zinc.

The furnace ufed for fmelting this ore is clofed on its fore-fide with thin plates or tables of ftone, not above an inch thick. This ftone is greyifh, and bears a violent fire.

In this furnace the ore is melted amidft charcoal, by the help of bellows. Each melting takes twelve hours, during which time the zinc flowing with the lead is refolved into flowers and vapours, great part of which adheres to the fides of the furnace in the form of a very hard cruft of earth. The workmen take care to remove this cruft from time to time; for it would otherwife grow fo thick at laft, as to leffen the cavity of the furnace very confiderably.

There adheres moreover to the fore-part of the furnace, which is formed, as we faid before, of thin plates of ftone, a metallic matter, which is the zinc, and is carefully collected at the end of each melting, by removing from this part all the live coals. A quantity of fmall coal is laid unlighted at the bottom; and on this fmall-coal, by ftriking the ftone-plates gently with a hammer, the zinc is made to fall out of the other matter, known by the Latin name of *cadmia fornacum*, among which it appears fixed in a radiated form. To this other matter we may properly enough give the name of *furnace-calamine*. The zinc falls in the form of a melted metal, all on fire, and in a bright flame. It would foon be entirely burnt and reduced to flowers, if it were not extinguifhed, and eafily cooled and fixed, by being hid under the unlighted fmall-coal placed below on purpofe to receive it.

The zinc adheres to the fore-part of the furnace preferably to any other, becaufe that being the thinneft, is therefore the cooleft: and, in order further to promote its fixing on this part, they take care to keep the thin ftone-plates cool during the operation, by throwing water on them.

Hence it appears that zinc is not extracted from its ore by fufion and the precipitation of a regulus, like other metallic fubftances. This is owing to the great volatility of our femi-metal, which cannot, without fubliming, bear the degree of fire neceffary to melt its ore. It is at the fame time fo combuftible, that a great part of it rifes in flowers which have not the metalline form.

To fublime Zinc into Flowers.

TAKE a very deep, large crucible: place this crucible in a furnace, fo that it may ftand inclining in an angle of forty-five degrees nearly. Throw fome zinc into it, and kindle a fire in the furnace fomewhat ftronger than would be neceffary to keep lead in fufion. The zinc will melt. Stir it with an iron wire, and there will appear on its furface a very bright white flame: two inches above this flame a thick fmoke will be formed, and with this fmoke exceeding white flowers will rife, and remain fome time adhering to the fides of the crucible, in the form of a very fine light down. When the flame flackens, ftir your melted matter again with the iron wire: you will fee the flame renewed, and the flowers begin again to appear in greater abundance. Go on thus till you obferve that the matter will not flame, nor any more flowers rife.

To combine Zinc with Copper. Brafs. Prince's Metal, &c.

POUND one part and an half of calamine, and an equal quantity of charcoal: mingle thefe two powders together, and moiften them with a little water. Put this mixture into a large crucible, or fome other earthen veffel that will bear a melting heat. Amongft and over this mixture put one part of very pure copper in thin plates, and then put frefh charcoal-duft over all: clofe the

the crucible; ſet it in a melting furnace; put coals all round it, and let them kindle gradually. Raiſe the fire ſo as to make the crucible very red-hot. When you obſerve that the flame hath acquired a purple or blueiſh-green colour, uncover the crucible, and dip into it an iron wire, to examine whether or no the copper be in fuſion under the charcoal duſt. If you find it is, moderate the force of the fire a little, and let your crucible remain in the furnace for a few minutes. Then take it out and let it cool: you will find your copper of a gold colour, increaſed in weight a fourth, or perhaps a third part, and yet very malleable.

The *lapis calaminaris* is not the only ſubſtance with which copper may be converted into braſs: all other ores containing zinc, the furnace-calamine that ſublimes where ſuch ores are worked, tutty, zinc in ſubſtance, may be ſubſtituted for it, and, like it, will make very fine braſs; but, in order to ſucceed, ſundry precautions are neceſſary.

This proceſs is a ſort of cementation; for the calamine doth not melt; only the zinc is converted into vapours, and then combines with the copper. On this the ſucceſs of the operation partly depends, as it is the means of the copper's preſerving its purity and malleability; becauſe the other metallic ſubſtances that may be united with the ore of zinc, or with the zinc itſelf, not having the ſame volatility, cannot be reduced to vapours. If you are appriſed that the calamine, or other ore of zinc uſed on this occaſion, is contaminated with a mixture of any other metallic matter, you muſt mingle luting earth with the charcoal-duſt and the matter containing the zinc; make it into a ſtiff paſte with water; of this make a bed at the bottom of your crucible, and ram it hard down; lay the copper-plates thereon, cover them with charcoal-duſt, and then proceed as before. By this means, when the copper melts, it cannot fall to the bottom of the crucible, nor mix with the ore; but is borne up by the mixture, and cannot combine with any thing but the zinc, that riſes in vapours, and, paſſing through the lute, fixes in the copper.

Lapis Calaminaris, or other ore of zinc, may be alſo purified before it be uſed for making braſs; eſpecially if adulterated with lead ore, which is often the caſe. For this purpoſe the ore muſt be roaſted in a fire ſtrong enough to give a ſmall degree of fuſion to the leaden matter; which will thereby be reduced into larger, heavier, and tougher maſſes. The moſt ſubtile particles are diſſipated in the torrefaction, together with ſome of the calamine. The calamine, on the contrary, is by roaſting made more tender, lighter, and much more friable. When it is in this condition, put it into a waſhing tray or fan; dip the tray in a veſſel full of water, and bruiſe the matter it contains. The water will carry off the lighteſt powder, which is the calamine, and leave nothing at the bottom of the tray but the heavieſt ſubſtance; that is, the leaden matter, which is to be rejected as uſeleſs. The powder of the calamine will ſettle at the bottom of the veſſel, where, after pouring off the water, it may be found, and uſed as above directed.

In this operation the charcoal-duſt ſerves to prevent both the copper and the zinc from being calcined: and for this reaſon, when you work on a great quantity of materials at once, it is not neceſſary to uſe ſo much charcoal-duſt, in proportion, as when you work but on a ſmall quantity; becauſe, the greater the maſs of metal, the leſs eaſily will it calcine.

Though the copper melts in this operation, yet it is far from being neceſſary to apply ſuch a ſtrong fire as copper uſually requires to melt it: for the acceſſion of the zinc, on this occaſion, communicates to it a great degree of fuſibility. The increaſe of its weight is alſo owing to the quantity of zinc combined with it. Copper acquires ſtill another advantage by its aſſociation with this ſemi-metal; for it remains longer in the fire without calcining.

Braſs well prepared ought to be malleable when cold. But in whatever manner it be made, and whatever proportion of zinc there be in it, it is conſtantly found quite unmalleable when red-hot.

Braſs melted in a crucible, with a fierce heat, takes fire almoſt like zinc, and from its ſurface many white flowers aſcend, dancing about in flakes like the flowers of zinc. They are indeed the flowers of zinc, and the flame of braſs urged by a ſtrong fire is no other than the flame of the zinc that is united with the copper, and then burns. If braſs be thus kept long in fuſion, it will loſe almoſt all the zinc it contains. It will alſo loſe much of its weight, and its colour will be nearly that of copper. It is therefore neceſſary, towards performing this operation aright, to ſeize the moment when the copper is ſufficiently impregnated with zinc, when it hath acquired the moſt weight and the fineſt colour, with the leaſt detriment to its ductility, that is poſſible, and that inſtant to put out the fire; becauſe, if the copper be left longer in fuſion, it will only loſe the zinc already united with it. Skill acquired by much practice, and an acquaintance with the particular calamine employed, are neceſſary to guide the artiſt ſurely through this operation; for there are very conſiderable differences between the ſundry ores of zinc. Some of them contain lead, and in others there is iron. When theſe heterogeneous metals come to be mixed with the copper, they do indeed augment its weight, but they render it at the ſame time pale, and make it very harſh. Some calamines require to be roaſted before they can be uſed for this purpoſe, and in the torrefaction emit vapours of a volatile alkali, ſucceeded by vapours of a ſulphureous ſpirit: others exhale no vapours while roaſting, and may be employed without any antecedent preparation. Theſe different qualities muſt evidently produce great differences in the operation.

Braſs may alſo be made, as prince's metal and other imitations of gold are actually made, by uſing zinc in ſubſtance, inſtead of the ores that contain it. But theſe compoſitions have not, when cold, the ductility of braſs prepared with *lapis calaminaris*, becauſe zinc is ſeldom pure, or free from a mixture of lead. Perhaps alſo the different manner in which the zinc unites with the copper may contribute to this variation.

To obviate this inconvenience, the zinc muſt be refined from all alloy of lead. The property of being indiſſoluble by ſulphur, which this ſemi-metal poſſeſſes, points out

out a very practicable method of doing it. The zinc muſt be melted in a crucible, and ſtirred briſkly with a ſtrong iron wire, while tallow and mineral ſulphur are alternately projected upon it; but ſo that the quantity of ſulphur may greatly exceed that of the tallow. If the ſulphur do not burn entirely away, but form a kind of ſcoria on the ſurface of the zinc, it is a ſign that your ſemi-metal contains lead. In this caſe you muſt continue throwing in more ſulphur, and keep ſtirring the zinc inceſſantly, till you perceive that the ſulphur ceaſes to unite any more with a metallic ſubſtance, but burns freely on the ſurface of the zinc. The ſemi-metal is then refined; becauſe the ſulphur, which cannot diſſolve it, unites very readily with the lead, or other metallic ſubſtance, contained in it.

If zinc thus refined be mixed with pure copper, in the proportion of a fourth or a third part, and the mixture be kept in fuſion and conſtantly ſtirring for ſome time, the braſs produced will be as ductile, when cold, as that made by cementation with the *lapis calaminaris*.

With regard to prince's metal, and other imitations of gold, they are made either with copper or braſs recombined with more zinc. As it is neceſſary, for giving them a fine golden colour, to mix with them other proportions of zinc than that required to make braſs only, they are generally much leſs ductile.

Zinc diſſolved in the Mineral Acids.

Weaken concentrated oil of vitriol by mixing with it an equal quantity of water. Into a matras put the zinc you intend to diſſolve, firſt broken to ſmall pieces. Pour on it ſix times its weight of the vitriolic acid, lowered as above directed, and ſet the matras in a ſand-bath gently heated. The zinc will diſſolve entirely, without any ſediment. The neutral metallic ſalt reſulting from this diſſolution ſhoots into cryſtals, which go by the name of *white vitriol*, or *vitriol of zinc*.

Zinc is diſſolved by the nitrous and marine acids, much in the ſame manner as by the vitriolic; except that the marine acid does not touch a black, ſpungy, rarefied matter, which it ſeparates from the zinc. M. Hellot found upon trial that this matter is not mercury, and that it cannot be reduced to a metallic ſubſtance.

A ſolution of zinc in the marine acid, being diſtilled to dryneſs, yields a ſublimate on applying a violent heat to it.

All the acids diſſolve with eaſe; not only zinc, but its flowers alſo; and that nearly in the ſame quantity, and with almoſt all the ſame phenomena.

Of Arsenic.

To extract Arſenic from its Matrices Zaffre or Smalt.

Powder ſome cobalt, white pyrites, or other arſenical matters. Put this powder into a retort with a ſhort wide neck, leaving a full third thereof empty. Set your retort in a reverberating furnace; lute on a receiver; heat your veſſel by degrees, and increaſe the fire till you ſee a powder ſublime into the neck of the retort. Keep up the fire in this degree as long as the ſublimation continues: when this begins to ſlacken, raiſe your fire, and make it as ſtrong as the veſſels will bear. When nothing more aſcends, let it go out. On unluting the veſſels, you will find in the receiver a little arſenic in the form of a fine light *farina*. The neck of the retort will be full of white flowers, not quite ſo fine, ſome of which will appear like little cryſtals; and if a good deal of arſenic be ſublimed, a ponderous matter, like a white, ſemi-tranſparent glaſs, will be found adhering to that part of the neck of the retort which is next its body.

When all the arſenic the cobalt will yield is thus ſeparated, the earthy fixed matter left behind is mixed with divers fuſible matters and vitrified, and produces a glaſs of beautiful blue colour. It is called *ſmalt*. This glaſs is to be prepared in the following manner.

Take four parts of fine fuſible ſand, an equal quantity of any fixed alkali perfectly depurated, and one part of cobalt from which the arſenic hath been ſublimed by torrefaction. Pulveriſe theſe different ſubſtances very finely, and mix them thoroughly together; put the mixture into a good crucible, cover it, and ſet it in a melting furnace. Make a ſtrong fire, and keep it up conſtantly in the ſame degree for ſome hours. Then dip an iron wire into the crucible; to the end of which a glaſſy matter will ſtick, in the form of threads, if the fuſion and vitrification be perfect. In this caſe take the crucible out of the fire; cool it by throwing water on it, and then break it. You will find in it a glaſs, which will be of an exceeding deep blue, and almoſt black, if the operation hath ſucceeded. This glaſs, when reduced to a fine powder, acquires a much brighter and more lively blue colour.

If you find after the operation that the glaſs hath too little colour, the fuſion muſt be repeated a ſecond time, with twice or thrice the quantity of cobalt. If, on the contrary, the glaſs be too dark, leſs cobalt muſt be uſed.

In order to make the eſſay of a particular cobalt, with a view to know what quantity of blue glaſs it will yield, it is not neceſſary to perform the operation in the manner here ſet down; a great deal of time and trouble may be ſaved by melting one part of cobalt with two or three parts of borax. This ſalt is very fuſible, and turns, when melted, into a ſubſtance which, for a time, poſſeſſes all the properties of glaſs. In this trial the glaſs of borax will be nearly of the ſame colour as the true glaſs, or ſmalt, made with the ſame cobalt.

The ores of biſmuth, as well as cobalt, yield a matter that colours glaſs blue; nay, the ſmalt made with thoſe ores is more beautiful than that procured from the ore of pure arſenic. Some cobalts yield both arſenic and biſmuth. When ſuch cobalts are uſed, it is common to find at the bottom of the crucible a little button of metallic matter, which is called *regulus of cobalt*. This regulus is a ſort of biſmuth, generally adulterated with a mixture of ferruginous and arſenical parts.

The heavieſt and moſt fixed flowers of arſenic, procured from cobalt, have likewiſe the property of giving a blue colour to glaſs. But this colour is faint: it is owing to a portion of the colouring matter carried up along with the arſenic. Theſe flowers may be made an ingredient in the compoſition of blue glaſs, not only becauſe of the colouring principle they contain, but alſo becauſe

they greatly promote fusion; arsenic being one of the most efficacious fluxes known.

In short, all those blue glasses, or smalts, contain a certain quantity of arsenic; for a portion of this semimetal always remains united with the fixed matter of the cobalt, though roasted for a long time, and in a very hot fire. The portion of arsenic that is thus fixed vitrifies with the colouring matter, and enters into the composition of the smalt.

The blue glass made with the fixed part of cobalt hath several names, according to the condition in which it is.

When it hath undergone the first imperfect degree of fusion only, it is called *zaffre*. It takes the name of *smalt* when perfectly vitrified: and this again being pulverised is called *powder blue*; or, if finely levigated, *blue enamel*; because it is used in enamelling, as well as in painting earthen ware and porcelain.

To separate Arsenic from Sulphur.

Powder the yellow or red arsenic which you intend to separate from its sulphur. Moisten this powder with a fixed alkali resolved into a liquor. Dry the mixture gently; put it into a very tall glass cucurbit, and fit on a blind-head. Set this cucurbit in a sand-bath; warm the vessels gently, and increase the fire by degrees, till you perceive that no more arsenic sublimes. The arsenic, which before was yellow and red, rises into the head partly on white flowers, and partly in a compact, white, semi-transparent matter, which looks as if it were vitrified. The sulphur combined with the fixed alkali remains at the bottom of the cucurbit.

To give Arsenic the Metalline Form. Regulus of Arsenic.

Take two parts of white arsenic in fine powder, one part of the black flux, half a part of borax, and as much clean iron filings. Rub the whole together, in order to mix them thoroughly. Put this mixture into a good crucible, and over it put sea-salt three fingers thick. Cover the crucible; set it in a melting furnace; and begin with a gentle fire to heat the crucible equally.

When arsenical vapours begin to ascend from the crucible, raise the fire immediately so as to melt the mixture. Examine whether or no the matter be thoroughly melted, by introducing an iron wire into the crucible; and if the fusion be perfect, take the crucible out of the furnace. Let it cool; break it; and you will find in it a regulus of a white and livid metallic colour, very brittle, scarcely hard, but rather friable.

To distil the Nitrous Acid by the Interposition of Arsenic. Blue Aqua Fortis.

Pulverise finely any quantity you please of refined salt-petre. Mix it accurately with an equal weight of white crystalline arsenic well pulverised, or else with very white and very fine flowers of arsenic. Put this mixture into a glass retort, leaving one half of it empty. Set your retort in a reverberating furnace; apply a receiver, having a small hole drilled in it, and containing a little filtered rain-water; lute the receiver to the retort with stiff lute. Begin with putting two or three small live coals in the ash-hole of the furnace, and replace them with others when they are ready to go out. Go on thus warming your vessels by insensible degrees, and put no coals in the fire-place till the retort begin to be very warm. You will soon see the receiver filled with vapours of a dark red, inclining to a russet colour. With a bit of lute stop the little hole of the receiver. The vapours will be condensed in the water of this vessel, and give it a very fine blue colour, that will grow deeper and deeper as the distillation advances. If your salt-petre was not very dry, some drops of acid will also come over, and falling from the nose of the retort mix with the water in the receiver. Continue your distillation, increasing the fire little by little as it advances, but exceeding slowly, till you see that when the retort is red-hot nothing more comes off; and then let your vessels cool.

When the vessels are cold, unlute the receiver, and as expeditiously as you can pour the blue *aqua fortis* it contains into a crystal bottle; which you must seal hermetically, because this colour disappears in a short time when the liquor takes air. You will find in the retort a white saline mass moulded in its bottom, and some flowers of arsenic sublimed to its upper cavity, and into its neck.

Pulverise the saline mass, and dissolve it in warm water. Filter the solution, in order to separate some arsenical parts that will be left on the filter. Let the filtered liquor evaporate of itself in the open air; when it is sufficiently evaporated, crystals will shoot in it representing quadrangular prisms terminated at each extremity by pyramids that are also quadrangular. These crystals will be in confused heaps at the bottom of the vessel: Over them will be other crystals in the form of needles; a saline vegetation creeping along the sides of the vessel; and the surface of the liquor will be obscured by a thin dusty pellicle.

To alkalisate Nitre by Arsenic.

Melt in a crucible the nitre you intend to alkalisate. When it is melted, and moderately red, project upon it two or three pinches of pulverised arsenic. A considerable effervescence and ebullition will immediately be produced in the crucible, attended with a noise like that which nitre makes when it detonates with an inflammable matter. At the same time a thick smoke will rise, which at first will smell like garlick, the odour peculiar to arsenic; it will also smell afterwards like spirit of nitre. When the effervescence in the crucible is over, throw again upon the nitre as much pulverised arsenic as you did the first time; and all the same phenomena will be repeated. Continue thus throwing in arsenic in small parcels, till it produce no more effervescence; taking care to stir the matter at every projection with an iron wire, the better to mix the whole together. Then increase your fire, and melt what remains. Keep it thus in fusion for a quarter of an hour, and then take the crucible out of the fire. It will contain a nitre alkalised by arsenic.

Of Vegetables.

Of the Subſtances obtained from Vegetables by Expreſſion only.

To expreſs and depurate the Juice of a Plant, containing its Eſſential Salt. The Cryſtalliſation of that Salt.

Before ſun-riſe, gather a good quantity of the plant, from which you deſign to expreſs the juice, in order to obtain its ſalt. Waſh it well in running water, to clear it of earth, inſects, and other adventitious matters. Bruiſe it in a marble mortar; put it into a bag of new, ſtrong, thick linen cloth; tie the bag tight, and commit it to a preſs. By preſſing it ſtrongly you will ſqueeze out a great quantity of green, thick juice, which will have the ſame taſte as the plant. Dilute this juice with ſix times as much pure rain water, and filter it repeatedly through a woolen bag, till it paſs clear and limpid. Evaporate the filtered juice with a gentle heat, till it be almoſt as thick as before it was mixed with water. Put this inſpiſſated juice into a jar, or other veſſel of earth or glaſs; on its ſurface pour olive oil to the depth of a line, and ſet it in a cellar. Seven or eight months after this pour off gently the liquor contained in the veſſel, the inſide of which you will find covered with a cryſtalliſed ſalt. Separate the cryſtals gently; waſh them quickly with a little fair cold water, and dry them: this is the eſſential oil of the plant.

Every plant is not equally diſpoſed to yield its eſſential ſalt by the method here propoſed. Succulent vegetables only, whoſe juices are aqueous and not too viſcous, are fit for this purpoſe. Such, for example, as ſorrel, brook-lime, ſuccory, fumitory, water-creſſes, plantain, *&c.* An eſſential ſalt cannot be procured from thoſe that yield thick, viſcid, mucilaginous juices, ſuch as the ſeeds of flea-wort, unleſs their juices be previouſly attenuated by fermentation, and that viſcoſity deſtroyed which obſtructs the cryſtalliſation of this ſalt.

Nor can the eſſential ſalt be obtained in any quantity from vegetable matters abounding in oil. Moſt kernels and ſeeds are of this ſort: they all contain a great quantity of fat oil, which ſo entangles and clogs this ſalt, that the particles thereof cannot ſhoot away from the tenacious juices into cryſtals.

The ſame is to be ſaid of dry aromatic plants; becauſe they contain much eſſential oil, or reſinous matters that produce the ſame effect. It is true, the eſſential ſalt itſelf contains a certain portion of oil; for it is no other than the acid of the plant incorporated and cryſtalliſed with part of its oil and of its earth: but then the oil muſt not be in too great a quantity; becauſe it ſheaths the acid, renders it clammy, as it were, and hinders it from extricating itſelf ſo as to be able to exert its qualities, and appear in the form of ſalt.

The juice of plants obtained by expreſſion is very thick; becauſe it contains many particles of the bruiſed plant that are unavoidably ſqueezed out along with it. In order to clear it of theſe ſuperfluous parts it is proper to filter it: but as that would be difficult, on account of the thickneſs of the juice, it muſt be thinned, by diluting it with a quantity of water, ſufficient to give it the requiſite degree of fluidity.

Inſtead of thus diluting the expreſſed juice, the plant may be ground with water before it is put into the preſs: it will by this means furniſh a more fluid juice, that will eaſily paſs through the filter. This method may be employed with ſucceſs on dry plants, or ſuch as are not very ſucculent. For this operation rain-water is to be preferred to any other; becauſe it is the pureſt.

The juice of the plant, when diluted with the quantity of water ſufficient to facilitate its filtration, is too aqueous to let the ſalt it contains unite into cryſtals: It muſt therefore be evaporated till it hath recovered a ſomewhat thicker conſiſtence. The heat applied for that purpoſe muſt be gentle; leſt the acid and oily parts that are to form the ſalt, be ſpoiled or diſſipated, as they are not very fixed.

The oil poured on the liquor prevents its fermenting, putrefying, or growing mouldy, during the long ſpace of time required for the cryſtalliſation of the eſſential ſalt.

Theſe ſalts are excellent medicines, being endued with the ſame virtues as the plants from which they were obtained.

To draw the Oils out of Kernels, Seeds, and Fruits, by Expreſſion.

Pound in a marble mortar, or grind in a mill, the kernels, ſeeds, or fruits, out of which you intend to expreſs the oil. If your matters be meagre, and grind to meal, ſuſpend that meal in the ſteam of boiling water, in order to moiſten it a little, and then dry it.

Tie up your matters thus prepared in a new, ſtrong, thick canvaſs bag, and put it into a preſs, between two iron plates previouſly heated in boiling water: ſqueeze it ſtrongly, and you will ſee the oil run in ſtreams into the receiving veſſel.

To draw the Eſſential Oil of certain Fruits by Expreſſion.

Take the rind of a citron, lemon, orange, Bergamot-pear, or other fruit of that kind; cut it in ſlices, and doubling the ſlices ſqueeze them between your fingers over againſt a poliſhed glaſs ſet upright, with its lower end in a veſſel of earth or porcelain. Every time you ſqueeze the peel in a new ply, there will ſquirt out of it ſeveral fine jets of liquor, which, meeting with the ſurface of the glaſs, will be condenſed into drops, and trickle down in ſmall ſtreams into the recipient. This liquor is the eſſential oil of the fruit.

Of the Subſtances obtained from Vegetables by Trituration.

To make the Extracts of a Plant by Trituration.

Bruise the vegetable ſubſtance of which you intend to make the extracts; or, if it be hard and dry, grind it to a powder: put the matter thus prepared, together with ſeven or eight times as much rain-water, into an earthen veſſel; and into this veſſel fit a churning ſtaff, ſo that

that it may be continually whirled round with a rotatory motion, by means of a cord, a wheel, and a winch. Ply this machine for ten or twelve hours; and then filter the liquor through two linen cloths ſpread on a hair-ſieve. Let your filtered liquor ſtand quiet for twelve hours more: Then pour it off by inclination from the ſediment you will find at bottom; and filter it a ſecond time through a flannel bag.

Pour freſh water, but in a ſmaller quantity, on the maſs left after trituration with the machine. Triturate it again for four or five hours. Treat the liquor of this ſecond triture juſt as you did that of the firſt, and mix them both together. Diſtribute all the liquor you now have among a ſufficient number of ſhallow earthen plates, and evaporate it by a gentle heat, ſuch as that of the ſun, or of a vapour-bath, to the conſiſtence of an extract, or even to dryneſs, as you think proper.

To extract from Seeds and Kernels, by Trituration, the Matter of Emulſions.

Blanch the kernels of which you deſire to make an emulſion; put them into a marble mortar; add a very little water; and pound them with a wooden peſtle. Continue pounding and triturating till the matter become like a white paſte. From time to time pour on it, by little and little, more fair water warmed, ſtill continuing the trituration; by which means the paſte will grow thinner. Go on thus till every particle of your kernels be cruſhed to pap. Then add, ſtill rubbing the mixture, enough of water to make the whole an actual fluid; and you will have a liquor of a dead-white colour, reſembling milk. Strain it through a clean linen cloth: it will leave on the filter ſome coarſe parts, which muſt be returned to thoſe left in the mortar. Again triturate and rub the remainder of the kernels, with the addition of water as before. This ſecond liquor will not be ſo white nor ſo rich as the former: filter it in the ſame manner, and again grind with water the ſolid parts remaining. In this manner proceed, repeatedly rubbing and adding freſh water, till it appear no longer milky, but come off clear. The white milky waters thus obtained go by the name of an *emulſion*.

All the matters, from which a fat oil is obtainable by expreſſion, produce emulſions when triturated with water.

An emulſion conſiſts chiefly of two ſubſtances. One of theſe is mucilaginous, and ſoluble in water. This ſubſtance by itſelf would not give a milky appearance to the emulſion, which, with it alone, would be limpid. The other is a fat oil, which of itſelf is not ſoluble in water; but being divided by the means of trituration into very ſmall globules, it is diſperſed through the whole liquor, and ſuſpended therein by the aid of the mucilaginous part. It is this oily part that gives the emulſion its dead-white milky colour; becauſe it is not actually diſſolved in the water, but only diffuſed through it.

If oil be mixed with water in a phial, and the mixture ſtrongly ſhaken for ſome time, with a rapid and continued motion, the oil will be divided into a vaſt number of little globules, which intervening between the parts of the water will deſtroy its tranſparency, and give it a dead-white colour, like that of our emulſion. But, as the oil is not ſo minutely divided by this means as by triturating the matters containing it; and again, there being no mucilage in this liquor, as there is in emulſions, the oil ſoon ſeparates from the water when it is left at reſt, re-unites into round globules, and theſe joining together riſe to the ſurface of the liquor, which then recovers its tranſparency.

The caſe is not exactly the ſame with emulſions; but ſomething like it happens to them alſo. If they be left to ſtand quiet in a long bottle, the liquor, which at firſt appeared homogeneous, ſeparates into two manifeſtly different parts. The upper part retains its dead-white colour, but is thicker and more opaque; while the lower part becomes perfectly tranſparent. This is the beginning of an entire ſeparation of the oily from the aqueous parts. The former, being the lighter, aſcend and gain the upper part of the liquor; while the lower, being freed from that which obſtructed its tranſlucence, recovers its proper limpidity: but the oily parts do not reunite into maſſes large enough to form one homogeneous whole, with the appearance and limpidneſs of oil; their being minutely divided and entangled in the mucilage impeding their natural tendency.

Emulſions firſt begin to ſpoil, as they grow old, not by turning rancid and acrimonious like the fat oils drawn by expreſſion, but by turning ſour; which is owing to the great quantity of mucilage they contain. As there is a fat oil in their compoſition, they have the ſame virtues with that ſort of oil: but they are moreover incraſſating, cooling, and emollient; qualities which render them extremely uſeful in acute and inflammatory diſorders. They grow ſour in a very ſhort time, eſpecially in the heat of ſummer; nay, they ſometimes do ſo in two hours: and therefore they ought to be prepared from time to time as they are to be uſed.

The matter that is left when all the ſubſtance of the emulſion is extracted, and from which the water comes off clear and limpid, is ſcarce any thing but the earthy part of the ſeed or kernel that was triturated; which, however, ſtill retains a portion of tenacious and groſs oil, adhering to it ſo firmly as not to be ſeparable by water.

The chyle and milk of animals reſemble an emulſion in ſeveral reſpects, and particularly in their dead-white colour; which ariſes, in the ſame manner, from the very minute particles of oil contained in them, and diſtributed through an aqueous gelatinous fluid, but not diſſolved therein. In general, whenever any oil of any kind happens to be lodged in this manner between the parts of an aqueous liquor, it always makes the whole of an opaque white: for oil will not mix with water, ſo as to produce a liquor that ſhall appear homogeneous and tranſparent, unleſs it be intimately diſſolved in the water; which cannot be effected but by means of an union previouſly contracted between it and ſome ſaline matter; as is the caſe of mucilages, certain ſaponaceous matters, and ſome other combinations of which we ſhall have occaſion to treat in the ſequel.

The methods we have hitherto propoſed, for extracting from vegetable ſubſtances all that they will yield without

without the affiftance of fire, are not capable of analyfing thofe fubftances accurately; fince by expreffion and trituration we obtain only the liquid parts, impregnated indeed with almoft all the principles of plants, which however are ftill combined with each other, and barely feparated from the groffeft earthy and oily parts. We muft therefore neceffarily have recourfe to a more effectual expedient for carrying our analyfis further. This expedient confifts in making them undergo the action of fire, fucceffively graduated, from the gentleft to the moft violent heat.

But, before we enter on this analyfis of vegetables, it is proper to defcribe the different operations that may be performed on oils, the only pure principle we have been able to obtain without the help of fire.

Of Operations on Fat Oils.

To attenuate Fat Oils, and change their Nature, by expofing them to the Action of Fire, and diftilling them.

Mix thoroughly three or four pounds of any fat oil whatever with twice its weight of lime flaked in the air. Put this mixture into a large earthen retort, leaving a third part of it empty. Set it in a reverberating furnace, and lute on a receiver. Heat the veffel with a very gentle fire. A little flame will rife firft, and will foon be followed by an oil that will fall in drops from the nofe of the retort. Continue the diftillation very flowly, till you perceive the oil that comes over begin to be not quite fo fluid as before, but rather a little thicker.

Then unlute your receiver, and put another in its place. Continue the diftillation, increafing your fire by degrees. The oil that comes over will grow thicker and thicker, its fluidity will decreafe, and it will acquire a dark-brown colour, which at laft will become blackifh. The oil will then be very thick. Pufh the operation till nothing more will come off, though the retort be red-hot. During the whole time this diftillation lafts, there rifes a good deal of water in company with the oil. Keep the fecond thick oil by itfelf.

Mix the oil that came over firft in this operation with an equal part of frefh lime flaked in the air. Put the mixture into an earthen or glafs retort, of a fize fo proportioned to the quantity, that a third part thereof may remain empty. Diftill as before. The fame phenomena will appear: a clear oil will firft come over, and be fucceeded by one a little thicker. Then fhift your receiver, and diftill off all the reft of the oil with an increafed fire. The firft oil obtained by this fecond diftillation will be clearer and thinner than that of the firft diftillation; and the fecond oil will not be fo thick nor of fo deep a colour as before.

Diftill over again in the fame manner the thin oil of this fecond diftillation, and go on thus repeatedly diftilling, till the firft clear oil come over with a degree of heat not exceeding that of boiling water. Then, inftead of mixing your oil with lime, put it with fome water into a glafs retort, or into a body with its head fitted on, and diftill it, keeping the water juft in a fimmer. Your oil will be more and more attenuated, and, after being thus diftilled twice or thrice with water, will be fo limpid, fo thin, and fo clear, that you will fcarce be able to diftinguifh it from water itfelf.

To combine Fat Oils with Acids.

Put any fat oil whatever into a glafs bafon, and fet it in a fand-bath very moderately heated. Pour on this oil an equal quantity of concentrated oil of vitriol, which will immediately diffolve it with violence; a confiderable ebullition and effervefcence will arife, attended with great heat, and a prodigious quantity of black thick vapours, in which may be eafily perceived the fmell of burnt oil, together with that of a fulphureous acid. The mixture will become of a deep-red, black, and thick. Stir it with a fmall ftick, till you obferve that all is quiet.

To combine Fat Oils with Fixed Alkalis. Hard and Soft Soap. The Decompofition of Soap.

Take a lixivium of Alicant kelp made more cauftic by lime, as we fhall fhew when we come to fpeak of alkalis. Evaporate this lye till it be capable of bearing a new-laid egg. Divide it into two parts; and to one of thefe put juft water enough to weaken it fo that a new laid egg will not fwim in it, but fall to the bottom. With the lye thus weakened, mix an equal quantity of frefh-drawn olive oil. Stir and agitate the mixture well till it become very white. Set it over a gentle fire, and continue ftirring it inceffantly, that the two ingredients of which it is compounded may gradually combine together, as part of the water evaporates. When you perceive they begin to unite, pour into the mixture thrice as much of the firft ftrong lye as you took of olive oil. Continue the coction with a gentle fire, always ftirring the matter, till it become fo thick that a drop of it fixes, as it cools, into the confiftence that foap ought to have. By diffolving a little of this foap in water, you will difcover whether or no it contains more oil than ought to be in the compofition. If it diffolve therein wholly and perfectly, without the appearance of the leaft little drop of oil floating on the water, it is a fign that it doth not contain too much oil. If, on the contrary, you perceive any of thefe little globules, you muft pour into the veffel containing your matter a little more of the ftrong lye, to abforb the redundant oil. If there be too much of the alkali, it may be difcovered by the tafte. If the foap leave on your tongue the fenfation of an alkaline falt, and produce an urinous favour, it is a fign that there is too much falt in proportion to the oil. In this cafe a little oil muft be added to the mixture, to faturate the fuperabundant alkali. An excefs in the quantity of alkali difcovers itfelf likewife by the foap's growing moift in the air, on being expofed to it for fome time.

Fixed alkalis, even when refolved into a liquor, that is, when loaded with much water, unite eafily with fat oils, as appears from the experiment juft recited, and require but a moderate heat to perfect that union. This combination may even be completely effected without the aid of fire, and by the heat of the fun only, provided fufficient time be allowed for that purpofe. It only requires the mixture of the oil and alkali to be kept five or fix

six days in digestion, and stirred from time to time. A lixivium of pure alkali, not acuated by lime, may also be used to make soap: but it is observed, that the combination succeeds better, and that the alkali unites sooner and more perfectly with the oil, when it is sharpened by lime.

The oil is first mixed with a weaker and more aqueous lye, to the end that the combination may not take place too hastily, but that all the particles of the two substances to be compounded together may unite equally. But as soon as the alkali begins to dissolve the oil gradually and quietly, the dissolution may then be accelerated; and that is done by adding the remaining lye, which is stronger and less diluted than the other.

Soap made with olive oil is white, hard, and hath not a very disagreeable smell: but as that oil is dear, others, even the fat and oils of animals, are sometimes substituted for it. The soaps made with most of these other matters are neither so hard, nor so white, as that made of olive oil: they are called *soft soaps*.

Oils thus associated with fixed alkalis are by that means rendered soluble in water; because the alkaline salts, having a great affinity with water, communicate part thereof to the oils with which they are now incorporated. Yet the oil is not for all that rendered thoroughly miscible with water, or perfectly soluble therein; for the water in which soap is dissolved hath always a milky cast: now there is no other criterion of a perfect solution but transparency.

Alkalis also lose part of their affinity with water, by the union they thus contract with oils: for, when the combination is properly made, they no longer attract the moisture of the air, nor doth water dissolve them in such quantities as before. The composition of soap is plainly a saturation of an alkali with an oil; and, in order to make perfect soap, we are forced, as was said in the process, to grope, in a manner, by repeated trials, for this point of saturation; just as when we prepare a neutral salt by saturating an alkali with an acid. The union which the oil contracts with the alkali makes it lose, in part, the readiness with which it naturally takes fire; because the salt is not inflammable: the water also, which enters, in pretty considerable quantities, into the composition of soap, contributes a good deal to hinder the accension of the oil.

Soap may be decompounded either by distilling it, or by mixing it with some substance that hath a greater affinity than oil with alkalis.

If we decompound it by distillation, a phlegm, or transparent spirit, of a somewhat yellowish colour, first comes over. This liquor is the aqueous part of the soap, quickened by a little of its alkali, which gives it an acrid taste. It is followed by a red oil, which at first is pretty thin and limpid, but thickens as the distillation advances, grows black, and has a very disagreeable empyreumatic smell. This oil is soluble in spirit of wine.

When the distillation is finished, that is, when the retort being kept red-hot for some time will discharge no more, there is left in it a saline mass; which is the alkali of the soap, crusted over with some of the most fixed parts of the oil, that are charred to a coal. This salt may be restored to the same degree of purity it had before its combination with the oil, by calcining it in a crucible with a naked fire, that may consume this burnt part of the oil, and reduce it to ashes.

It is plain, that the oil contained in soap is affected by distillation, much in the same manner as that which we mixed with lime and distilled.

Mr Geoffroy, by analysing soap with care, discovered that two ounces thereof contain ninety-six grains of salt of kelp, freed from all oil and moisture; or two drams and forty-eight grains of that salt, as it is used in manufacturing soap; that is, containing water enough to make it crystallise; one ounce three drams twenty grains of olive oil; and about two drams four grains of water.

As acids have a greater affinity than any other substance with alkalis, they may be very effectually employed to decompound soap.

If you propose to decompound soap by means thereof, you must first dissolve it in a sufficient quantity of water. Mr Geoffroy, who made this experiment likewise, dissolved two ounces thereof in about three gallons of warm water, and to the solution added oil of vitriol, which he let fall into it drop by drop. Every time a drop of acid falls into it, a *coagulum* is formed in the liquor. The vessel in which the solution is contained must then be shaken, that the acid may equally attack all the alkali diffused in it When no new coagulation is produced by a drop of the acid, it is a sign you have added enough. The liquor then begins to grow clear: and if another quart of water be added, in order to facilitate the separation of the oily particles, you will see them rise and unite together on the surface of the liquor.

This is a pure, clear, true olive oil, hath its taste, its smell, and, like it, is fluid in warm weather, and becomes fixed by cold. Yet it differs in some respects from that which never hath been united with an alkali in order to form a soap; for it burns more vividly and more rapidly, and is soluble in spirit of wine. We shall account for these differences when we come to treat of ardent spirits.

Not only the vitriolic acid, but all others, even those obtained from vegetables, are capable of decompounding soap, and separating the oil from the alkali. In the liquor wherein soap is thus decompounded, is found a neutral salt, consisting of the acid made use of, united with the alkali of the soap. If the vitriolic acid be used, you will have a Glauber's salt; a quadrangular nitre, if the nitrous acid be used; and so of the rest.

The facility with which acids decompound soap is the reason that no water, but what is very pure, will dissolve it, or is fit to be used in washing with it.

Water that doth not dissolve soap well is usually called hard water. Such waters contain a certain quantity of saline matters, washed out of the earths through which they pass. The hardness of water is generally occasioned by selenitic particles.

The hardness of most well-waters is owing to a considerable quantity of selenitic gypsum with which the soil abounds. The selenites are neutral salts consisting of the vitriolic acid united with an earthy basis. If, therefore, soap be put into water in which a salt of this kind is dissolved,

solved, it is evident that the vitriolic acid in the selenites, having a greater affinity with the fixed alkali of the soap than with its own earthy basis, will quit the latter to unite with the former; and thus the soap will be decompounded instead of being dissolved. Accordingly we see, that, when we attempt to dissolve soap in our well-water, the surface of the liquor is in a short time covered with a fat oily pellicle. However, this decomposition of soap is not complete; at least but a small part of it is perfectly decompounded; because the great quantity of selenites, with which the water is impregnated, hinders the soap from mixing so thoroughly with it, as is requisite to produce a total decomposition thereof.

All mineral waters are likewise hard, with regard to soap; for, as most of them owe their virtues to the efflorescencies they have washed off, from pyrites that have grown hot and begun to be decomposed, they are impregnated with the saline matters produced by pyrites in that state; that is, with aluminous, vitriolic, and sulphureous substances, which have the same effect on soap as the selenites hath.

Mineral waters containing neutral salts only, such as sea-salt, Epsom salt, Glauber's salt, are nevertheless hard with regard to soap, though the acids of those salts, being united with fixed alkalis, are incapable of decompounding it. The reason is, that those neutral salts are more soluble in water than soap is; so much indeed as even to exclude it: because each of the two principles that compose them hath a very great affinity with water; whereas only one of the principles of soap, namely, its alkali, hath that affinity; the other, *viz.* the oily principle, having none at all. Thus water impregnated with an acid, or with any neutral salt, is hard with regard to soap, and incapable of dissolving it; and hence it follows, that soap is a sort of touchstone for trying the purity of water.

Wine dissolves soap; but imperfectly, because it contains an acid or tartarous part. Spirit of wine also dissolves it: but neither is this dissolution perfect; because it contains too little water: for its spirituous part can dissolve nothing but the oil of the soap; and the alkali is not at all, or at least in a very small quantity, soluble in this menstruum. The true solvent of soap is therefore a liquor that is partly spirituous, partly aqueous, and not acid.

Brandy has these qualities: and accordingly it is the solvent that unites best with soap, dissolves the greatest quantity, and makes the most limpid solution thereof. Yet even this solution hath something of a milky cast, occasioned by its not being entirely free from an acid, or the tartarous principle. This fault may be easily corrected, by mixing with it a little alkali to absorb the acid. A dram of crystallised salt of kelp mixed with three ounces and a half of good brandy, renders it capable of dissolving an ounce and two drams of good hard soap into a perfectly limpid liquor.

Some years ago it was discovered that soap might be used with great success in medicine, and that it possesses the property of dissolving the stony concretions that form in several parts of the body, particularly in the kidneys and bladder. Soap is the basis of the composition known by the name of *Mrs Stephen's remedy*; and in this one ingredient its whole virtue resides.

From what hath been said on the nature of this compound, as well as on the cause and phenomena of its dissolution, it plainly appears to be of the last consequence, in administering it to a patient, that his constitution be considered, and a proper regimen ordered. All acids should be absolutely forbid him; as we know they hinder the soap from dissolving, and decompound it: and if the patient have any acidities in the first passages, matters capable of neutralising them should be prescribed him; as prepared crabs eyes, and other absorbents known in medicine: In such cases those with which the soap is compounded in Mrs Stephen's remedy may be of use.

To combine Fat Oils with Sulphur.

Put any fat oil whatever into an earthen vessel; add to it about a fourth part of its weight of flower of sulphur, and set the vessel in a furnace, with lighted coals under it. When the oil hath acquired a certain degree of heat, the sulphur will melt, and you will see it fall immediately to the bottom of the oil, in the form of a very red fluid. The two substances will remain thus separated, without mixing together, while the heat is no greater than is necessary to keep the sulphur in fusion. Increase it therefore; but slowly, and with circumspection, lest the matter take fire. When the oil begins to smoke, the two liquors will begin to mix and look turbid: at last they will unite so as to appear one homogeneous whole. If you keep up the heat, so that the mixture shall always continue smoking and ready to boil, you may add more sulphur, which will perfectly incorporate with it: and thus may a pretty considerable quantity thereof be introduced into this composition.

To combine Fat Oils with Lead, and the Calxes of Lead. The Basis of Plasters. The Decomposition of this Combination.

Into an earthen vessel put granulated lead, litharge, ceruse, or minium; and pour thereon twice its weight of any fat oil whatever. If you set the vessel over a brisk fire, the lead at bottom will melt before the oil begin to boil. When it boils, stir the matter with a stick: the lead, or the calx of lead, will gradually disappear, and at last be totally dissolved by the oil, to which it will give a very thick consistence.

Fat oils dissolve not only lead, but its calxes also: nay, they dissolve the latter more readily than lead in substance; probably because they are more divided. The result of a combination of these matters is a thick, tenacious mass, that grows in some degree hard in the cold, and soft by heat. This composition is known in pharmacy by the name of *plaster*. It is made up with several drugs into plasters, which partake of the virtues of those drugs; so that it is the basis of almost all plasters.

Lead itself is seldom used to make plasters: ceruse, litharge, or minium, are preferred to it; because these matters unite more readily with oils.

Of the Subſtances obtained from Vegetables with a Degree of heat not exceeding that of boiling Water.

To obtain from Plants, by diſtilling them with the mean Degree of heat between freezing and boiling Water, a Liquor impregnated with their Principle of Odour.

In the morning, before ſun-riſe, gather the plant from which you deſign to extract its odoriferous water. Chuſe the plant in its full vigour, perfectly ſound, and free from all adventitious matters, except dew. Put this plant, without ſqueezing it, into the body of a tinned copper alembic, and ſet it in a water bath. Fit on its head, and to the noſe thereof lute a glaſs receiver with wet bladder.

Warm the bath to the mean degree between freezing and boiling water. You will ſee a liquor diſtill and fall drop by drop into the receiver. Continue the diſtillation with this degree of heat, till no more drops fall from the noſe of the alembic. Then unlute the veſſels; and if you have not as much liquor as you want, take out of the cucurbit the plant already diſtilled, and put a freſh one in its place. Diſtill as before, and go on thus till you have a ſufficient quantity of odoriferous liquor. Put it into a bottle; ſtop it cloſe; and ſet it in a cool place.

The liquor obtained from plants, with the degree of heat here preſcribed, conſiſts of the dew that was on the plant, and ſome of the phlegm of the plant itſelf, together with its odorous principle. Mr Boerhaave, who examined this odoriferous part of plants with great care, calls it the *ſpiritus rector*. The nature of this ſpirit is not yet thoroughly aſcertained; becauſe it is ſo very volatile, that it cannot eaſily be ſubjected to the experiments that are neceſſary to analiſe it, and to diſcover all its properties. If the bottle containing the liquor which may be conſidered as the vehicle of this ſpirit, be not exceeding carefully ſtopped, it flies quite off: ſo that in a few days nothing will be found but an inſipid inodorous water.

Great part of the virtue of plants reſides in this their principle of odour; and to it muſt be aſcribed the moſt ſingular and the moſt wonderful effects we every day ſee produced by them. Every body knows that a great number of odorous plants affect, in a particular manner, by their ſcent only, the brain and the *genus nervoſum*, of ſuch eſpecially whoſe nerves are very ſenſible, and ſuſceptible of the ſlighteſt impreſſion; ſuch as hypochondriacal or melancholy men, and hyſterical women. The ſmell of the tuberoſe, for inſtance, is capable of throwing ſuch perſons into fits, ſo as to make them drop down and ſwoon away. The ſmell of rue again, which is equally ſtrong and penetrating, but of a different kind, is a ſpecific remedy againſt the ill effects of the tuberoſe; and brings thoſe perſons to life again, with as quick and as ſurpriſing an efficacy as that by which they were reduced to a ſtate not unlike death. This is Mr Boerhaave's obſervation.

The odorous exhalations of plants muſt be conſidered as a continual emanation of their *ſpiritus rector*: but as growing plants are in a condition to repair, every inſtant, the loſſes they ſuſtain by this means, as well as by tranſpiration, it is not ſurpriſing that they are not ſoon exhauſted while they continue in vigour. Thoſe, on the contrary, which we diſtill, having no ſuch reſource, are very ſoon entirely exhauſted of this principle.

The ſeparation of the *ſpiritus rector* from plants requires but a very gentle heat, equally diſtant from the freezing point, and from the heat of boiling water. Accordingly the heat of the ſun in ſummer is ſufficient to diſſipate it almoſt entirely. This ſhews why it is dangerous to ſtay long in fields, or woods, where many noxious plants grow. The virtues of plants reſiding chiefly in their exhalations, which the heat of the ſun increaſes conſiderably, a ſort of atmoſphere is formed round them, and carried by the air and the wind to very great diſtances.

For the ſame reaſon the air of a country may be rendered ſalutary and medicinal, by the exhalations of wholeſome plants growing therein. From the facility with which the odorous principle of plants evaporates, we learn what care ought to be taken in drying thoſe intended for medical uſes, ſo as to preſerve their virtues. They muſt by no means be expoſed to the ſun, or laid in a warm place: a cool, dry place, into which the rays of the ſun never penetrate, is the propereſt for drying plants with as little loſs of their virtue as poſſible.

Though there is reaſon to believe that every vegetable matter hath a *ſpiritus rector*, ſeeing each hath its particular ſcent, yet this principle is not very perceptible in any but thoſe which have a very manifeſt odour: and accordingly it is extracted chiefly from aromatic plants, or the moſt odoriferous parts of plants.

To extract the Fat Oils of Plants by the Decoction in boiling Water. Cacao-Butter.

Pound or bruiſe in a marble mortar your vegetable ſubſtances abounding with the fat oil which you intend to extract by decoction; tie them up in a linen cloth: put this packet into a pan, with ſeven or eight times as much water, and make the water boil. The oil will be ſeparated by the ebullition, and float on the ſurface of the water. Skim it off carefully with a ladle, and continue boiling till no more oil appear.

The heat of boiling water is capable of ſeparating the fat oils from vegetable matters that contain any: but this is to be effected by actual decoction only, and not by diſtillation; becauſe theſe oils will not riſe in an alembic with the heat of boiling water. We are therefore neceſſitated to collect them from the ſurface of the water, as above directed.

The water uſed in this coction generally becomes milky, like an emulſion. Nevertheleſs this way of obtaining the fat oils is not generally practiſed; becauſe the heat, to which they are expoſed in the operation, occaſions their being leſs mild than they generally are: but it is an excellent method, and indeed the only one that can be employed, for extracting from particular vegetables certain concrete oily matters, in the form of butter or wax; which

which matters are no other than fat oils in a fixed ftate. The cacao yields, by this means, a very mild butter; and in the fame manner is a wax obtained from a certain fhrub in America.

To extract the Effential Oils of Plants by diftillation with the heat of boiling water. Diftilled waters.

Put into a cucurbit the plant from which you defign to extract the effential oil. Add as much water as will fill two thirds of your veffel, and diffolve therein half an ounce of fea-falt for every quart of water you ufe. To this body fit on an alembic-head, and to the nofe thereof lute a receiver with fized paper or wet bladder. Set it in a furnace, and let the whole digeft together, in a very gentle warmth, for twenty-four hours.

This being done, light a wood-fire under your veffel, brifk enough to make the water in it boil immediately. Then flacken your fire, and leave it juft ftrong enough to keep the water fimmering. There will come over into the receiver a liquor of a whitifh colour, fomewhat milky; on the furface of which, or at the bottom, will be found an oil, which is the effential oil of the vegetable you put into the cucurbit. Continue your diftillation with the fame degree of heat, till you perceive the liquor come off clear and unaccompanied with an oil.

When the diftillation is finifhed, unlute the receiver; and, if the effential oil be of that fort that is lighter than water, fill the veffel up to the top with water. On this occafion a long-necked matras fhould be ufed for a receiver; that the oil which floats on the water may collect together in its neck, and rife up to its mouth. Then in the neck of this veffel put the end of a thread of cotton twine, fo that the depending part without the veffel may be longer than that in the oil, and the extremity thereof hang within the mouth of a little phial, juft big enough to contain your quantity of oil. The oil will rife along the yarn as in a fiphon, filter through it, and fall drop by drop into the little phial. When all the oil is thus come over, ftop your little bottle very clofe, with a cork coated over with a mixture of wax and a little pitch.

If your oil be ponderous, and of the fort that finks in water, pour the whole contents of the receiver into a glafs funnel, the pipe of which muft terminate in a very fmall aperture that may be ftopped with your fore-finger. All the oil will be collected in the lower part of the funnel: then remove your finger, and let the oil run out into a little bottle through another fmall funnel. When you fee the water ready to come, ftop the pipe of the funnel, and cork the bottle containing your oil.

To extract the Effential Oils of Plants by Diftillation per defcenfum.

Reduce to a powder, or a pafte, the vegetable fubftances from which you intend to extract the effential oil by the method propofed. Lay this matter about half an inch thick on a fine, clofe, linen cloth. If it be dry and hard, expofe the cloth containing it to the fteam of boiling water, till the matter become moift and foft. Then lay the cloth, with its contents, over the mouth of a very tall cylindrical glafs veffel, which is to do the office of a receiver in this diftillation; and, by means of a piece of fmall pack-thread, faften down the extremities of the cloth, by winding the thread feveral times over them and round the veffel; in fuch a manner, however, that the cloth be not tight, but may yield to a fmall weight, and fink about five or fix lines deep into the veffel over which it is faftened. Set this recipient in a larger veffel, containing fo much cold water as will reach half way up the cylindrical veffel, which, having little in it but air, muft be ballafted with as much lead as will fink it to the bottom of the water.

On the cloth, containing the fubftance to be diftilled, fet a flat pan of iron or copper, about five or fix lines deep, that may juft fit the mouth of the glafs veffel over which the cloth is faftened, fo as to fhut it quite clofe. Fill this pan with hot afhes, and on thefe lay fome live coals. Soon after this you will fee vapours defcend from the cloth, which will fill the recipient, and drops of liquor will be formed on the under fide of the cloth, from whence they will fall into the veffel. Keep up an equal gentle heat, till you preceive nothing more difcharged. Then uncover the recipient: you will find in it two diftinct liquors; one of which is the phlegm, and the other the effential oil of the fubftance diftilled.

Infufions, Decoctions, and Extracts of Plants.

Make fome water boiling-hot, and then take it off the fire. When it ceafes to boil, pour it on the plant of which you defire to have the infufion; taking care there be enough of it to cover the plant entirely. Cover the veffel, and let your plant lie in the hot water for the fpace of half an hour, or longer if it be of a firm clofe texture. Then pour off the water by inclination: it will have partly acquired the colour, the fmell, the tafte, and the virtues of the plant. This liquor is called an *infufion*.

To make the decoction of a vegetable fubftance, put it into an earthen pan, or into a tinned copper veffel, with a quantity of water fufficient to bear being boiled for feveral hours without leaving any part of the plant dry. Boil your plant more or lefs according to its nature; and then pour off the water by inclination. This water is impregnated with feveral of the principles of the plant.

If the infufions and decoctions of plants be filtered, and evaporated in a gentle heat, they become extracts, that may be kept for whole years, efpecially if they be evaporated to a thick confiftence; and better ftill if they be evaporated to drynefs.

Of Operations on Effential Oils.

The Rectification of Effential Oils.

Put into a cucurbit the effential oil you propofe to rectify. Set the cucurbit in a *balneum mariæ*; fit to it a head of tin, or of copper tinned, together with its refrigeratory; and lute on a receiver. Make the water in the bath boil, and keep up this degree of heat till nothing more will come over. When the diftillation is finifhed,

nished, you will find in the receiver a rectified essential oil, which will be clearer, thinner, and better scented than before it was thus before re-distilled; and in the bottom of the cucurbit will be left a matter of a deeper colour, more tenacious, more resinous, and of a less grateful smell.

Essential oils, even the purest, the best prepared, and the thinnest, suffer great changes, and are much impaired by growing old: they gradually turn thick and resinous; their sweet, grateful scent is lost, and succeeded by a more disagreeable smell, somewhat like that of turpentine. The cause of these changes is, that their finest and most volatile part, that which contains most of the odorous principle, is dissipated and separated from that which contains least of it; which therefore grows thicker, and comes so much the nearer to the nature of a resin, as the quantity of acid, that was distributed through the whole oil before the dissipation of the more volatile part, is, after such dissipation, united and concentrated in the heaviest part; the acid in oils being much less volatile than the odorous part, to which alone they owe their levity.

Hence it appears what precautions are to be used for preserving essential oils as long as possible without spoiling. They must be kept in a bottle perfectly well stopped, and always in a cool place, because heat quickly dissipates the volatile parts. Some authors direct the bottle to be kept under water.

To fire Oils by combining them with highly concentrated Acids: instanced in Oil of Turpentine.

Mix together in a glass equal parts of concentrated oil of vitriol, and highly smoking fresh-drawn spirit of nitre: pour this mixture at several times, but suddenly, on three parts of oil of turpentine, set for that purpose in a glass bason. By a part here must be understood a dram at least. A most violent commotion, accompanied with smoke, will immediately be raised in the liquors, and the whole will take fire in an instant, flame, and be consumed.

There is not in chemistry a phenomenon more extraordinary, and more surprising, than the firing of oils by mixing them with acids. It could never have been suspected, that a mixture of two cold liquors would produce a sudden, violent, bright, and lasting flame, like that we are at present considering.

To combine Essential Oils with Mineral Sulphur. Balsam of Sulphur.

Put into a matras one part of flowers of sulphur; pour on them six parts of the essential oil of turpentine, for instance; set the matras in a sand-bath, and heat it gradually till the oil boil. The sulphur, which at first lay at the bottom of the matras, will begin to melt, and appear to dissolve in the oil. When it hath boiled in this manner for about an hour, take the matras from the fire, and let the liquor cool. A great deal of the sulphur that was dissolved therein will separate from it as it cools, and fall to the bottom of the vessel in the form of needles, much like a salt shooting in water.

When the liquor is perfectly cold, decant it from the sulphur that lies at the bottom of the vessel: to that sulphur put fresh oil of turpentine, and proceed as before: the sulphur will again disappear, and be dissolved in the oil; but when the mixture is cold you will find new crystals of sulphur deposited at the bottom. Decant once more this oil from the crystals, and pour on fresh oil to dissolve them: continue the same method, and you will find, that about sixteen parts of essential oil are required to keep one part of sulphur dissolved when cold. This combination is called *balsamum sulphuris terebinthinatum*, if made with oil of turpentine; *anisatum*, if with oil of anise-seeds; and so of others.

To combine Essential Oils with fixed Alkalis. Starkey's Soap.

Take salt of tartar, or any other alkali, thoroughly calcined. Heat it in a crucible till it be red, and in that condition throw it into a hot iron mortar: rub it quickly with a very hot iron pestle; and as soon as it is powdered, pour on it, little by little, nearly an equal quantity of oil of turpentine. The oil will enter into the salt, and unite intimately with it, so as to form a hard paste. Continue rubbing this composition with a pestle, in order to complete the union of the two substances; and, as your oil of turpentine disappears, add more, which will unite in the same manner, and give a softer consistence to the soapy mass. You may add still more oil, according to the consistence you intend to give your soap.

Starkey, the first chemist who found the means of making soap with an essential oil, and by whose name this kind of soap is therefore called, made use of a much more tedious method than that proposed in our process. He began with mixing a very small quantity of oil with his salt, and waited till all the oil united therewith of its own accord, so as to disappear entirely, before he added any more; and thus protracted his operation exceedingly, though in the main it was the same with ours. The method here proposed is more expeditious, and was invented by Dr Geoffroy.

Starkey's soap dissolves in water much as common soap does, without any separation of the oil: and by this mark it is known to be well made. It may also be decompounded, either by distillation, or by mixing it with an acid: and its decomposition, in either of these ways, is attended with nearly the same phenomena as the decomposition of common soap.

Of the Substances obtained from Vegetables by means of a graduated Heat, from that of boiling Water, to the strongest that can be applied to them in close Vessels.

To analise Vegetable Substances that yield neither a Fat nor an Essential Oil. Instanced in Guaiacum-wood.

Take thin shavings of Guaiacum-wood, and put them into a glass or stone retort, leaving one half thereof empty. Set your retort in a reverberating furnace, and lute on a large glass receiver having a small hole drilled in it, such as is used for distilling the mineral acids. Put a live

live coal or two in the furnace, to warm the veſſels gently and ſlowly.

With a degree of heat below that of boiling water, you will ſee drops of a clear inſipid phlegm fall into the receiver. If you raiſe the fire a little, this water will come ſlightly acid, and begin to have a pungent ſmell. With a degree of fire ſomewhat ſtronger, a water will continue to riſe which will be ſtill more acid, ſmell ſtronger, and become yellowiſh. When the heat comes to exceed that of boiling water, the phlegm that riſes will be very acid, high coloured, have a ſtrong pungent ſmell, like that of matters long ſmoked with wood in a chimney, and will be accompanied with a red, light oil, that will float on the liquor in the receiver.

And now it is neceſſary, that the operation be carried on very cautiouſly, and vent frequently given to the rarefied air by opening the ſmall hole in the receiver; ſuch an incredible quantity thereof ruſhing out of the wood, with this degree of heat, as may burſt the veſſels to pieces, if not diſcharged from time to time.

When this red, light oil is come over, and the air ceaſes to ruſh out with impetuoſity, raiſe your fire gradually, till the retort begin to redden. The receiver will be filled with denſe vapours; and together with the watery liquor, which will then be extremely acid, there will riſe a black, thick, ponderous oil, which will fall to the bottom of the receiver and lie under the liquor.

Then give the utmoſt degree of heat; that is, the greateſt your furnace will allow, and your veſſels bear. With this exceſſive heat a little more oil will riſe, which will be very ponderous, as thick and black as pitch; and the veſſels will continue full of vapours that will not condenſe.

At laſt, when you have kept the retort exceeding red for a long time in this extremity of heat, ſo that it begins to melt if it be of glaſs, and you perceive nothing more come over, let the fire go out and the veſſel cool. Then take off your receiver: from the black oil at bottom decant the acid liquor with the red oil floating on it, and pour them both into a glaſs funnel, lined with brown filtering paper, and placed over a bottle. The acid liquor will paſs through the filter into the bottle, and the oil will be left behind, which muſt be kept by itſelf in a ſeparate bottle. Laſtly, into another funnel, prepared as the former, pour the thick oil remaining with a little of the acid liquor at the bottom of the receiver. This liquor will filter off in the ſame manner, and thus be ſeparated from the heavy oil.

In the retort you will find your Guaiacum ſhavings not in the leaſt altered as to their figure, but light, friable, very black, ſcentleſs and taſteleſs, eaſily taking fire, and conſuming without flame or ſmoke: in ſhort you will find them charred to a perfect coal.

Hitherto we have examined the ſubſtances that may be obtained from vegetables, either without the help of fire, or with a degree of heat not exceeding that of boiling water. The analyſis of plants can be carried no further without a greater degree of heat: for, when the principle of odour and the eſſential oil of an aromatic plant are wholly extracted by the preceding proceſſes, if the diſtillation be afterward continued without increaſing the heat, nothing more will be obtained but a little acid; which will ſoon ceaſe, as a ſmall part only of the quantity contained in the plant will be elevated; the reſt being either too ponderous, or too much entangled with the other principles of the body, to riſe with ſo ſmall a degree of heat.

In order therefore to carry on the decompoſition of a plant, from which you have, by the methods before propoſed, extracted all the principles it is capable of yielding when ſo treated; or, in order to analiſe a vegetable matter, which affords neither an expreſſed nor an eſſential oil, it muſt be diſtilled in a retort with a naked fire, as directed in the proceſs, and be made to undergo all the degrees of heat ſucceſſively, from that of boiling water to the higheſt that can be raiſed in a reverberating furnace.

A heat inferior to that of boiling water, with which we muſt begin in order to warm the veſſel gradually, brings nothing over, but an inſipid water, deſtitute of all acidity. By increaſing it nearly to the degree of boiling water, the diſtilled water comes to be ſlightly acid.

When the heat is made a little ſtronger than that which is neceſſary for the elevation of an eſſential oil, the acidity of the water that comes off is much more conſiderable. It hath now both colour and ſmell, and there riſes with it a red, light oil, that floats on the liquor in the receiver. This is not an eſſential oil; it hath none of the odour of the plant. Though ſo light as to float on water, yet it will not riſe with the degree of heat that raiſes eſſential oils, even thoſe that much ſurpaſs it in gravity, and will not ſwim on water as they do. This proves, that the eaſe or difficulty with which a particular degree of heat raiſes any ſubſtance in diſtillation doth not depend altogether on its gravity: its dilatability, or the volatile nature of the matters with which it is ſo cloſely united as not to be ſeparated from them by diſtillation, may probably contribute greatly to produce this effect.

It is very ſurpriſing, that a ſubſtance ſo hard, ſo compact, ſo dry in appearance, as Guaiacum-wood, ſhould yield ſuch a large quantity of water by diſtillation; and it is equally ſo, that it ſhould diſcharge ſo much air, and with ſo much impetuoſity, as nothing but experience could render credible.

It hath been remarked, that the heavieſt and moſt compact woods yield the moſt air in diſtillation: and accordingly Guaiacum-wood, as exceeding almoſt all others in hardneſs and weight, diſcharges a vaſt quantity of air when analiſed.

The thick, burnt, empyreumatic oil, that comes over laſt in this diſtillation, is heavier than water; on account, probably, of the great quantity of acid with which it is replete. The two kinds of oil obtained in this analyſis may be rectified, by diſtilling them a ſecond time, or rather ſeveral times; by which means they will become lighter and more fluid. In general, all thick, heavy oils conſtantly owe theſe qualities to an acid united with them; and it is by being freed from ſome of that acid in diſtillation, that they always acquire a greater

er degree of lightnefs and fluidity from that operation.

The analyfis of a vegetable fubftance, fhews what may be obtained from them when diftilled in clofe veffels, with a graduated heat, from that of boiling water, to that which converts the mixt to a perfect coal; viz. phlegm, an acid, a light oil, much air, and a thick oil. But this analyfis is far from being a complete one: it may be carried much farther, and made more perfect.

None of the principles obtained by this analyfis are pure, fimple, and thoroughly feparated from the reft. They are ftill in fome meafure blended all together: their feparation is but begun; and each requires a fecond and more accurate analyfis, to reduce it to the greateft degree of purity of which it is capable. The oil and the acid chiefly merit fo much pains.

A great deal of the acid of the plant remains, combined with the two forts of oil here obtained; which we have reafon to think differ no otherwife from one another, than as there is more or lefs acid united with each. The beft way of freeing thefe oils from their redundant acid is to diftill them frequently from alkalis and abforbents.

The acid is in the fame circumftances nearly as the oil. The firft that rifes is mortified with much water, to which it owes a good deal of its volatility. That which comes over laft is much more concentrated, and confequently heavier; yet it is ftill very aqueous. It might be freed in a great meafure from this adventitious water, and fo rendered much ftronger; which would give us a better opportunity to difcover its nature and properties, of which we know but very little.

Water is not the only heterogeneous fubftance that difguifes the vegetable acid: a pretty confiderable quantity of the oil of the plant is alfo combined with it, and contaminates its purity. The proof of this is, that when thefe acids are kept, in the fame condition in which they firft come over, for any length of time, in a glafs veffel, they gradually depofite, on the bottom and fides of the veffel, an oily incruftation, which grows thicker and thicker the longer it ftands; and, as this oily matter feparates from it, the acid liquor appears lefs unctuous and faponaceous.

A very good way to feparate this oil more effectually from the acid is to combine the whole with abforbents, and abftract the oil again by diftillation. By this means a very fenfible quantity of oil may be feparated that was not perceived before.

The air, that is difcharged with impetuofity in the operation, and muft be let out, is loaded with many particles of acid and oil reduced to vapours, which it carries off; and by this means the quantity of the principles extracted from the mixt cannot be accurately determined: nor are the vapours, of which the veffels remain full after the operation, any other than particles of acid and oil, which the violence of the fire hath rarefied exceedingly, and which do not eafily condenfe.

If we diftill in this manner a vegetable aromatic fubftance, which of courfe contains an effential oil, provided it hath not been previoufly extracted by the appropriated procefs, this effential oil will rife firft, as foon as the diftilling veffel acquires the heat of boiling water: but its fcent will not be near fo fweet or grateful, as if it were diftilled in the manner before directed as propereft for it. On the contrary, it will have an empyreumatic fmell: becaufe in this way it is impoffible to avoid fcorching, and half-burning fome of the matter diftilled; efpecially that part of it which touches the fides of the retort. Moreover, the very fame equable degree of heat can hardly be kept up with a naked fire. The effential oil therefore, though it rifes firft, will not be pure, but contaminated with a mixture of the empyreumatic oil that firft comes over, and will be confounded therewith.

Moft vegetable fubftances, when diftilled with a ftrong fire, yield the fame principles with that which we have chofen for an inftance. Entire plants of this kind, thofe from which the odorous principle, the effential oil, or the fat oil, hath been drawn, thofe of which extracts have been made by infufion or decoction, or the extracts themfelves; all fuch matter being diftilled yield a phlegm, an acid, a thin oil, air, and a thick oil; and the products of their feveral analyfes differ from each other, only on account of the different quantity or proportion that each contains of the principles here enumerated.

But there are many other plants, which, befides thefe fubftances, yield alfo a confiderable quantity of a volatile alkaline falt. This property is poffeffed chiefly by that tribe of plants which is diftinguifhed by having cruciform flowers: among which there are fome that, being analifed, greatly refemble animal-matters. We fhall now analife one of thefe; muftard-feed, for inftance.

To analife a Vegetable Subftance which yields the fame Principles as are obtained from Animal-matters: inftanced in Muftard-feed.

With an apparatus like that of the preceding procefs, and with the fame fire, diftill muftard-feed. With a degree of heat, inferior to that of boiling water, there will come over a phlegm fomewhat coloured, and impregnated with a volatile alkaline falt. With a degree of heat, greater than that of boiling water, the fame kind of phlegm, impregnated with the fame falt, will continue to come over; but it will be much higher coloured, and will be accompanied with a light oil. At this time a confiderable quantity of air is difcharged; with regard to which the fame precautions muft be taken as in diftilling Guaiacum.

If the fire be gradually raifed, there will come over a black thick oil, lighter however than water; and at the fame time vapours will rife, and, condenfing on the fides of the receiver, form into fprings or ramifications. This is a volatile alkaline falt, in a concrete form, like that of animals, as we fhall hereafter fee. Thefe vapours are much whiter than thofe of Guaiacum.

When you have thus drawn off, with a very ftrong fire, all the volatile alkali and thick oil contained in the fubject, there will be nothing left in the retort but a fort of coal, from which a fmall quantity of phofphorus may be obtained, provided the retort you employ for that purpofe be good enough to ftand a very violent heat.

Muftard-feed furnifhes us with an inftance of a vegetable, from which we obtain, by analifing it, the very fame principles that animal-matters yield. Inftead of

of getting an acid from it, we obtain only a volatile alkali.

We ſhall not here ſpeak of the manner of ſeparating and depurating the principles obtained by this proceſs; but reſerve it for the analyſis of animals, which is abſolutely the ſame. We ſhall content ourſelves with obſerving, that the firſt volatile alkali, which riſes at the beginning of the operation together with the phlegm, in a degree of heat below that of boiling water, differs from that which doth not come over till towards the end of the diſtillation, when the laſt thick oil aſcends. The different times, and different degrees of heat, in which theſe two alkalis riſe, ſhew that the former exiſts actually and perfectly in the plant; but that the latter is generated during the diſtillation, and is the product of the fire, which combines together the materials whereof it is compoſed.

Vegetables, that thus yield a volatile alkali with a heat leſs than that of boiling water, irritate the organ of ſmelling, affecting it with a ſenſation of acrimony; and the effluvia, which riſe from them when bruiſed, make the eyes ſmart ſo as to draw tears from them in abundance. Several of theſe matters, being only bruiſed, effervefce with acids: effects producible only by a very volatile alkaline principle.

This is that alkali, the lighteſt of all the principles that can be extracted from bodies, which riſes firſt in our diſtillation along with the phlegm, and with a degree of heat much inferior to that of boiling water. As the phlegm with which it riſes is very copious, it is diſſolved thereby; which is the reaſon it doth not appear in a concrete form. To this water it gives a ſlight yellowiſh tinge, becauſe it is impure and oily. The ſaline alkaline properties of this liquor have procured it the title of a volatile ſpirit. This volatile alkali, which exiſts naturally and perfectly formed in muſtard-ſeed, onions, garlick, creſſes, and other ſuch vegetables, conſtitutes a difference between them and animal ſubſtances, which contain only the materials requiſite to form a volatile alkali, but none ready formed, unleſs they have undergone the putrid fermentation.

The ſecond volatile alkali, which riſes in our diſtillation, but not without a very ſtrong degree of fire, and at the ſame time with the laſt thick oil, ſeems to be a production of the fire; for, if it were already formed in the mixt, as the other is, it would riſe with the ſame heat, and at the ſame time, being equally volatile.

Of the Subſtances obtained from Vegetables by Combuſtion.

To procure a fixed Cauſtic Alkaline Salt from a Vegetable Subſtance, by burning it in the open Air.

Take any vegetable matter whatever; ſet it on fire, and let it burn in the open air till it be wholly reduced to aſhes. On theſe aſhes pour a quantity of boiling water ſufficient to drench them thoroughly. Filter the liquor, in order to ſeparate the earthy parts; and evaporate your lye to dryneſs, ſtirring it inceſſantly; and you will have a yellowiſh-white ſalt.

Put this ſalt in a crucible; ſet it in a melting furnace, and make a moderate fire, ſo as not to fuſe the ſalt. It will turn firſt of a blue-grey colour, afterwards of a blue-green, and at laſt reddiſh. Put on the dome of the furnace; fill it with coals; make your fire ſtrong enough to melt the ſalt, and keep it in fuſion for an hour, or an hour and half. Then pour it into a heated metal mortar; pound it while it is red-hot; put it as ſoon as poſſible into a glaſs bottle, firſt made very hot and dry, and ſhut it up cloſe with a glaſs ſtopple rubbed with emery. By this means you will have the pure fixed alkali of the vegetable ſubſtance you burnt.

Burning a vegetable ſubſtance in the open air is a kind of violent and rapid analyſis made by fire, which ſeparates, reſolves, and decompoſes ſeveral of its principles.

When any wood or plant is laid on a quick fire, there aſcends from it immediately an aqueous ſmoke, which conſiſts of little more than phlegm; but this ſmoke ſoon becomes thicker and blacker; it is then pungent, draws tears from one's eyes, and excites a cough if drawn into the lungs with the breath. Theſe effects ariſe from its being replete with the acid, and ſome of the oil, of the vegetable converted into vapours. Soon after this the ſmoke grows exceeding black and thick; it is now ſtill more acrid, and the plant turns black. Its ſtrongeſt acid and laſt thick oil are now diſcharged with impetuoſity.

This rarefied oil being heated red-hot ſuddenly takes fire and flames. The vegetable burns and deflagrates rapidly, till all its oil is conſumed. Then the flame ceaſes; and nothing remains but a coal, like that found in a retort after all the principles of a plant have been extracted by the force of fire. But this coal having a free communication with the air, which is abſolutely neceſſary to keep a combuſtible burning, continues to be red, ſparkles, and waſtes till all its phlogiſton is diſſipated and deſtroyed. After this nothing remains but the earth and fixed ſalt of the vegetable; which, mixed together, form what we call the aſhes. Water, which is the natural ſolvent of ſalts, takes up every thing of that kind that is contained in the aſhes; ſo that by lixiviating them, as directed, all the ſalt is extracted, and nothing left but the pure earth of the mixt which is thus decompoſed.

The phenomena obſerved in the burning of a vegetable ſubſtance, and the production thereby of a fixed alkali, ſeem to prove that this ſalt is the work of the fire; that it did not exiſt in the plant before it was burnt; that the plant only contained materials adapted to form this ſalt; and that this ſalt is no other than a combination of ſome of the acid, united with a portion of earth, by means of the igneous motion.

The alkali obtained from the aſhes of burnt plants is not perfectly pure: it is contaminated with a ſmall mixture of fatty matters, which were probably defended thereby againſt the action of the fire, and which render it ſomewhat ſaponaceous. In order to free it from this extraneous matter, and to render it very cauſtic, it muſt be calcined a long time in a crucible, but without melting it at firſt; becauſe it is with this ſalt as with moſt metallic matters, which are ſooner and more eaſily deprived of their phlogiſton by being calcined without melting, provided they be comminuted into ſmall particles, than when they are in fuſion; all melted matters having but a

a ſmall ſurface expoſed to the air, by the contact of which the evaporation of any thing whatever is exceedingly promoted.

To procure the fixed Salt of a Plant, by burning it after the manner of Tachenius.

INTO an iron pot put the plant whoſe ſalt you deſire to obtain in the manner of Tachenius. and ſet it over a fire, ſtrong enough to make its bottom red-hot; at the ſame time cover your plant with a plate of iron, that may lie immediately upon it in the pot. The plant will grow black, and ſmoke conſiderably; but will not flame, becauſe it hath not a ſufficient communication with the air. The black ſmoke only will eſcape through the interſtice left between the ſide of the pot and the rim of the plate; which, for that purpoſe, ſhould be made ſo as not to fit exactly into the pot. From time to time take up the iron plate, ſtir the plant, and cover it again immediately, to prevent its taking fire, or to ſmother it if it ſhould happen to flame: go on thus till the black ſmoke ceaſe.

Then take off the iron plate: the upper part of the half-burnt plant will take fire as ſoon as the air is admitted, conſume gradually, and be reduced to a white aſh. Stir your matter with an iron wire, that the undermoſt parts, which are ſtill black, may be ſucceſſively brought uppermoſt, take fire, and burn to white aſhes.

Go on thus as long as you perceive the leaſt blackneſs remaining. After this, leave your aſhes ſome time longer on the fire; but ſtir them frequently, to the end that, if any black particles ſhould ſtill be left, they may be entirely conſumed.

Your aſhes being thus prepared, lixiviate them with ſeven times their quantity of water, made to ſimmer over the fire, and keep ſtirring it with an iron ladle. Then filter the liquor, and evaporate it to dryneſs in an iron pot, ſtirring it inceſſantly towards the end, leſt the matter, when it grows ſtiff, ſhould adhere too cloſely to the veſſel. When all the humidity is evaporated. you will have a ſalt of a darkiſh colour and alkaline nature; which you may melt in a crucible, and mould into cakes. This is the fixed ſalt of plants, prepared in the manner of Tachenius.

To render Fixed Alkalis very cauſtic by means of Lime. The Cauſtic Stone.

TAKE a lump of newly burnt quick-lime, that hath not yet begun to ſlake in the air: put it into a ſtone pan, and cover it with twice its weight of the unwaſhed aſhes of ſome plant that are full of the ſalt you deſign to render cauſtic. Pour on them a great quantity of hot water; let them ſteep in it five or ſix hours, and then boil them gently. Filter the liquor through a thick canvas bag, or through brown filtering paper ſupported by a linen cloth.

Evaporate the filtered liquor in a copper baſon ſet over the fire; and there will remain a ſalt, which muſt be put into a crucible ſet in the fire. It will melt, and boil for ſome time; after which it will be ſtill, and look like an oil, or melted fat. When it comes to this condition, pour it out on a very hot copper plate, and cut it into oblong tapering ſlips, before it grow hard by cooling. Put theſe ſlips, while they are ſtill hot, into a very dry glaſs bottle, and ſeal it hermetically. This is the *cauſtic ſtone*, or *common cauſtic*.

The Analyſis of Soot.

TAKE wood-ſoot from a chimney under which no animal matter hath been dreſſed or burnt: put it into a glaſs retort ſet in a reverberating furnace; lute on a receiver, and begin to diſtill with a degree of heat ſomewhat leſs than that of boiling water. A conſiderable quantity of limpid phlegm will come over. Keep the fire in the ſame degree as long as any of this phlegm riſes, but increaſe it when the drops begin to come ſlow; and then there will aſcend a good deal of a milky water. When this water ceaſes to run, change the receiver, and increaſe your fire a little: a yellow volatile ſalt will riſe, and ſtick to the ſides of the receiver. The fire ought now to be very fierce, and, if ſo, will force up at the ſame time a very thick black oil. Let the veſſels cool: you will find a ſaline matter riſen into the neck of the retort, which could not paſs over into the receiver: in the bottom of the retort will be a *caput mortuum*, or black charred ſubſtance, the upper part of which will be cruſted over with a ſaline matter, like that in the neck of the retort.

As we are at preſent inquiring into the nature of vegetables only, it is evidently neceſſary that we chuſe a ſoot produced by burning vegetables alone. Soot, though dry in appearance, contains nevertheleſs much humidity, as appears from this analyſis; ſeeing there comes over at firſt a conſiderable quantity of phlegm, that doth not ſeem to be impregnated with any principle, except perhaps an extremely ſubtile, ſaline, and oily matter, that communicates to it a diſagreeable ſmell, from which it cannot by any means be entirely freed.

The volatile alkali obtained from ſoot is, in a double reſpect, the product of the fire. In the firſt place, though it derives its origin wholly from wood, or other vegetables, which, when diſtilled in cloſe veſſels, yield no volatile alkali at all, yet it produces ſuch a ſalt when analyſed in the preſent manner: whence it muſt be inferred, that the principles of thoſe vegetables are metamorphoſed into a volatile alkali, by being burnt in the open air, and ſublimed in the form of ſoot. Secondly, though ſoot, when analyſed, yields a great deal of this ſalt, yet this ſalt doth not formally pre-exiſt therein; for it doth not riſe till after the phlegm, nor without a very conſiderable degree of heat: therefore ſoot contains only the materials neceſſary to form this ſalt; therefore the perfect combination of this ſalt requires that the force of fire be applied a ſecond time; therefore it is, as was ſaid, doubly the product of the fire.

The ſaline matter which we find ſublimed into the neck of the retort, and which alſo forms the cruſt that covers the *caput mortuum* of the ſoot, appears by all chemical trials to be an ammoniacal ſalt; that is, a neutral ſalt, conſiſting of an acid and a volatile alkali. This ammoniacal ſalt riſes only into the neck of the retort, and doth not come over into the receiver; becauſe it is but ſemi-volatile. We ſhall treat more at large of the production

production of a volatile alkali, and of this ammoniacal ſalt, when we come to the analyſis of animals, and the article of ſal ammoniac.

The Analyſis of ſome particular Subſtances belonging to the Vegetable Kingdom.

Analyſis of the natural Balſams: inſtanced in Turpentine.

INTO a cucurbit put as much rain-water as will fill about a fourth part of its cavity, and pour into it the turpentine you intend to analyſe. Cover the cucurbit with its head, and lute it on with ſlips of ſized paper or wet bladder. Set your alembic in a ſand-heat; lute on a long-necked receiver; and give a gradual fire till the water in the cucurbit boil. There will come over into the receiver a good deal of phlegm, which, by little and little, will become more and more acid; and at the ſame time there will riſe a great quantity of an æthereal oil, extremely light, fluid, and as limpid and colourleſs as water.

When you obſerve that no more oil comes off, unlute your veſſels; and in the receiver you will find an acidulated water, and the æthereal oil floating on it. Theſe two liquors may be eaſily ſeparated from each other, by means of a glaſs funnel.

In the cucurbit will be left ſome of the water you put in, together with the remainder of your turpentine; which, when cold, inſtead of being fluid, as it was before diſtillation, will be ſolid, and of the conſiſtence of a reſin, and is then called *roſin*.

Put this reſiduum into a glaſs retort, and diſtill it in a reverberatory with a naked fire, gradually increaſed according to the general rule for all diſtillations. At firſt, with a degree of heat a little greater than that of boiling water, you will ſee two liquors come over into the recipient; one of which will be aqueous and acid, the other will be a tranſparent, limpid, yellowiſh oil, floating on the acid liquor.

Continue your diſtillation, increaſing your fire from time to time, by ſlow degrees. Theſe two liquors will continue to come off together; and the nearer the operation draws to its end, the more acid will the aqueous liquor become, and the thicker and deeper coloured will the oil grow. At laſt the oil will be very thick, and of a deep reddiſh yellow colour. When nothing more aſcends, unlute your veſſels: in the retort you will find only a very ſmall quantity of a charred, light, friable ſubſtance.

All natural balſams, as well as turpentine, are oily, aromatic matters, which flow in great quantities from the trees containing them, either ſpontaneouſly, or thro' inciſions made on purpoſe. As theſe matters have a ſtrong ſcent, it is not ſurpriſing that they ſhould greatly abound with eſſential oils. They may even be conſidered as eſſential oils, that naturally, and of their own accord, ſeparate from the vegetables in which they exiſt.

Natural balſams, and eſſential oils grown thick with age, are exactly one and the ſame thing. Accordingly we ſee that fire and diſtillation produce the ſame effects on both. The rectification of an eſſential oil, thickened by keeping, is nothing but a decompoſition thereof, by ſeparating, with the heat of boiling water, all thoſe parts that are light enough to riſe with that degree of heat, from what is ſo loaded with acid as to remain fixed therein.

The newer natural balſams are, the thinner they are, and the more eſſential oil do they yield; and this eſſential oil, like all others, grows thick in time, and at laſt turns again to an actual balſam.

Theſe balſams, by being long expoſed to the heat of the ſun, acquire ſuch a conſiſtence as to become ſolid. They then take another name, and are called *reſins*. Reſins yield much leſs eſſential oil when diſtilled, than balſams do. Hence it follows, that reſins are to balſams, what balſams are to eſſential oils.

The Analyſis of Reſins: inſtanced in Benjamin. The Flowers and Oil of Benjamin.

INTO a pretty deep earthen pot, having a border or rim round its mouth, put the benjamin you intend to analyſe. Cover the pot with a large conical cap of very thick white paper, and tie it on under the rim. Set your pot in a ſand-bath, and warm it gently till the benjamin melt. Continue the heat in this degree for an hour and half. Then untie the paper cap and take it off, ſhaking it as little as poſſible. You will find all the inſide of the cap covered with a great quantity of beautiful, white, ſhining flowers, in the form of little needles. Bruſh them off gently with a feather, put them into a bottle, and ſtop it cloſe.

As ſoon as you take off the firſt cap, cover your pot immediately with a ſecond like the former. In this manner go on till you perceive the flowers begin to grow yellowiſh; and then it is proper to deſiſt.

The matter left in the pot will be blackiſh and friable when cold. Pulveriſe it; mix it with ſand; and diſtill it in a glaſs retort with a graduated heat. There will come over a light oil, of a fragrant ſcent, but in very ſmall quantity; a little of an acid liquor, and a great quantity of a red thick oil. There will be left in the retort a charred, ſpungy ſubſtance.

Of the Nature and Properties of Camphor.

WE do not propoſe to give an analyſis of this ſingular body; becauſe hitherto there is no proceſs known in chemiſtry by which it can be decompoſed. We ſhall therefore content ourſelves with reciting its principal properties, and making a few reflections on its nature.

Camphor is an oily concrete ſubſtance; a kind of reſin, brought to us from the iſland of Borneo, but chiefly from Japan. This ſubſtance reſembles reſins, in being inflammable, and burning much as they do; it is not ſoluble in water, but diſſolves entirely and perfectly in ſpirit of wine; it is eaſily ſeparated again from this menſtruum, as all other oily matters are, by the addition of water; it diſſolves both in expreſſed and in diſtilled oils; it hath a very ſtrong aromatic ſmell. Theſe are the chief

chief properties which camphor poſſeſſes in common with reſins: but in other reſpects it differs totally from them; eſpecially in the following particulars.

Camphor takes fire and flames with vaſtly more eaſe than any other reſin. It is ſo very volatile, that it vaniſhes entirely in the air, without any other heat than that of the atmoſphere. In diſtillation it riſes entire, without any decompoſition, or even the leaſt alteration. It diſſolves in concentrated mineral acids; but with circumſtances very different from thoſe that attend other oily or reſinous ſubſtances. The diſſolution is accompanied with no efferveſcence, no ſenſible heat; and conſequently can produce no inflammation. Acids do not burn, blacken, or thicken it, as they do other oily matters; on the contrary, it becomes fluid, and runs with them into a liquor that looks like oil.

Camphor doth not, like other oily matters, acquire a diſpoſition to diſſolve in water by the union it contracts with acids; though its union with them ſeems to be more intimate than that of many oily matters with the ſame acids. On the contrary, if a combination of camphor and an acid be diluted with water, theſe two ſubſtances inſtantly ſeparate from each other: the acid unites with the water, and the camphor, being entirely diſengaged from it, ſwims on the ſurface of the liquor. Neither volatile alkalis, nor the moſt cauſtic fixed alkalis, can be brought into union with it; for it always eludes their power.

Notwithſtanding theſe wide differences between camphor and all other oily and reſinous ſubſtances, the rule, that acids thicken oils, ſeems to be ſo univerſal, and ſo conſtantly obſerved by nature, that we cannot help thinking this ſubſtance, like all the reſt, is an oil thickened by an acid. But what oil? what acid? and how are they united? This is a ſubject for very curious inquiries.

With a yellow oil drawn from wine, and an acid vinous ſpirit, Mr Hellot made a kind of artificial camphor; a ſubſtance having the odour, ſavour, and inflammability of camphor; an imperfect camphor. True camphor hath the levity, the volatility, and the inflammability of æther. Can it be a ſubſtance of the ſame nature with æther, a kind of ſolid æther, an æther in a concrete form?

The Analyſis of Bitumens: inſtanced in Amber. The Volatile Salt and Oil of Amber.

Into a glaſs retort put ſome ſmall bits of amber, ſo as to fill but two thirds of the veſſel. Set your retort in a furnace covered with its dome; fit on a large glaſs receiver; and beginning with a very gentle heat, diſtill with degrees of fire. Some phlegm will firſt come off, which will gradually grow more acid, and be ſucceeded by a volatile ſalt, figured like fine needles, that will ſtick to the ſides of the receiver.

Keep the fire up to this degree, in order to drive over all the ſalt. When you perceive that little or none riſes, change the receiver, and increaſe your fire a little. A light, clear, limpid oil will aſcend. As the diſtillation advances, this oil will grow higher coloured, leſs limpid, and thicker; till at laſt it will be opaque, black, and have the conſiſtence of turpentine.

When you perceive that, though the retort be red-hot, nothing more comes off, let the fire go out. You will have in the retort a black, light, ſpungy coal. If you have taken care to ſhift the receiver, from time to time, during the diſtillation of your oil, you will have ſundry ſeparate portions thereof, each of which will have a different degree of tenuity or thickneſs, according as it came over at the beginning, or towards the end of the diſtillation.

The ſubſtance of which we have here given the analyſis, together with all others of the ſame, that is, of the bituminous kind, is, by moſt chemiſts and naturaliſts, claſſed with minerals: and ſo far they are right, that we actually get theſe mixts, like other minerals, out of the bowels of the earth, and never procure them immediately from any vegetable or animal compound. Yet we have our reaſons for acting otherwiſe, and for thinking that we could not, in this work, place them better, than immediately after thoſe vegetable ſubſtances which we call *reſins*.

Several motives determine us to proceed in this manner. The analyſis of bitumens demonſtrates, that, with regard to the principles of which they conſiſt, they are totally different from every other kind of mineral; and that, on the contrary, they greatly reſemble vegetable reſins in almoſt every reſpect. In ſhort, though they are not immediately procured from vegetables, there is the greateſt reaſon for believing that they were originally of the vegetable kingdom, and that they are no other than reſinous and oily parts of trees or plants, which by lying long in the earth, and there contracting an union with the mineral acids, have acquired the qualities that diſtinguiſh them from reſins.

Mineralogiſts know very well that we find, every where in the earth, many vegetable ſubſtances, that have lain very long buried under it, and frequently at a conſiderable depth. It is not uncommon to find, under ground, vaſt beds of foſſile trees, which ſeem to be the remains of immenſe foreſts; and bitumens, particularly amber, are often found among this ſubterraneous wood.

Theſe conſiderations, joined to proofs drawn from their analyſis, make this opinion more than probable: nor are we ſingular in maintaining it, as it is adopted by many able modern chemiſts.

The analyſis of amber, above deſcribed, may ſerve as a general ſpecimen of the decompoſition of other bitumens: with this ſingle difference, that amber is the only one among them which yields the volatile ſalt aforeſaid; and this determined us to examine it preferably to any other. As for the reſt, they all yield a phlegm, an acid liquor, and an oil; which is thin at firſt, but grows thicker and thicker as the diſtillation draws towards an end. It muſt be underſtood, however, that theſe acids and theſe oils may differ, according to the nature of the bitumens from which they are drawn; juſt as the phlegm, the acid, and the oil, reſulting from the decompoſition of reſins, differ in quantity and quality, according to the nature of the reſins from which they are procured.

The

The principal differences obferved between refins and bitumens are thefe: the latter are lefs foluble in fpirit of wine; have a peculiar fcent, which cannot be accurately defcribed, and of which the fenfe of fmelling only can judge; and their acid is ftronger and more fixed. This laft property is one of the motives which induce us to think, that befides the vegetable acid, originally combined with the refinous or oily matter now become a bitumen, a certain quantity of mineral acid hath, in a courfe of time, been fuperadded to conftitute this mixt. We fhall prefently fee that the fact is certainly fo, in the cafe of amber at leaft.

The Analyfis of Bees-wax.

Melt the wax you intend to analyfe, and mix with it as much fine fand as will make it into a ftiff pafte. Put this pafte in little bits into a retort, and diftil as ufual, with a graduated fire, beginning with a very gentle heat. An acid phlegm will come over, and be followed by a liquor which at firft will look like an oil, but will foon congeal in the receiver, and have the appearance of a butter or greafe. Continue the diftillation, increafing the fire by infenfible degrees, till nothing more will come off. Then feparate the butter from the acid phlegm in the receiver, mix it with frefh fand, and diftil it again juft as you did the wax before. Some acid phlegm will ftill come off, and an oil will afcend, which will not fix in the receiver, though it be ftill thick. Continue the diftillation, with a fire fo governed that the drops may fucceed each other at the diftance of fix or feven feconds of time. Do not increafe it, till you perceive the drops fall more flowly; and then increafe it no more than is neceffary to make the drops follow each other as above directed. When the diftillation is finifhed, you will find in the receiver the oil come wholly over, and a little acid phlegm. Separate the oil from this liquor; and, if you defire to have it more fluid, rediftil it a third time in the fame manner.

The Saccharine Juices of Plants analyfed: inftanced in Honey.

Put into a ftone cucurbit the honey you intend to diftil; fet it in a moderate fand-heat, and evaporate the greateft part of its humidity, till you perceive the phlegm to be acid. Then take out the matter remaining in the cucurbit, put it into a retort, leaving a full third thereof empty, and diftil in a reverberatory with degrees of fire. An acid amber-coloured liquor will come over. As the operation advances, this liquor will continually become deeper coloured and more acid, and at the fame time a little black oil will afcend. When the diftillation is over, you will find in the retort a pretty large charred mafs, which being burnt in the open air, and lixiviated, affords a fixed alkali.

Sugar, manna, and the faccharine juices of fruits and plants, are of the fame nature as honey, yield the fame principles, and in the fame proportions. All thefe fubftances muft be confidered as native foaps; becaufe they confift of an oil rendered mifcible with water, by means of a faline fubftance. They differ from the common artificial foaps in feveral refpects; but chiefly in this, that their faline part is an acid, whereas that of common foap is an alkali. The natural foaps are not for that reafon the lefs perfect: on the contrary, they diffolve in water without deftroying its tranfparency, and without giving it a milky colour; which proves, that acids are not lefs proper than alakalis, or rather that they are more proper additaments, for bringing oils into a faponaceous ftate.

Gummy Subftances analyfed: inftanced in Gum Arabic.

Distil gum arabic in a retort with degrees of fire. A limpid, fcentlefs, and taftelefs phlegm will firft come over; and then a ruffet coloured acid liquor, a little volatile alkali, and an oil, which will firft be thin and afterwards grow thick. In the retort will be left a good deal of a charred fubftance, which, being burnt and lixiviated, will give a fixed alkali.

Gums have at firft fight fome refemblance of refins; which hath occafioned many refinous matters to be called gums, though very improperly: for they are two diftinct forts of fubftances, of natures abfolutely different from each other. It hath been fhewn, that refins have an aromatic odour; that they are indiffoluble in water, and foluble in fpirit of wine; that they are only an effential oil grown thick. Gums, on the contrary, have no odour, are foluble in water, indiffoluble in fpirit of wine, and, by being analyfed as in the procefs, are converted almoft wholly into a phlegm and an acid. The fmall portion of oil contained in them is fo thoroughly united with their acid, that it diffolves perfectly in water, and the folution is clear and limpid. In this refpect gums refemble honey, and the other vegetable juices analogous to it. They are all fluid originally; that is, when they begin to ooze out of their trees. At that time they perfectly refemble mucilages, or rather they are actual mucilages, which grow thick and hard in time by the evaporation of a great part of their moifture: juft as refins are true oils, which, lofing their moft fluid parts by evaporation, at laft become folid. Infufions or flight decoctions of mucilaginous plants, when evaporated to drynefs, become actual gums.

Some trees abound both in oil and in mucilage: thefe two fubftances often mix and flow from the tree blended together. Thus they both grow dry and hard together in one mafs, which of courfe is at the fame time both gummy and refinous: and accordingly fuch mixts are named *gum refins*.

Of Operations on Fermented Vegetable Substances.

Of the Product of Spirituous Fermentation.

To make Wine of Vegetable Subftances that are fufceptible of Spirituous Fermentation.

Let a liquor fufceptible of, and prepared for, the fpirituous fermentation, be put into a cafk. Set this cafk in a temperately warm cellar, and cover the bung-hole with a bit of linen cloth only. In more or lefs time, according to the nature of the liquor to be fermented, and

and to the degree of heat in the air, the liquor will begin to ſwell, and be rarefied. There will ariſe an inteſtine motion, attended with a ſmall hiſſing and effervescence, throwing up bubbles to the ſurface, and diſcharging vapours; while the groſs, viſcous, and thick parts, being driven up by the fermenting motion, and rendered lighter by little bubbles of air adhering to them, will riſe to the top, and there form a kind of ſoft ſpungy cruſt, which will cover the liquor all over. The fermenting motion ſtill continuing, this cruſt will, from time to time, be lifted up and cracked by vapours making their eſcape through it; but thoſe fiſſures will preſently cloſe again, till, the fermentation gradually going off, and at laſt entirely ceaſing, the cruſt will fall in pieces to the bottom of the liquor, which will inſenſibly grow clear. Then ſtop the caſk cloſe with its bung, and ſet it in a cooler place.

Matters that are ſuſceptible of the ſpirituous fermentation are ſeldom ſo perfectly prepared for it by nature as they require to be. If we except the juices that flow naturally from certain trees, but oftener from inciſions made on purpoſe in them, all other ſubſtances require ſome previous preparation.

Boerhaave divides the ſubſtances that are fit for ſpirituous fermentation into five claſſes. In the firſt he places all the meally ſeeds, the legumens, and the kernels of almoſt all fruits. The ſecond claſs includes the juices of all fruits that do not tend to putrefaction. In the third claſs ſtand the juices of all the parts of plants which tend rather to acidity than to putrefaction; and conſequently thoſe which yield much volatile alkali are to be excluded. The fourth claſs comprehends the juices or ſaps that ſpontaneouſly diſtil from ſeveral trees and plants, or flow from them when wounded. He forms his fifth and laſt claſs of the ſaponaceous, ſaccharine, and concrete or thick juices of vegetables. Reſinous or purely gummy matters are excluded, as not being fermentable.

Theſe five claſſes may be reduced into two; one comprehending all the juices, and another all the meally parts of vegetables that are ſuſceptible of fermentation. The juices want nothing to fit them for fermentation, but to be expreſſed out of the ſubſtances containing them, and to be diluted with a ſufficient quantity of water. If they be very thick, the beſt way is to add ſo much water as ſhall render the mixed liquor juſt capable of bearing a new laid egg. With reſpect to farinaceous ſubſtances, as they are almoſt all either oily or mucilaginous, they require a little more management. The method of brewing malt liquors will furniſh us with examples of ſuch management See Brewing.

Beſides the preparations relating chiefly to malt liquors, there are many other things to be obſerved relating to ſpirituous fermentation in general, and to all matters ſuſceptible of that fermentation. For example, all grains and fruits deſigned for that fermentation muſt be perfectly ripe; for otherwiſe they will not ferment without difficulty, and will produce little or no inflammable ſpirit. Such matters as are too auſtere, too acrid, or aſtringent, are for the ſame reaſon unfit for ſpirituous fermentation; as well as thoſe which abound too much in oil.

In order to make the fermentation ſucceed perfectly, ſo as to produce the beſt wine that the fermented liquor is capable of affording, it is neceſſary to let it ſtand quiet without ſtirring it, leſt the cruſt that forms on its ſurface ſhould be broken to little fragments, and mix with the liquor. This cruſt is a kind of cover, which hinders the ſpirituous parts from exhaling as faſt as they are formed. The free acceſs of the air is another condition neceſſary to fermentation: and for this reaſon the veſſel that contains the fermenting liquor muſt not be cloſe ſtopped; the bung-hole is only to be covered with a linen cloth, to hinder dirt and inſects from falling into it. Nor muſt the bung-hole be too large, leſt too much of the ſpirituous parts ſhould eſcape and be loſt.

Laſtly, a juſt degree of warmth is one of the conditions moſt neceſſary for fermentation: for in very cold weather there is no fermentation at all; and too much heat precipitates it in ſuch a manner that the whole liquor becomes turbid, and many fermenting and fermented particles are diſſipated.

If, notwithſtanding the exacteſt obſervance of every particular requiſite to excite a ſucceſsful fermentation, the liquor cannot, without difficulty, be brought to effervesce, which ſcarce ever happens but to malt-liquor, it may be accelerated by mixing therewith ſome matter that is very ſuſceptible of fermentation, or actually fermenting. Such matters are called *ferments*. The cruſt that forms on the ſurface of fermenting liquors is a moſt efficacious ferment, and on that account very much uſed.

It ſometimes happens, that there is occaſion to check the fermentation excited in the liquor, before it ceaſes of itſelf. To effect this, ſuch means muſt be uſed as are directly oppoſite to thoſe mentioned above for promoting fermentation. The ſame end is obtained by mixing with the liquor a quantity of alkali, ſufficient to abſorb the acid contained therein: but this method is ſeldom made uſe of, becauſe it ſpoils the liquor; which, after being thus treated, is incapable of any ſpirituous fermentation, but on the contrary will certainly putrefy.

Spirituous fermentation may alſo be ſtopped by mixing with the liquor a great quantity of ſome mineral acid. But this likewiſe alters its nature; becauſe theſe acids, being fixed, always remain confounded therewith, and never ſeparate from it.

The beſt method yet found out for checking this fermentation, without injury to the fermenting liquor, is to impregnate it with the fumes of burning ſulphur. Theſe fumes are known to be acid; and it is that quality in them which ſuſpends the fermentation. But at the ſame time this acid is extremely volatile; ſo that it ſeparates ſpontaneouſly from the liquor, after ſome time, and leaves it in a condition to continue its fermentation.

For this reaſon, when a wine is deſired that ſhall be but half fermented, and ſhall partly retain the ſweet taſte it had in the ſtate of *muſt*, (the proper name for the unfermented juice of the grape), it is put into caſks in which ſulphur hath been previouſly burnt, and the vapours thereof confined by ſtopping the bung-hole. Theſe are called *matched wines*. If the ſame operation be performed on muſt, its fermentation will be abſolutely prevented: it will retain all its ſaccharine taſte, and is then called

called *ſtum*. As the ſulphureous acid evaporates ſpontaneouſly, in no long ſpace, it is neceſſary to fumigate matched wines or ſtums from time to time, when they are intended to be kept long without fermenting.

To draw an Ardent Spirit from Subſtances that have undergone the Spirituous Fermentation. — The Analyſis of Wine.

Fill a large copper cucurbit half full of wine. Fit on its head and refrigeratory. Lute on a receiver with wet bladder, and diſtill with a gentle fire; yet ſo that the drops which fall from the noſe of the alembic may ſucceed one another pretty quick, and form a ſort of ſmall continued ſtream. Go on thus till you perceive that the liquor which comes over ceaſes to be inflammable; and then deſiſt. You will find in the receiver a clear liquor, ſomewhat inclining to an amber-colour, of a pleaſant quick ſmell, and which being thrown into the fire inſtantly flames. The quantity thereof will be nearly a fourth part of the wine you put into the alembic; and this is what is called *brandy*; that is, the ardent ſpirit of wine loaded with much phlegm.

In order to rectify it, and reduce it to ſpirit of wine, put it into a long-necked matras, capable of holding double the quantity. Fit a head to the matras, and lute on a receiver: place your matras over a pot half full of water: ſet this pot over a moderate fire; and with this vapour-bath diſtil your ſpirit, which will riſe pure. Continue this degree of heat till nothing more will come over. You will find in the receiver a very clear colourleſs ſpirit of wine, of a quick but agreeable ſmell, which will catch fire at once by the bare contact of any flaming ſubſtance.

To dephlegmate Spirit of Wine by the Means of Fixed Alkalis.

Into a glaſs cucurbit pour the ſpirit of wine you intend to dephlegmate, and add to it about a third part of its weight of fixed alkali, newly calcined, perfectly dry, heated, and pulveriſed. Shake the veſſel, that the two matters may be mixed and blended together. The ſalt will gradually grow moiſt, and, if the ſpirit of wine be very aqueous, melt into a liquor, that will always lie at the bottom of the veſſel, without uniting with the ſpirit of wine which will ſwim at top.

When you perceive that the alkali attracts no new moiſture, and that no more of it melts, decant your ſpirit of wine from the liquor beneath it, and add to your ſpirit freſh ſalt thoroughly dried as before. This ſalt alſo will imbibe a little moiſture; but it will not grow liquid, becauſe the alkali, with which it was mixed before, hath left too little phlegm to melt this. Decant it from this ſalt as at firſt, and continue to mix and ſhake it in the ſame manner with freſh ſalt, till you obſerve that the ſalt remains as dry after as it was before mixing it with the ſpirit of wine. Then diſtil your ſpirit in a ſmall alembic with a gentle heat, and you will have it as much dephlegmated as it can be.

Spirit of Wine combined with different Subſtances.

To combine Spirit of Wine with the Vitriolic Acid. This Combination decompounded. Æther.

Into an Engliſh glaſs retort put two pounds of ſpirit of wine perfectly dephlegmated, and pour on it at once two pounds of highly concentrated oil of vitriol: ſhake the retort gently ſeveral times, in order to mix the two liquors. This will produce an ebullition, and conſiderable heat; vapours will aſcend, with a pretty loud hiſſing noiſe, which will diffuſe a very aromatic ſmell, and the mixture will be of a deeper or lighter red colour, according as the ſpirit of wine was more or leſs oily. Set the retort on a ſand-bath made nearly as hot as the liquor; lute on a tubulated ballon, and diſtil the mixture with a fire ſtrong enough to keep the liquor always boiling; a very aromatic ſpirit of wine will firſt come over into the ballon, after which the æther will riſe. When about five or ſix ounces of it are come off, you will ſee in the upper concavity of the retort a vaſt number of little points in a veined form, which will appear fixed, and which are nevertheleſs ſo many little drops of æther, rolling over one another, and trickling down into the receiver. Theſe little points continue to appear and ſucceed each other to the end of the operation. Keep up the ſame degree of fire, till upon opening the little hole in the ballon you perceive that the vapours, which inſtantly fill the receiver, have the ſuffocating ſmell of volatile ſpirit of ſulphur.

Then unlute the ballon, pour the liquor it contains into a cryſtal bottle, and ſtop it cloſe: there will be about eighteen ounces of it. Lute on your receiver again, and continue the diſtillation with a greater degree of fire. There will come over an aqueous, acid liquor, ſmelling ſtrong of a ſulphureous ſpirit, which is not inflammable. It will be accompanied with undulating vapours; which being condenſed will form an oil, moſt commonly yellow, one part of which will float on the ſurface of the liquor, and another will ſink to the bottom.

Towards the end of the diſtillation of this acid liquor, and of the yellow oil of which it is the vehicle, that part of the mixture, which is left in the retort and grown black, will begin to riſe in froth. Then ſuppreſs your fire at once, ſtop the diſtillation, and change your receiver once more. When the veſſels are grown pretty cool, finiſh your diſtillation with a lamp-heat kept up for twelve or fifteen days, which in all that time will raiſe but a very little ſulphureous ſpirit. Then break your retort, in which you will find a black, ſolid maſs, like a bitumen. It will have an acid taſte, ariſing from a remainder of the acid imperfectly combined with oil.

This artificial bitumen may be freed from its redundant acid, by waſhing it in ſeveral waters. Then put it into a glaſs retort, and diſtil it with a ſtrong reverberated fire. You will obtain a reddiſh oil that will ſwim on water, much like the oil obtained by diſtilling the natural bitumens.

bitumens. This oil alſo will be accompanied with an aqueous acid liquor. In the retort will be left a charred matter, which, being put into an ignited crucible in the fire, burns for ſome time, and, when well calcined, leaves a white earth.

The liquors that riſe firſt in this diſtillation, and which we directed to be kept by themſelves, are a mixture conſiſting, 1. of a highly dephlegmated ſpirit of wine, of a moſt fragrant ſmell; 2. of æther, which the ſpirit of wine wherewith it is united renders miſcible with water; 3. of a portion of oil, which commonly riſes with the æther towards the end of the operation; 4. and ſometimes of a little ſulphureous acid, if the receiver be not changed ſoon enough.

In order to ſeparate the æther from theſe other ſubſtances, put the whole into an Engliſh retort, with a little oil of tartar *per deliquium* to abſorb the ſulphureous acid, and diſtil very ſlowly in a ſand-bath heated by a lamp, till near half the liquor be come over. Then ceaſe diſtilling; put the liquor in the receiver into a phial with ſome water, and ſhake it; you will ſee it riſe with rapidity to the upper part of the phial, and float on the ſurface of the water: this is the æther.

Spirit of Wine combined with Spirit of Nitre. Sweet Spirit of Nitre.

Into an Engliſh retort of cryſtal glaſs put ſome highly rectified ſpirit of wine; and, by means of a glaſs funnel with a long pipe let fall into your ſpirit of wine a few drops of the ſmoking ſpirit of nitre. There will ariſe in the retort an effervеſcence attended with heat, red vapours, and a hiſſing noiſe like that of a live coal quenched in water. Shake the veſſel a little, that the liquors may mix thoroughly, and that the heat may be equally communicated to the whole. Then add more ſpirit of nitre, but in a very ſmall quantity, and with the ſame precautions as before. Continue thus adding ſpirit of nitre, by little and little at a time, till you have put into the retort a quantity equal to a third part of your ſpirit of wine. Let this mixture ſtand quiet, in a cool place, for ten or twelve hours; then ſet it to digeſt in a very gentle warmth for eight or ten days, having firſt luted on a receiver to the retort

During this time a ſmall quantity of liquor will come over into the receiver, which muſt be poured back into the retort. Then diſtill with a ſomewhat ſtronger degree of heat, but ſtill very gently, till nothing be left in the retort but a thick matter. In the receiver you will find a ſpirituous liquor, of a quick grateful ſmell, which will excite a very ſmart ſenſation on the tongue, but without any corroſive acrimony. This is the *ſweet ſpirit of nitre.*

Spirit of Wine combined with the Acid of Sea-ſalt. Dulcified Spirit of Salt.

Mix together, little by little, in a glaſs retort, two parts of ſpirit of wine with one part of ſpirit of ſalt. Set this mixtnre to digeſt for a month in a gentle heat, and diſtill it, till nothing remain in the retort but a thick matter.

The acid of ſea-ſalt is much leſs diſpoſed to unite with inflammable matters than the other two mineral acids; and therefore, though it be ever ſo highly concentrated when mixed with ſpirit of wine, it never produces effervеſcence comparable to that which is produced by the ſpirit of nitre. Neither the proportion nor ſtrength of the ſpirit of ſalt, requiſite to prepare the ſweet ſpirit of ſalt, are unanimouſly agreed upon by authors. Some direct equal parts of the two liquors; while others preſcribe from two to four or five parts of ſpirit of wine to one part of ſpirit of ſalt. Some uſe only common ſpirit of ſalt; others require the ſmoking ſpirit diſtilled by means of ſpirit of vitriol. Laſtly, ſome order the mixture to be diſtilled, after ſome days digeſtion; and others content themſelves with barely digeſting it. The whole depends on the degree of ſtrength which the ſweet ſpirit of ſalt is intended to have. This compoſition, as well as the ſweet ſpirit of nitre, is eſteemed in medicine to be very aperitive and diuretic.

When the mixture of ſpirit of ſalt and ſpirit of wine is diſtilled, there comes over but one liquor, which appears homogeneous. This is the *ſweet ſpirit of ſalt.* The nature of the marine acid is not changed in this combination: the acid is only weakened and rendered more mild: but in other reſpects it retains its characteriſtic properties.

Oils, or Oily matters, that are ſoluble in Spirit of Wine, ſeparated from Vegetables, and diſſolved by means of that Menſtruum. Tinctures; Elixirs; Varniſhes. Aromatic ſtrong waters.

Put into a matras the ſubſtances from which you intend to extract a tincture, having firſt pounded them. or pulveriſed them if they are capable of it. Pour upon them ſpirit of wine to the depth of three fingers breadth. Cover the matras with a piece of wet bladder, and tie it on with packthread. Make a little hole in this bit of bladder with a pin, leaving it in the hole to keep it ſtopped. Set the matras in a ſand-bath very gently heated. If the ſpirit of wine diſſolve any part of the body. it will accordingly acquire a deeper or lighter colour. Continue the digeſtion till you perceive that the ſpirit of wine gains no more colour. From time to time pull out the pin to give vent to the vapours, or rarefied air, which might otherwiſe burſt the matras. Decant your ſpirit of wine, and keep it in a bottle well corked. Pour on ſome freſh ſpirit in its ſtead: digeſt as before; and go on in this manner, pouring on and off freſh ſpirit of wine, till the laſt come off colourleſs.

Spirit of wine impregnated with ſuch parts of any vegetable ſubſtance as it is capable of diſſolving, is commonly called a *tincture*. Several tinctures mixed together, or a tincture drawn from ſundry vegetable ſubſtances at the ſame time, and in the ſame veſſel, take the name of an *elixir*. Tinctures of elixirs impregnated with reſinous matters only, are true *varniſhes*. All theſe preparations are made in the ſame manner; to wit, as directed in our proceſs. We ſhall only add here, that if the ſubſtances from which a tincture or elixir is to be made contain too much moiſture, it is proper to free them from it by gentle deſiccation; eſpecially if you deſign that the tincture ſhould be well impregnated with the oily and reſinous

resinous parts: for their excess of moisture uniting with the spirit of wine would weaken it, and render it unable to act on those matters, which it cannot dissolve when it is aqueous.

If your tinctures or elixirs be not so strong or so saturated as you desire, you may by distillation abstract part of the spirit of wine which they contain, and by that means give them such a degree of thickness as you judge proper. But the spirit of wine thus drawn off constantly carries along with it a good deal of the aromatic principle. It is a truly *aromatic strong water*. This spirit of wine also carries up with it a portion of thin oil, which is so much the more considerable as the degree of heat employed is greater: and this is the reason why it becomes of a milky colour when mixed with water.

If you intend to make an aromatic strong water only, you need not previously extract a tincture from the vegetable substance with which you mean to prepare your water: you need only put it in a cucurbit, pour spirit of wine upon it, and distil with a gentle heat. By this means you will obtain a spirit of wine impregnated with all the odour of the plant.

Of TARTAR.

Tartar analysed by distillation. The Spirit, Oil, and Alkaline Salt of Tartar.

INTO a stone retort, or a glass one coated with lute, put some white tartar broken into small bits; observing that one half, or at least a full third, of the vessel be left empty. Set your retort in a reverberating furnace. Fit on a large ballon, having a small hole drilled in it: lute it exactly with fat lute, and secure the joint with a linen cloth smeared with lute made of quick-lime and the white of an egg. Apply at first an exceeding gentle heat, which will raise a limpid, sourish, pungent water, having but little smell, and a bitterish taste.

When this first phlegm ceases to come off, increase your fire a little, and make the degree of heat nearly equal to that of boiling water. A thin, limped oil will rise, accompanied with white vapours, and with a prodigious quantity of air, which will issue out with such impetuosity, that if you do not open the little hole in the receiver time enough to give it vent, it will burst the vessels with explosion. An acid liquor will rise at the same time. Continue the distillation, increasing the heat by insensible degrees, and frequently unstopping the little hole of the receiver, till the elastic vapours cease to issue, and the oil to distil.

Then raise your fire more boldly. The acid spirit will continue to rise, and will be accompanied with a black, fetid, empyreumatic, ponderous, and very thick oil. Urge the fire to the utmost extremity, so that the retort may be of a perfect red heat. This violent fire will raise a little volatile alkali, besides a portion of oil as thick as pitch. When the distillation is finished, you will find in the retort a black, saline, charred matter, which grows hot when wetted, attracts the moisture of the air, runs *per deliquium*, and hath all the properties of a fixed alkali.

The mass, being exposed to a naked fire in the open air, burns, consumes, and is reduced to a white ash, which is a fiery, caustic, fixed alkali.

The lees of wine resemble tartar, in as much as they contain, and yield when analised, the same principles; but they differ from it in this, that they contain, moreover, a greater quantity of earth, of phlegm, and a little ardent spirit, which are only mixed, but not united, with its tartarous acid.

The Depuration of Tartar. Cream and Crystals of Tartar.

REDUCE to a fine powder the tartar you intend to purify, and boil it in twenty five or thirty times as much water. Filter the boiling liquor through a flannel bag, and then gently evaporate some part of it: there will soon form on its surface a saline crust, which is the *cream of tartar*. Let your liquor cool, and there will adhere to the sides of the vessel a great quantity of a crystallised saline matter, which is *crystal of tartar*.

Crystal of Tartar combined with several substances.

Crystal of Tartar combined with Absorbent Earths. Soluble Tartars.

BOIL an absorbent earth, such as chalk, in a pan with water; and, when you perceive the earth thoroughly divided and equally distributed through the water, throw into the pan, from time to time, some pulverised crystal of tartar, which will excite a considerable effervescence. Continue these projections, till you observe no effervescence excited thereby. All the absorbent earth, which obscured the transparency of the water, and gave it an opaque white colour, will gradually disappear as the crystal of tartar combines with it; and when the combination is perfected, the liquor will be clear and limpid. Then filter it, and there will be left on the filter but a very small quantity of earth. Evaporate all the filtered liquor with a gentle heat; and then set it in a cool place to shoot. Crystals will form therein, having the figure of flat quadrangular prisms, with almost always one, sometimes two, of the angles of the prism shaved down, as it were; and then the surfaces at each end are oblique answering to those depressed angles. These crystals are a neutral salt which readily dissolves in water; a true *soluble tartar*.

Crystal of Tartar combined with fixed Alkalis. The Vegetable Salt. Saignette's Salt. The decomposition of Soluble Tartars.

IN eight parts of water dissolve one part of a very pure alkaline salt, perfectly freed from the phlogiston by calcination. Heat this lixivium in a stone pan set on a sand bath, and from time to time throw into it a little powdered cream or crystal of tartar. Each projection will excite a great effervescence, attended with many bubbles, which will rise to a considerable height one over the other. Stir the liquor when the effervescence ceases, and you will see it begin again.

When no effervescence appears upon ftirring the liquor, add a little more cream of tartar, and the fame phenomena will be renewed. Go on thus till you have obtained the point of perfect faturation.

Then filter your liquor. If the alkali you made ufe of was the falt of Soda, evaporate your liquor quickly to a pellicle, and there will fhoot in it cryftals of nine fides refembling a coffin; the bottom part thereof being concave, and ftreaked with a great many parallel lines; and this is *Saignette's falt*. If you have employed any other alkali but foda, or the bafis of fea-falt, evaporate your liquor flowly to the confiftence of a fyrup: let it ftand quiet, and there will form in it cryftals having the figure of flatted parallelopipeds; and this is the *vegetable falt*, or *tartarifed tartar*.

All foluble tartars are eafily decompounded, by means of a certain degree of heat. They yield in diftillation the fame principles as tartar; and the alkali that remains, when they are perfectly calcined, confifts of that which the tartar naturally affords, and of the alkaline matter with which it was converted into a neutral falt.

Cryftal of Tartar combined with Iron. Chalybeated Tartar. Tincture of Steel with Tartar. Soluble Chalybeated Tartar.

Mix four ounces of iron in filings with one pound of white tartar finely pulverifed, Boil the mixture in about twelve times as much water as you took of tartar. When the faline part of the tartar is diffolved, filter the liquor boiling-hot through a flannel bag, and then fet it in a cool place. In a very little time cryftals of a ruffet colour will fhoot therein. Decant the liquor from thefe cryftals; evaporate it to a pellicle, and fet it again to cryftallife. Go on in this manner till it will fhoot no more. Collect all the falt you have thus obtained, and keep it under the name of *chalybeated tartar*.

To make the tincture of fteel with tartar, mix together fix ounces of clean iron filings, and one pound of white tartar in powder. Put this mixture into a large iron kettle, and pour thereon as much rain-water as will moiften it. Make a pafte of this matter, and leave it thus in a mafs for twenty-four hours. Then pour on it twelve pounds of rain-water, and boil the whole for twelve hours at leaft, ftirring the mixture frequently, and adding from time to time fome hot water, to fupply the place of what evaporates. When you have thus boiled the liquor, let it ftand quiet for fome time, and then pour it off from the fediment at bottom. Filter, and evaporate to the confiftence of a fyrup; and you have the *tincture of Mars with tartar*. The difpenfatories generally order an ounce of rectified fpirit of wine to be poured on this tincture, in order to preferve it, and to keep it from growing mouldy, as it is very apt to do.

Soluble chalybeated tartar is prepared by mixing four ounces of tartarifed tartar with one pound of the tincture of Mars with tartar, and evaporating them together in an iron veffel to drynefs; after which it is kept in a well ftopped phial to prevent its growing moift in the air.

Cryftal of Tartar combined with the reguline part of Antimony. Stibiated or Emetic tartar.

Pulverise and mix together equal parts of the glafs and of the liver of antimony. Put this mixture, with the fame quantity of pulverifed cream of tartar, into a veffel capable of containing as much water as will diffolve the cream of tartar. Boil the whole for twelve hours, from time to time adding warm water, to replace what is diffipated by evaporation. Having thus boiled your liquor, filter it while boiling hot; evaporate to drynefs; and you will have a faline matter, which is *emetic tartar*.

Of the Product of Acetous Fermentation.

Subftances fufceptible of the Acetous Fermentation turned into Vinegar.

The wine, the cyder, or the malt-liquor, you intend to convert into vinegar, being firft thoroughly mixed with its lees, and with the tartar it may have depofited, put your liquor into a fat ufed before either for making or for holding vinegar. This veffel muft not be quite full, and the external air muft have accefs to the liquor contained in it. Set it where the air may have a degree of warmth anfwering nearly to the twentieth degree above 0 in Mr de Rèaumur's thermometer. Stir the liquor from time to time. There will arife in it a new fermentative motion, accompanied with heat: its vinous odour will gradually change, and turn to a four fmell, which will become ftronger and ftronger till the fermentation be finifhed and ceafe of itfelf. Then ftop your veffel clofe; the liquor it contains will be found converted into vinegar.

All fubftances that have undergone the fpirituous fermentation are capable of being changed into an acid by paffing through this fecond fermentation, or this fecond ftage of fermentation. Spirituous liquors, fuch as wine, cyder, beer, being expofed to a hot air, grow four in a very fhort time. Nay, thefe liquors, though kept with all poffible care, in very clofe veffels, and in a cool place, degenerate at laft, change their natures, and infenfibly turn four. Thus the product of fpirituous fermentation naturally and fpontaneoufly degenerates to an acid.

For this reafon it is of great importance, in making wine, or any other vinous liquor, to ftop the fermentation entirely, if you defire the wine fhould contain as much fpirit as poffible. It is even more advantageous to check the fermentation a little before it come to the height than afterwards: becaufe the fermentation, tho' flackened and in appearance totally ceafed, ftill continues in the veffels; but in a manner fo much the lefs perceptible as it proceeds more flowly. Thus thofe liquors, in which the fermentation is not quite finifhed, but checked, continue for fome time to gain more fpirit; whereas, on the contrary, they degenerate and gradually turn four, if you let the fpirituous fermentation go on till it be entirely finifhed.

The production of the fecond fermentation, which we are now to confider, is an acid of fo much the greater ftrength,

ſtrength, the ſtronger and more generous the ſpirituous liquor in which it is excited originally was. The ſtrength of this acid, commonly called *vinegar*, depends likewiſe in a great meaſure on the methods uſed in fermenting the vinous liquor, in order to convert it into vinegar: for if it be fermented in broad, flat veſſels, and left to grow ſour of itſelf, the ſpirituous parts will be diſſipated, and the liquor be ſour indeed, but vapid and effete.

The vinegar-makers, to increaſe the ſtrength of their vinegar, uſe certain methods of which they make a myſtery, keeping them very ſecret. However, Mr. Boerhaave give us, from ſome authors, the following deſcription of a proceſs for making vinegar:

" Take two large oaken vats or hogſheads, and in each of theſe place a wooden grate or hurdle, at the diſtance of a foot from the bottom. Set the veſſel upright, and on the grates place a moderately cloſe layer of green twigs, or freſh cuttings of the vine. Then fill up the veſſel with the foot-ſtalks of grapes, commonly called the *rape*, to within a foot of the top of the veſſel, which muſt be left quite open.

" Having thus prepared the two veſſels, pour into them the wine to be converted into vinegar, ſo as to fill one of them quite up, and the other but half full. Leave them thus for twenty-four hours, and then fill up the half-filled veſſel with liquor from that which is quite full, and which will now in its turn be left only half full. Four and twenty hours afterwards repeat the ſame operation, and go on thus, keeping the veſſels alternately full and half full during every twenty-four hours, till the vinegar be made. On the ſecond or third day there will ariſe, in the half-filled veſſel, a fermentative motion, accompanied with a ſenſible heat, which will gradually increaſe from day to day. On the contrary, the fermenting motion is almoſt imperceptible in the full veſſel; and as the two veſſels are alternately full and half full, the fermentation is by that means, in ſome meaſure, interrupted, and is only renewed every other day, in each veſſel.

" When this motion appears to be entirely ceaſed, even in the half-filled veſſel, it is a ſign that the fermentation is finiſhed; and therefore the vinegar is then to be put into common caſks cloſe ſtopped, and kept in a cool place.

" A greater or leſs degree of warmth accelerates or checks this, as well as the ſpirituous fermentation. In France it is finiſhed in about fifteen days, during the ſummer; but if the heat of the air be very great, and exceed the twenty-fifth degree of Mr de Réaumur's thermometer, the half-filled veſſel muſt be filled up every twelve hours; becauſe if the fermentation be not ſo checked in that time, it will become ſo violent, and the liquor will be ſo heated, that many of the ſpirituous parts, on which the ſtrength of the vinegar depends, will be diſſipated; ſo that nothing will remain, after the fermentation, but a vapid waſh, ſour indeed, but effete. The better to prevent the diſſipation of the ſpirituous parts, it is a proper and uſual precaution to cloſe the mouth of the half-filled veſſel, in which the liquor ferments, with a cover made alſo of oak wood. As to the full veſſel, it is always left open, that the air may act freely on the liquor it contains: for it is not liable to the ſame inconveniences, becauſe it ferments but very ſlowly."

The vine-cuttings and grape-ſtalks, which the vinegar-makers put into their veſſels, ſerve to increaſe the ſtrength of the liquor. Theſe matters contain a very manifeſt and perceptible acid. They alſo ſerve as a ferment; that is, they diſpoſe the wine to become eager more expeditiouſly and more vigorouſly. They are the better and the more efficacious for having been once uſed, becauſe they are thereby thoroughly drenched with the fermented acid: and therefore the vinegar-makers lay them by for preparing other vinegar, after waſhing them nimbly in running water, in order to free them from a viſcid oily matter which ſettles on them during the fermentation. This matter muſt by all means be removed; becauſe it is diſpoſed to grow mouldy and rot; ſo that it cannot but be prejudicial to any liquor in which you put it.

As the acetous fermentation differs from the ſpirituous in its production, ſo it doth in many circumſtances attending it. 1. Motion and agitation are not prejudicial to the acetous fermentation, as they are to the ſpirituous; on the contrary, moderate ſtirring, provided it be not continual, is of ſervice to it. 2. This fermentation is accompanied with remarkable heat; whereas the warmth of the ſpirituous fermentation is ſcarce ſenſible. 3. We do not believe there ever was an inſtance of the vapour that riſes from a liquor in acetous fermentation proving noxious, and producing either diſorders or ſudden death, as the vapour of fermenting wine doth. 4. Vinegar depoſites a viſcid oily matter, as hath juſt been obſerved, very different from the lees and tartar of wine. Vinegar never depoſites any tartar; even though new wine, that hath not yet depoſited its tartar, ſhould be uſed in making it.

To concentrate Vinegar by Froſt.

Expose to the air, in froſty weather, the vinegar you deſire to concentrate. Icicles will form in it; but the whole liquor will not freeze. Take out thoſe icicles: and if you deſire a further concentration of your vinegar by this method, the liquor which did not freeze the firſt time muſt be expoſed to a ſtronger froſt. More icicles will form therein, which muſt likewiſe be ſeparated, and kept by themſelves. The liquor which doth not freeze this ſecond time will be a very ſtrong concentrated vinegar.

Vinegar analyſed by Diſtillation.

Into a glaſs or ſtone cucurbit put the vinegar to be diſtilled; fit to it a glaſs head; place your alembic in the ſand-bath of a diſtilling furnace, and lute on a receiver. Apply a very gentle heat at firſt. A clear, limpid, light liquor will riſe, and fall in diſtinct drops, like water, from the noſe of the alembic.

Continue diſtilling this firſt liquor, till the vinegar contained in the cucurbit be diminiſhed about a fourth part. Then ſhift your receiver, and increaſe the fire a little. A clear liquor will ſtill come over, but heavier and more acid

acid than the former. Distil in this manner till you have drawn off into your second receiver two thirds of the liquor that was left in the cucurbit.

A thick matter will now remain at the bottom of the still: put it into a retort; lute on a receiver; set your retort in a reverberating furnace, and distil with degrees of fire. There will come over a limpid liquor, very acid and sharp, yet ponderous, and requiring a great degree of fire to raise it; on which account it makes the receiver very hot. It hath a strong empyreumatic smell. When the distillation begins to slacken, increase your fire. There will rise an oil of a fetid, quick smell. At last when nothing more will rise with the strongest fire, break the retort, and in it you will find a black, charred matter: burn it, and from the ashes lixiviated with water you will obtain a fixed alkali.

The Acid of Vinegar combined with different Substances.

The Acid of Vinegar combined with Alkaline Substances. Foliated Salt of Tartar, or regenerated Tartar. Decomposition of that Salt.

INTO a glass cucurbit put some very pure and well dried salt of tartar; and pour on it some good distilled vinegar, by little and little at a time. An effervescence will arise. Pour on more vinegar, till you attain the point of saturation. Then fit a head to the cucurbit; set it in a sand bath: and, having luted on a receiver, distil with a gentle heat, and very slowly, till nothing remain but a dry matter. On this residuum drop a little of the same vinegar; and if any effervescence appears, add more vinegar till you attain the point of saturation, and distil again as before. If you observe no effervescence, the operation was rightly performed.

It is not easy to hit the exact point of saturation in preparing this neutral salt; because the oily parts, with which the acid of vinegar is loaded, hinder it from acting so briskly and readily as it would do, if it were as pure as the mineral acids: and for this reason it often happens, that, when we have nearly attained the point of saturation, the addition of an acid makes no sensible effervescence, though the alkali be not yet entirely saturated; which deceives the operator, and makes him conclude erroneously that he hath attained the true point of saturation.

But he easily perceives his mistake, when, after having separated from this saline compound all its superfluous moisture by distillation, he drops fresh vinegar upon it: for then the salts being more concentrated and consequently more active, produce an effervescence, which would not have been sensible if this last portion of acid, instead of coming into immediate contact with the dried alkali, could not have mixed therewith till diffused through, and in a manner suffocated by that phlegm from which the acid of the vinegar before neutralised was gradually separated by its combining with the alkali; that phlegm keeping in solution both the neutral salt already formed, and the alkali not yet saturated. And for this reason it is necessary to try, after the first desiccation of this salt, which is called *regenerated tartar*, whether or no the just point of saturation hath been attained.

From what hath been said, concerning the desiccation of this neutral salt, it is plain, that the use of it is only to free the salt from the great quantity of superfluous moisture wherein it is dissolved: which proves, that the acid of vinegar, like all other acids dissolved in much water, is separated from most of this redundant phlegm by being combined with a fixed alkali. And hence we must conclude, that the acid of vinegar, contained in regenerated tartar desiccated, is vastly stronger and more concentrated than it was before.

Though the acid of vinegar is freed, by combining with a fixed alkali, from a great quantity of superfluous phlegm, yet the oily parts with which it is entangled still cleave to it: these parts are not separated from it by its conversion into a neutral salt, but, without quitting it, combine also with the fixed alkali; and this gives regenerated tartar a saponaceous quality, and several other peculiar properties.

Regenerated tartar, when dried, is of a brown colour. It is semi-volatile; melts with a very gentle heat, and then resembles an unctuous liquor; which indicates its containing an oil: when cast upon live coals, it flames; and, when distilled with a strong heat, yields an actual oil; all which evidently proves the existence of that oil.

This salt is soluble in spirit of wine; a quality which it probably owes also to its oil. It requires about six parts of spirit of wine to dissolve it; and the dissolution succeeds very well in a matras, with the help of a gentle warmth. If the spirit of wine be abstracted from this solution, by distilling with a small fire, it remains at the bottom of the cucurbit, in the form of a dry substance composed of leaves lying one upon another; which hath procured it the name of *terra foliata tartari*, or *foliated salt of tartar*.

It is not absolutely necessary that regenerated tartar be dissolved in spirit of wine to make the foliated salt: for it may be procured in this form only by evaporating the water in which it is dissolved. But the operation succeeds better with spirit of wine; probably because the success thereof depends on using an exceeding gentle warmth: now spirit of wine evaporates with much less heat than water.

Regenerated tartar may also be crystallised. If you desire to have it in this form, combine the acid with the alkali to the point of saturation; evaporate the liquor slowly to the consistence of a syrup, and set it in a cool place; where it will shoot into clusters of crystals lying one upon another like feathers.

Vinegar perfectly dissolves absorbent matters also, and particularly those of the animal kingdom; such as corals, crabs eyes, pearls, *&c.* In order to a dissolution of such matters, you must pulverise them, put them into a matras, and pour on them spirit of vinegar to the depth of four fingers breadth: an effervescence will arise: when that is over, set the mixture to digest two or three days in a sand-bath; then decant the liquor, filter it, and evaporate it to dryness with a very gentle heat. The matter which remains is called *salt of coral*, *of pearls*,

of

of crabs-eyes, &c. according to the ſubſtances diſſolved. If, inſtead of evaporating the liquor, a fixed alkali be mixed therewith, the abſorbent matter, that was diſſolved by the acid, will precipitate in the form of a white powder, which is called the *magiſtery of coral*, *of pearls*, &c.

The Acid of Vinegar combined with copper. Verdegris. Cryſtals of Copper. This Combination decompounded. Spirit of Verdegris.

INTO a large matras put verdegris in powder. Pour on it diſtilled vinegar to the depth of four fingers breadth. Set the matras in a moderate ſand-heat, and leave the whole in digeſtion, ſhaking it from time to time. The vinegar will acquire a very deep blue-green colour. When the liquor is ſufficiently coloured, pour it off by inclination. Put ſome freſh vinegar into the matras; digeſt as before; and decant the liquor again when it is ſufficiently coloured. Proceed in this manner till the vinegar will extract no more colour. There will remain in the matras a conſiderable quantity of undiſſolved matter. The vinegar thus impregnated with verdegris is called *tincture of copper*.

Mix theſe ſeveral tinctures, and evaporate them with a gentle heat to a pellicle. Then ſet the liquor in a cool place: in the ſpace of a few days a great many cryſtals of a moſt beautiful green colour will ſhoot therein, and ſtick to the ſides of the veſſel. Pour off the liquor from the cryſtals; evaporate it again to a pellicle, and ſet it by to cryſtalliſe. Continue theſe evaporations and cryſtalliſations, till no more cryſtals will ſhoot in the liquor. Theſe are called *cryſtals of copper*, and are uſed in painting. To this combination of the acid of vinegar with copper the painters and dealers have given them the title of *diſtilled verdegris*.

Verdegris is prepared at Montpellier. To make it they take very clean plates of copper, which they lay, one over another, with huſks of grapes between, and after a certain time take them out. Their ſurfaces are then covered all over with a very beautiful green cruſt, which is *verdegris*. This verdegris is nothing but copper corroded by the acid of tartar, analogous to the acid of vinegar, which abounds in the wines of Languedoc, and eſpecially in the rape, huſks, and ſtones of grapes that have a very auſtere taſte. Verdegris is a ſort of ruſt of copper, or copper corroded and opened by the acid of wine, but not yet converted entirely into a neutral ſalt: for it is not ſoluble in water, nor does it cryſtalliſe. This ariſes from its not being united with a ſufficient quantity of acid. The deſign of the operation here deſcribed is to furniſh the verdegris with the quantity of acid requiſite to make it a true metallic ſalt; for which purpoſe diſtilled vinegar is very fit.

Cryſtals of copper may be obtained, without employing verdegris, by making uſe of copper itſelf diſſolved by the acid of vinegar, according to the method practiſed with reſpect to lead as ſhall be ſhewn hereafter. But verdegris is generally uſed, becauſe it diſſolves ſooneſt; it being a copper already half diſſolved by an acid correſpondent to that of vinegar.

Cryſtals of copper are decompounded by the action of fire alone, without any additament; becauſe the acid of vinegar adheres but looſely to copper. In order to decompound this ſalt, and extract its acid, it muſt be put into a retort, and diſtilled in a reverberatory furnace with degrees of fire. An inſipid phlegm riſes firſt, which is the water retained by the ſalt in cryſtalliſing. This phlegm is ſucceeded by an acid liquor, which riſes in the form of white vapours that fill the receiver. Towards the end of the diſtillation the fire muſt be violently urged, in order to raiſe the ſtrongeſt and moſt fixed acid. At laſt there remains in the retort a black matter, which is nothing but copper, that may be reduced by melting it in a crucible with one part of ſaltpetre and two parts of tartar. A ſimilar acid, but more oily, and in a much ſmaller quantity, may be obtained from verdegris by diſtillation.

The acid, which in this diſtillation comes over after the firſt phlegm, is an exceeding ſtrong and concentrated vinegar. It is known by the title of *ſpirit of verdegris*.

The Acid of Vinegar combined with Lead. Ceruſe. Salt or Sugar of Lead. This Combination decompounded.

INTO the glaſs head of a cucurbit put thin plates of lead, and ſecure them ſo that they may not fall out when the head is put upon the cucurbit. Fit on this head to a wide-mouthed cucurbit containing ſome vinegar. Set it in a ſand-bath; lute on a receiver, and diſtil with a gentle heat for ten or twelve hours. Then take off the head: in it you will find the leaden plates covered, and, in a manner, cruſted over with a white matter. This being bruſhed off with a hare's foot is what we call *ceruſe*. The leaden plates thus cleanſed may be employed again for the ſame purpoſe, till they be wholly converted into ceruſe by repeated diſtillations. During the operation there will come over into the receiver a liquor ſomewhat turbid and whitiſh. This is a diſtilled vinegar in which ſome lead is diſſolved.

Reduce a quantity of ceruſe into powder; put it into a matras; pour on it twelve or fifteen times as much diſtilled vinegar; ſet the matras in a ſand-bath; leave the matter in digeſtion for a day, ſhaking it from time to time: then decant your liquor, and keep it apart. Pour freſh vinegar on what is left in the matras, and digeſt as before. Proceed thus till you have diſſolved one half, or two thirds, of the ceruſe.

Evaporate to a pellicle the liquors you poured off from the ceruſe, and ſet them in a cool place. Greyiſh cryſtals will ſhoot therein. Decant the liquor from the cryſtals; evaporate it again to a pellicle, and ſet it by to cryſtalliſe. Proceed thus evaporating and cryſtalliſing, as long as any cryſtals will ſhoot. Diſſolve your cryſtals in diſtilled vinegar, and evaporate the ſolution, which will then ſhoot into whiter and purer cryſtals. This is the *ſalt*, or *ſugar of lead*.

Lead is eaſily diſſolved by the acid of vinegar. If it be barely expoſed to the vapour of that acid, its ſurface is corroded, and converted into a kind of calx or white ruſt, much uſed in painting, and known by the name of *ceruſe*, or *white lead*. But this preparation of lead is not combined with a ſufficient quantity of acid to convert it

it into a ſalt: it is no more than lead divided and opened by the acid of vinegar; a matter which is to lead what verdegris is to copper. And therefore if you deſire to combine ceruſe with the quantity of acid neceſſary to convert it into a true neutral ſalt, you muſt treat it in the ſame manner as we did verdegris in order to procure cryſtals of copper; that is, you muſt diſſolve it in diſtilled vinegar, as the proceſs directs.

The ſalt of lead is not very white when it firſt ſhoots; and for this reaſon it is diſſolved again in diſtilled vinegar, and cryſtalliſed a ſecond time. If ſalt of lead be repeatedly diſſolved in diſtilled vinegar, and the liquor evaporated, it will grew thick; but ſtill cannot be deſiccated without great difficulty. If the ſame operation be oftener repeated, this quality will be thereby more and more increaſed; till at laſt it will remain on the fire like an oil or melted wax: it coagulates as it cools, and then looks, at firſt ſight, like a metallic maſs, ſomewhat reſembling ſilver. This matter runs with a very gentle heat, almoſt as eaſily as wax.

The ſalt of lead hath a ſaccharine taſte, which hath procured it the name alſo of ſugar of lead. For this reaſon, when wine begins to turn ſour, the ſure way to cure it of that diſagreeable taſte, is to ſubſtitute a ſweet one which is not diſagreeable to the taſte, by mixing therewith ceruſe, litharge, or ſome ſuch preparation of lead; for the acid of the wine diſſolves the lead, and therewith forms a ſugar of lead, which remains mixed with the wine, and hath a taſte which, joined with that of the wine, is not unpleaſant. But, as lead is one of the moſt dangerous poiſons we know, this method ought never to be practiſed; and whoever uſes ſuch a pernicious drug deſerves to be moſt ſeverely puniſhed. Yet ſome thing very like this happens every day, and muſt needs have very bad conſequences; while there is nobody to blame, and thoſe to whom the thing may prove fatal can have no miſtruſt of it.

Salt of lead may be decompounded by diſtillation without additament. In order to perform this, you muſt put the ſalt of lead into a glaſs or ſtone retort, leaving a full third thereof empty, and diſtil in a reverberating furnace with degrees of fire. A ſpirit riſes, which fills the receiver with clouds. When nothing more will come over with a fire that makes the retort red-hot, let the veſſels cool, and then unlute them. You will find in the receiver an auſtere liquor, which is inflammable; or, at leaſt, an inflammable ſpirit may be obtained from it, if about one half thereof be drawn off by diſtillation in a glaſs alembic. The retort in which the ſalt of lead was decompounded contains, at the end of the operation, a blackiſh matter: this is lead, which will reſume its metallic form on being melted in a crucible; becauſe the acid by which it was diſſolved, and from which it hath been ſeparated, being of a very oily nature, hath left in it a ſufficient quantity of phlogiſton.

What is moſt remarkable in this decompoſition of ſalt of lead, is the inflammable ſpirit which it yields, though the vinegar which entered into the compoſition of the ſalt ſeemed to contain none at all.

Of the Putrid Fermentation of Vegetable Subſtances.

The Putrefaction of Vegetables.

Fill a hogſhead with green plants, and tread them down a little; or, if the vegetables be dry and hard ſubſtances, divide them into minute parts, and ſteep them a little in water to moiſten them: then leave them, or the green plants, in the veſſel, uncovered and expoſed to the open air. By degrees a heat will ariſe in the center of the veſſel, which will continue increaſing daily, at laſt grow very ſtrong, and be communicated to the whole maſs. As long as the heat is moderate, the plants will retain their natural ſmell and taſte. As the heat increaſes, both theſe will gradually alter, and at laſt become very diſagreeable, much like thoſe of putrid animal ſubſtances. The plants will then be tender as if they had been boiled; or even be reduced to a kind of pap, more or leſs liquid according to the quantity of moiſture they contained before.

Almoſt all vegetable matters are ſuſceptible of putrefaction; but ſome of them rot ſooner, and others more ſlowly. As putrefaction is only a ſpecies of fermentation, the effect whereof is to change entirely the ſtate of the acid, by combining it with a portion of the earth and oil of the mixt, which are ſo attenuated that from this union there reſults a new ſaline ſubſtance in which no acid is diſcernible; which on the contrary hath the properties of an alkali, but rendered volatile; it is plain, that, the nearer the acid of a plant ſet to putrefy is to this ſtate, the ſooner will the putrefaction of that plant be completed. Accordingly all plants that contain a volatile alkali ready formed, or from which it can be obtained by diſtillation, are the moſt diſpoſed to putrefaction.

Thoſe plants, in which the acid is very manifeſt and ſenſible, are leſs apt to putrefy; becauſe all their acid muſt undergo the change above ſpecified. But vegetable matters, whoſe acid is entangled and clogged by ſeveral of their other principles, muſt be ſtill longer elaborated before they can be reduced to the condition into which complete putrefaction brings all vegetables. The earthy and oily parts, in which the acids of theſe ſubſtances are ſheathed, muſt be attenuated and divided by a previous fermentation, which, of thoſe parts ſubtiliſed and united with the acid, forms an ardent ſpirit, wherein the acid is more perceptible than in the almoſt inſipid or ſaccharine juices out of which it is produced. The acid contained in the ardent ſpirit muſt be ſtill further diſengaged, before it can enter into the combination of a volatile alkali: conſequently the ardent ſpirit muſt undergo a ſort of decompoſition; its acid muſt be rendered more ſenſible, and be brought to the ſame condition as the acid of plants in which it manifeſts all its properties.

Hence it appears that the ſpirituous and acetous fermentations are only preparatives which nature makes uſe of for bringing certain vegetable matters to putrefaction. Theſe fermentations therefore muſt be conſidered as ad-

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vances towards that putrefaction in which they terminate, or rather as the first stages of putrefaction itself.

Putrefied Vegetable Substances analysed.

Put the putrefied plants you mean to analyse into a glass cucurbit, and set it in a sand-bath. Fit to it a head; lute on a receiver; distil with a gentle fire, and a limpid fetid liquor will come over. Continue the distillation till the matter contained in the retort be almost dry.

Then unlute your vessels, and keep the liquor you find in the receiver by itself. Put the matter remaining in the cucurbit into a retort, and distil with a graduated heat There will rise white vapours; a pretty considerable quantity of liquor nearly like that of the former distillation; a volatile salt in a concrete form; and a black oil, which towards the end will be very thick. In the retort there will remain a black charred matter, which being burnt in the open air will fall into ashes, from which no fixed alkali can be extracted.

By means of a funnel separate your oil from the aqueous liquor. Distil this liquor with a gentle heat. You will by this means obtain a volatile salt like that of animals; of which you may also get some, by the same means, from the liquor which came over in the first distillation.

This analysis shews the changes which putrefaction produces in vegetable matters. Scarce any of their principles are now to be discerned. They now yield no aromatic liquor; no essential oil; no acid; and consequently no essential salt, ardent spirit, or fixed alkali: in a word, whatever their natures were before putrefaction, they are all alike when they have once undergone this fermentative motion in its full extent. Nothing can then be obtained from them but phlegm, a volatile alkali, a fetid oil, and an insipid earth.

Almost all these changes are owing to the transmutation of the acid, which is depraved by putrefaction, and combined with a portion of the oil and subtilised earth of the mixt; so that the result of their union is a volatile alkali. Now, as the fixed alkali, found in the ashes of unputrefied plants, is only the most fixed part of their earth and of their acid, closely united together by the igneous motion, it is not surprising, that, when all the acid, with a part of the earth, is subtilised and volatilised by putrefaction, no fixed alkali can be found in the ashes of putrefied vegetables. The alteration which the acid suffers by the putrefactive motion is, in our opinion, the greatest it can undergo, without being entirely destroyed and decomposed, so as to be no longer a salt.

Of Operations on Animal Substances.

Of Milk.

Milk separated into Butter, Curd, and Whey; instanced in Cow's-Milk.

Put new cow's milk into a flat earthen pan, and set it in a temperate heat. In ten or twelve hours time there will gather on its surface a thick matter, of a somewhat yellowish white: this is called *cream*. Gently skim off this cream with a spoon, letting the milk you take up with it run off. Put all this cream into another vessel, and keep it. The milk thus skimmed will not be quite so thick as before; nor will it be of such a dead white, but have a little blueish cast. If all the cream be not separated from it, more will gather on its surface after some time, which must be taken off as the former. In two or three days the skimmed milk will coagulate into a soft mass called *curd*, and then it tastes and smells sour.

Cut this curd across in several places. It will immediately discharge a large quantity of *serum*. Put the whole into a clean linen cloth; hang it up, and underneath it set a vessel to receive the serum as it drops. When the aqueous part hath done dripping, there will remain in the filter a white substance somewhat harder than the curdled milk. This substance is called *cheese*, and the *serum* separated from it is known by the name of *whey*.

The milk of animals that feed only on vegetables is, of all animal matters, the least removed from the vegetable nature. The truth of this will be demonstrated by the experiments we shall produce by and by, for the further analysis of milk.

Most chemists justly consider milk as of the same nature with chyle. Indeed there is great reason to think, that, except some small differences to be afterwards taken notice of, these two matters are nearly the same. They are both of a dead white colour, like that of an emulsion; which proves that, like emulsions, they consist of an oily matter divided, diffused and suspended, but not perfectly dissolved, in an aqueous liquor.

It is not surprising that these liquors should resemble emulsions; for they are produced in the same manner, and may very justly be called *animal emulsions*. For how are vegetable substances converted into chyle and milk in an animal body? They are bruised, divided, and triturated by mastication and digestion, as perfectly, at least, as the matters pounded in a mortar to make an emulsion; and must thereby undergo the same changes as those matters; that is, their oily parts, being attenuated by those motions, must be mixed with and lodged between the aqueous parts, but not dissolved therein; because they do not, in the bodies of animals, meet with saline matters, sufficiently disentangled and active, to unite intimately with them, and by that means render them soluble in water.

Nevertheless, chyle and milk, though produced in the same manner as emulsions, and very much resembling them, differ greatly from them in some respects; owing chiefly to the time they remain in the bodies of animals, their being heated while there, the elaborations they undergo therein, and the animal juices commixed with them.

New milk hath a mild agreeable taste, without any saline pungency; nor hath any chemical trial discovered in it either an acid or an alkali. Yet it is certain, that the juices of plants, out of which milk is formed, contain many saline matters, and especially acids: accordingly milk also contains the same; but the acids are so sheathed and combined, that they are not perceplible. The case

is the ſame with all the other liquors intended to conſtitute part of an animal body: there is no perceptible acid in any of them.

Hence it may be inferred, that one of the principal changes which vegetables undergo, in order to their being converted into an animal ſubſtance, conſiſts in this, that their acids are combined, entangled, and ſheathed in ſuch a manner, that they become imperceptible, and exert none of their properties.

Milk left to itſelf, without the help of diſtillation, or any additament whavever, undergoes a ſort of decompoſition. It runs into a kind of ſpontaneous analyſis; which doth not indeed reduce it to its firſt principles, yet ſeparates it into three diſtinct ſubſtances, as the proceſs ſhews; namely, into cream, or the buttery fat part, into curd or cheeſe, and into ſerum or whey: which ſhews, that thoſe three ſubſtances of which milk conſiſts, are only mixed and blended together, but not intimately united.

The firſt parts, being the lighteſt, riſe gradually to the ſurface of the liquor as they ſeparate from the reſt: and this forms the cream.

Cream, as ſkimmed from the ſurface of milk, is not however the pure buttery or fat part; it is ſtill mixed with many particles of cheeſe and whey, which muſt be ſeparated in order to reduce it into butter. The moſt ſimple, and at the ſame time the beſt method of effecting this, is daily practiſed by the country people. It conſiſts in beating or churning the cream, in a veſſel contrived for that purpoſe, with the flat ſide of a circular piece of wood, in the centre of which a ſtaff is fixed. One would think that the motion, impreſſed one the cream by this inſtrument, ſhould rather ſerve to blend more intimately the particles of butter, cheeſe, and whey, of which it conſiſts, than to ſeparate them from each other; as this motion ſeems perfectly adapted to divide and attenuate thoſe particles. But, if we conſider what paſſes on this occaſion, we ſhall ſoon perceive that the motion by which butter is churned is nothing like triture: for churning is no other, properly ſpeaking, than a continually repeated compreſſion, the effect whereof is to ſqueeze out from amongſt the buttery particles thoſe of cheeſe and whey mixed therewith; by which means the particles of butter are brought into contact with each other, unite, and adhere together.

Milk, whether ſkimmed or no, grows ſour of itſelf, and curdles in a few days. When it is newly curdled, the cheeſe and whey ſeem to be united, and to make but one maſs: but theſe two matters ſeparate ſpontaneouſly from each other, with the greateſt eaſe, and in a very ſhort time.

The acidity, which milk naturally contracts in the ſpace of a few days, muſt be conſidered as the effect of a fermenting motion, which diſcovers in that liquor an acid that was not perceptible before. This, properly ſpeaking, is an acetous fermentation, which milk paſſes through in its way to putrefaction; and it ſoon follows, eſpecially if the milk be expoſed to a hot air.

If, inſtead of leaving milk to grow ſour and curdle of itſelf, an acid be mixed therewith, while it is yet ſweet and newly milked, it immediately coagulates; which gives reaſon to think, that its curdling naturally is the effect of the acid, which diſcovers itſelf therein as it grows ſtale.

The coagulation of milk may alſo be conſiderably accelerated, by ſetting it in a ſand-bath gently heated; or by mixing therewith a little of what, in the language of the dairy, is called *runnet*; which is nothing but ſome curdled and half-digeſted milk taken from the ſtomach of a calf: or both theſe methods may be employed at once, which will produce the effect ſtill more expeditiouſly.

It is not difficult to find out the cauſe of theſe effects. The runnet, which is milk already curdled and grown ſour, is an actual ferment to ſweet milk, diſpoſing it to turn ſour much more readily: for though milk, when thus haſtily curdled by the runnet, hath not a manifeſtly acid taſte, yet it is certain that this acid begins to exert itſelf. The proof thereof is, that, being expoſed to the ſame degree of heat with milk equally new, that is not mixed with this ferment, it turns ſour much ſooner. As to the effect of heat in coagulating milk, there is nothing extraordinary in it: we know how much it promotes and accelerates all fermentative motion. The whole of this perfectly agrees with what we ſaid before concerning fermentation.

Fixed alkalis alſo coagulate milk; but at the ſame time they ſeparate the whey from the cheeſe, which floats on the liquor in cloats. They give the milk a ruſſet colour inclining to red; which may ariſe from their attacking the fat part.

The ſeparation of milk into butter, cheeſe, and whey, is a kind of imperfect analyſis thereof, or rather the beginning of one. In order to render it complete, we muſt examine each of theſe ſubſtances ſeparately, and find the principles of which they conſiſt. This we ſhall endeavour to do in the following proceſs.

Butter analyſed by Diſtillation.

INTO a glaſs retort put the quantity of freſh butter you intend to diſtil. Set the retort in a reverberatory; apply a receiver; and let your fire be very gentle at firſt. The butter will melt, and there will come over ſome drops of clear water, which will have the peculiar ſmell of freſh butter, and ſhew ſome tokens of acidity. If the fire be increaſed a little, the butter will ſeem to boil: a froth will gather on its ſurface, and the phlegm, ſtill continuing to run, will gradually come to ſmell juſt like butter clarefied in order to be preſerved. Its acidity will be ſtronger and more manifeſt than that of the firſt drops that came over.

Soon after this, by encreaſing the fire a little more, there will riſe an oil, having nearly the ſame degree of fluidity as fat oils; but it will grow thicker as the diſtillation advances, and at laſt will fix in the receiver when it cools. It will be accompanied with ſome drops of liquor, the acidity whereof will always increaſe, while its quantity decreaſes, as the diſtillation advances.

While this thick oil is diſtilling, the butter contained in the retort, which at firſt ſeemed to boil, will be calm and ſmooth, without the leaſt appearance of ebullition; though the heat be then much greater than when it boiled. Continue the diſtillation, conſtantly increaſing the fire

fire by degrees as you find it neceſſary for the elevation of the thick oil. This oil, or rather this kind of butter, will be at laſt of a ruſſet colour. There will riſe along with it ſome white vapours exceeding ſharp and pungent.

When you obſerve that nothing more comes over, though the retort be quite red-hot, let the veſſels cool, and unlute them. You will find in the receiver an aqueous acid liquor, a fluid oil, and a kind of fixed brown butter. Break the retort, and you will find therein a kind of charred matter; the ſurface of which, where it touched the glaſs, will be of a ſhining black, and have a fine poliſh.

The analyſis of butter proves, that this ſubſtance, which is an oily matter in a concrete form, owes its conſiſtence to the acid only, with which the oily part is combined: that is, it follows the general rule frequently mentioned above in treating of other oily compounds; the conſiſtence whereof we ſhewed to be ſo much the firmer, the more acid they contain. The firſt portions of oil that come over in the diſtillation of butter are fluid, becauſe a pretty conſiderable quantity of acid roſe before them, which, being mixed with the phlegm, gives it the acidity we took notice of.

This oil, being freed from its acid, and by that means rendered fluid, riſes firſt; becauſe it is by the ſame means rendered lighter. The kind of butter that comes over afterwards, though it be fixed, is nevertheleſs far from having the ſame conſiſtence as it had before diſtillation; becauſe it loſes much of its acid in the operation. This acid is what riſes in the form of white vapours. Theſe vapours are at leaſt as pungent and irritating as the ſulphureous acid or volatile alkalis; but their ſmell is different: it hath a reſemblance, or rather is the ſame, with that which riſes from butter when it is burnt and browned in an open veſſel. But, when concentrated and collected in cloſe veſſels, as in the diſtillation of butter, they are vaſtly ſtronger; they irritate the throat ſo as to inflame it; they are exceeding ſharp and pungent to the ſmell, and are ſo hurtful to the eyes that they quickly inflame them, as in an ophthalmy, and and make them ſhed abundance of tears. The great volatility of this acid is entirely owing to a portion of the phlogiſton of the butter with which it is ſtill combined.

We took notice in the proceſs, that butter ſeems to boil with a very moderate heat at the beginning of the diſtillation, and that in the courſe of the operation the ebullition ceaſes entirely, though the heat be then greatly increaſed; which is contrary to the general rule. The reaſon is, that butter, though a ſeemingly homogeneous maſs, contains nevertheleſs ſome particles of cheeſe and whey. The particles of whey, being much the lighteſt, endeavour, on the firſt application of heat, to extricate themſelves from amongſt the particles of butter, and to riſe in diſtillation. Thus they form the drops of acidulated phlegm which come over at firſt, and, in ſtruggling to get free, lift up the buttery parts, or actually boil, which occaſions the ebullition obſervable at the beginning of the proceſs. When they are once ſeparated, the melted butter remains calm and ſmooth, without boiling. If you want to make it boil, you muſt apply a much greater degree of heat; which you cannot do in cloſe veſſels, without ſpoiling the whole operation: becauſe the degree of heat neceſſary for that purpoſe would force up the butter in ſubſtance, which would ruſh over into the receiver, without any decompoſition. Indeed if the veſſels were luted, they would be in danger of burſting.

As to the caſeous parts, which are mixed with freſh butter, they alſo ſeparate at the beginning of the diſtillation when the butter is melted, and gather on its ſurface in a ſcum. Theſe particles of cheeſe and whey, which are heterogeneous to butter, help to make it ſpoil the ſooner. And for this reaſon, thoſe who want to keep butter a long time, without the uſe of ſalt, melt it, and thereby evaporate the aqueous parts. The lighteſt portion of the particles of cheeſe riſes to the ſurface, and is ſkimmed off; the reſt remains at the bottom of the veſſel, from which the butter is eaſily ſeparated, by decanting it while it is yet fluid.

Butter may alſo be diſtilled, by incorporating it with ſome additament which will yield no principle itſelf, nor retain any of thoſe of the butter. It may be diſtilled in this manner with the additament of fine ſand: the operation ſucceeds very well, is ſooner finiſhed, and more eaſily conducted.

If you deſire to convert the butter wholly into oil, you muſt take the fixed matter you find in the receiver, and diſtil it once more, or oftener, according to the degree of fluidity you want to give it. The caſe is the ſame with this matter as with all other thick oils, which, the oftener they are diſtilled, grow always the more fluid, becauſe in every diſtillation they are ſeparated from part of the acid, to which alone they owe their conſiſtence.

The Curd of Milk analyſed by Diſtillation.

INTO a glaſs retort put ſome new curd, having firſt drained it thoroughly of all its whey, and even ſqueezed it in a linen cloth to expreſs all its moiſture. Diſtil it as you did butter. There will come over at firſt an acidulated phlegm, ſmelling like cheeſe or whey. As the diſtillation advances, the acidity of this phlegm will increaſe.

When it begins to run but very ſlowly, raiſe your fire. There will come over a yellow oil, ſomewhat empyreumatic. Continue the diſtillation, ſtill increaſing the fire by degrees as occaſion requires. The oil and acid phlegm will continue to riſe; the phlegm growing gradually more acid, and the oil deeper coloured and more empyreumatic. At laſt, when the retort is almoſt red-hot, there comes off a ſecond black oil, of the conſiſtence of turpentine, very empyreumatic, and ſo heavy as to ſink in water. In the retort will be left a conſiderable quantity of charred matter.

Cheeſe curd barely drained, till no more whey will drip from it, is not entirely freed thereof; and for this reaſon we directed it to be preſſed in a linen cloth, before it be put into the retort to be diſtilled. Without this precaution, the remaining whey would riſe in a conſiderable quantity on the firſt application of heat; and, inſtead of analyſing the curd only, we ſhould at the ſame time analyſe the whey alſo. This is to be underſtood of green curd and new-made cheeſe; for, if it be ſuffered to grow old,

old, it will at length dry of itſelf: but then we ſhould not obtain from it the ſame principles by diſtillation; as it corrupts and begins to grow putrid after ſome time, eſpecially if it be not mixed with ſome ſeaſoning to preſerve it.

The firſt phlegm that riſes in this diſtillation, as in that of butter, is a portion of the whey that was left in the cheeſe, notwithſtanding its being well preſſed. This phlegm grows gradually more acid, being the vehicle of the acids of the cheeſe, which are forced up along with it by the fire.

The acid obtained from this matter is leſs in quantity, and weaker, than that of butter: and accordingly the oil diſtilled from cheeſe is not fixed like that of butter. Yet it is remarkable that the laſt empyreumatic oil, which is as thick as turpentine, is heavier than water: a property which it probably derives from the quantity of acid it retains.

The quantity of charred matter, which remains in the retort after the diſtillation of cheeſe, is much greater than that left by butter: which proves that the former contains a much greater quantity of earth.

Whey analyſed.

Evaporate two or three quarts of whey almoſt to dryneſs in a *balneum mariæ*; and diſtil the extract or reſiduum in a retort ſet in a reverberating furnace, with degrees of fire, according to the general rule. At firſt ſome phlegm will come over; then a lemon-coloured acid ſpirit; and afterwards a pretty thick oil. There will remain in the retort a charred matter, which being expoſed to the air grows moiſt. Lixiviate it with rain water, and evaporate the lixivium; it will yield you cryſtals of ſea-ſalt. Dry the charred matter, and burn it in the open air with a ſtrong fire, till it be reduced into aſhes. A lixivium of theſe aſhes will ſhew ſome tokens of a fixed alkali.

It will appear, on examining the three analyſes of the the ſubſtances whereof milk conſiſts, that none of them yields a volatile alkali: which is worthy of notice; as it is the only animal matter from which ſuch a ſalt cannot be obtained. It is true, the milk of animals that feed on vegetables may be conſidered as an intermediate liquor between vegetable and animal ſubſtances; as an imperfect animal-juice, which ſtill retains much of the vegetable nature: and we actually find, that milk almoſt always hath, at leaſt in part, the properties of thoſe plants with which the animals that yield it are fed. Yet, as it cannot be formed in the body of the animal, without mixing with ſeveral of its juices that are entirely perfected, and become purely animal, it muſt appear ſtrange that the analyſis thereof ſhould not afford the leaſt veſtige of that principle, which all other animal-matters yield in the greateſt plenty.

The reaſon of this may be found in the uſe to which milk is deſtined. It is intended for the nouriſhment of animals of the ſame ſpecies with thoſe in whoſe bodies it is produced. Conſequently it ought as much as poſſible to reſemble the juices of the food which is proper for thoſe animals. Now, as animals that live only on vegetables could not be properly nouriſhed by animal matters, for which nature itſelf hath even given them an averſion, it is not ſurpriſing that the milk of ſuch animals ſhould be free from any mixture of ſuch things as are unſuitable to the young ones whom it is deſigned to nouriſh. There is reaſon therefore to think, that nature hath diſpoſed the organs in which the ſecretion of milk is performed, ſo as to ſeparate it entirely from all the animal juices firſt mixed with it: and this is the principal difference between milk and chyle; the latter being neceſſarily blended with the ſaliva, the gaſtric and pancreatic juices, the bile and lymph, of the animals in which it is formed. Hence it may be concluded, that, if a quantity of chyle could be collected ſufficient to enable us to analyſe it, the analyſis thereof would differ from that of milk, in this chiefly, that it would yield a great deal of volatile alkali, of which milk, as hath been ſaid, yields none at all.

The ſame thing probably takes place in carnivorous animals. It is certain, that thoſe animals chuſe to eat the fleſh of ſuch others only as feed upon vegetables; and that nothing but extreme hunger, and the abſolute want of more agreeable food, will force them to eat the fleſh of other carnivorous animals. Wolves, which greedily devour ſheep, goats, &c. ſeldom eat foxes, cats, polecats, &c. though theſe animals are not ſtrong enough to reſiſt them. Foxes, cats, and birds of prey, that make ſuch terrible havock among wild-fowl, and other ſorts of game, do not devour one another. This being laid down, there is reaſon to think, that the milk of carnivorous animals is ſomething of the nature of the fleſh of thoſe animals that feed on vegetables, and which they chuſe to eat, and not of the nature of their own fleſh; as the milk of animals that feed on vegetables is analogous to the juices of vegetables, and when analyſed yields no volatile alkali, though every other part of their body does.

But whatever be the nature of milk, and of whatever ingredients it be formed, it always contains the three ſeveral ſubſtances above mentioned; namely, the fat, or buttery part, properly ſo called, the cheeſy, and the ſerous part, the laſt of which we are now to examine. It is, properly ſpeaking, the phlegm of the milk, and conſiſts almoſt entirely of water. For this reaſon it is proper to leſſen the quantity thereof conſiderably by evaporation, ſo that its other principles, being concentrated and brought nearer together, may become much more ſenſible. There is no danger of loſing any eſſential part of the whey in the evaporation, if it be performed in the *balneum mariæ* with ſuch a gentle heat as may carry off the aqueous parts only: this greatly ſhortens the analyſis, which will be exceeding long and tedious if all the water be diſtilled off in cloſe veſſels.

As whey is chiefly the aqueous part of milk, as ſaid above, it muſt contain all the principles thereof that are ſoluble in water; that is, its ſaline and ſaponaceous parts. And accordingly the analyſis thereof ſhews that it contains an oil, rendered perfectly ſaponaceous by an acid; that is, made perfectly miſcible with water. This quality of the oil contained in whey appears from the perfect tranſparency of that liquor, which we know is the

the mark of a complete diffolution. In the diftillation of whey, the faponaceous matter contained therein is decompofed; the faline part rifes firft, as being the lighteft; this is the acid taken notice of in the procefs; after which the oil, now feparated from the principle which rendered it mifcible with water, comes over in its natural form, and doth not afterwards mix with the aqueous part.

Befides the faponaceous matter, whey contains alfo another faline fubftance; namely, fea falt: this is obtained by lixiviating the *caput mortuum* left in the retort, which, becaufe of its fixednefs, cannot rife with the other principles in diftillation. To this falt it is owing that what remains in the retort after diftillation grows moift in the air; for we know that fea-falt thoroughly dried hath this property.

The fixed alkaline falt, obtained from the *caput mortuum* burnt to afhes, proves that milk ftill retains fomething of the vegetable nature: for the following analyfis will fhew us that matters purely animal yield none at all.

Of the Subftances which compofe an Animal Body.

Blood analyfed. Inftanced in Bullock's Blood.

In a *balneum mariæ* evaporate all the moifture of the blood that the heat of boiling water will carry off. There will remain an almoft dry matter. Put this dried blood into a glafs retort, and diftil with degrees of heat, till nothing more will come over, even when the retort is quite red-hot, and ready to melt. A brownifh phlegm will rife at firft: this will foon be impregnated with a little volatile alkali, and then will come over a yellow oil, a very pungent volatile fpirit, a volatile falt in a concrete form, which will adhere to the fides of the receiver; and, at laft, a black oil, as thick as pitch. There will be left in the retort a charred matter, which being burnt yields no fixed alkali.

Blood, which is carried by the circulation into all the parts of the animal body, and furnifhes the matter of all the fecretions, muft be confidered as a liquor confifting of almoft all the fluids neceffary to the animal machine: fo that the analyfis thereof is a fort of general though imperfect analyfis of an animal.

Blood drawn from the body of an animal, and fet by in a veffel, coagulates as it grows cold; and fometimes afterwards the *coagulum* difcharges a yellowifh *ferum* or lymph; and in the midft thereof fwims the red part, which continues curdled. Thefe two fubftances, when analyfed, yield nearly the fame principles; and in that refpect feem to differ little from each other. Though the ferum of blood be naturally in a fluid form, yet it hath alfo a great tendency to coagulate; and a certain degree of heat applied to it, either by water or by a naked fire, will curdle it. Spirit of wine mixed with this liquor produces on it the fame effect as heat.

Blood, while circulating in the body of a healthy animal, and when newly taken from it, hath a mild tafte, which difcovers nothing like either an acid or an alkali; nor doth it fhew any fign of either the one or the other in chemical trials. When tafted with attention, it betrays fomething like a favour of fea-falt; becaufe it actually contains a little thereof, which is found in the charred matter left in the retort after the diftillation, when carefully examined.

We fhewed that milk alfo contains a little of this falt. It enters the bodies of animals with the food they eat, which contains more or lefs thereof according to its nature. It plainly fuffers no alteration by undergoing the digeftions, and paffing through the ftrainers, of the animal body. The cafe is the fame with the other neutral falts which have a fixed alkali for their bafis: we find them unchanged in the juices of animals into whofe bodies they have been introduced. They are incapable of combining, as acids do, with the oilly parts; and fo are diffolved by the aqueous fluids, of which nature makes ufe to free herfelf from thofe falts, and difcharge them out of the body.

Blood, like all other animal-matters, is, properly fpeaking, fufceptible of no fermentation but that of putrefaction. Yet it turns fomewhat four before it putrefies. This fmall degree of acetous fermentation is moft fenfible in flefh; and efpecially in the flefh of young animals, fuch as calves, lambs, chickens, &c.

The quantity of pure water, which blood, in its natural ftate, contains, is very confiderable, and makes almoft feven eighths thereof. If it be diftilled, without being firft dried, the operation will be much longer; becaufe it will be neceffary to draw off all this infipid phlegm with a gentle fire. There is no reafon to apprehend that, by drying blood in open veffels as directed, any of its other principles will be carried off with its phlegm: for it contains no other fubftance that is volatile enough to rife with the warmth of a *balneum mariæ*. This may be proved by putting fome undried blood into a glafs cucurbit, fitting thereto a head and receiver, and diftilling, in a *balneum mariæ*, all that the heat of the bath, not exceeding the heat of boiling water, will raife: for, when nothing more will come over, you will find in the receiver an infipid phlegm only, fcarce differing from pure water, except in having a faint fmell like that of blood; wherein it refembles all the phlegms that rife firft in diftillation, which always retain fomething of the fmell of the matters from which they were drawn. That part of the blood, which remains in the cucurbit after this firft diftillation, being put into a retort, and diftilled with a ftronger fire, yields exactly the fame principles, and in the fame proportion, as blood dried in open veffels in the *balneum mariæ*: fo that, if this phlegm of blood contains any principles, the quantity thereof is fo fmall as to be fcarce perceptible.

The volatile alkali that rifes with the oil, when blood is diftilled in a retort with a degree of heat greater than that of boiling water, is either the production of the fire, or arifes from the decompofition of an ammoniacal falt of which it made a part. For we fhall fee, when we come to treat of this faline fubftance, that it is fo extremely volatile as to exceed, in that refpect, almoft all other bodies that we know: and therefore if this volatile alkali pre-exifted formerly in the blood, uncombined with any other matter capable, in fome meafure, of

of fixing it, it would rise at first almost spontaneously, or at least on the first application of the gentlest heat. We have an instance of this in blood, or any other animal-matter, that is perfectly putrefied; which containing a volatile alkali, either formed or extricated by putrefaction, lets go this principle when distilled, even before the first phlegm: and, for this reason, when putrefied blood is to be analysed, it must by no means be dried, like fresh blood, before distillation; for all the volatile alkali would by that means be dissipated and lost at once.

Though blood and other animal matters afford no fixed alkali, but, on the contrary, yield much volatile alkali, it doth not therefore follow that all the acid, which those substances contained before they were analysed, is employed in the production of a volatile alkali.

Flesh analysed. Instanced in Beef.

INTO an alembic or retort, placed in a sand-bath, put some lean beaf, from which you have carefully separated all the fat. Distil till nothing more will rise. In this first distillation a phlegm will come over, weighing at least half the mass of the distilled flesh. In the retort you will find a matter almost dry, which you must afterwards distil with a naked fire in a reverberating furnace, taking the usual precautions. There will come over at first a little phlegm replete with volatile alkali; then a volatile alkali in a dry form, which will stick to the sides of the vessel; and also a thick oil. After the distillation there will be left in the retort a black, shining, light coal. Burn it to ashes in the open air, and lixiviate those ashes: the water of the lixivium will have no alkaline property, but will shew some tokens of its containing a little sea-salt.

The flesh of an animal, as appears from the process, yields much the same principles with its blood: and it cannot be otherwise; because it is formed altogether of materials furnished by the blood.

Bones analysed. Instanced in Ox-Bones.

CUT into pieces the bones of a leg of beef, carefully separating all the marrow. Put them into a retort, and distil them in a reverberating furnace as usual. A phlegm will come over first; then a volatile spirit, which will become stronger and stronger; afterwards a volatile salt in a dry form, with some oil; and, lastly, a black oil, with a little more volatile salt. There will be left in the retort a charred matter, from which a little sea-salt may be extracted. Reduce this charred matter to ashes, by burning it in the open air. These ashes will give some slight tokens of a fixed alkali.

The analysis of bones proves, that they consist of the same principles with flesh and blood; and the same may be said in general of all matters that are truly animal, that actually constitute any part of an animal.

Animal Fat Analysed. Instanced in Mutton-Suet.

PUT as much mutton-suet as you please into a glass retort, only taking care that the vessel be but half full; and distil with degrees of fire as usual. A phlegm smelling of the suet will rise first, and soon grow very acid. After this some drops of oil will come over, and be followed by a matter like oil, in appearance, when it comes over; but it will fix in the receiver, and acquire a consistence somewhat softer than suet. This kind of butter of suet will continue to rise to the end of the distillation; and there will be left in the retort a small quantity of charred matter.

Eggs analysed. Instanced in Pullet's Eggs.

PUT some hens eggs in water, and boil them till they be hard. Then separate the yolks from the whites. Cut the whites into little bits; put them into a glass cucurbit; fit on a head and receiver; distil in a *balneum mariæ* with degrees of fire, raising it towards the end to the strongest heat which that bath can give; that is, to the heat of boiling water. There will come over an aqueous liquor, or insipid phlegm; the quantity whereof will be very considerable seeing it will make about nine tenths of the whole mass of the whites of the eggs. Continue your distillation, and keep the water in the bath constantly boiling, till not a drop more of liquor will ascend from the alembic. Then unlute your vessels. In the cucurbit you will find your whites of eggs considerably shrunk in their bulk. They will look like little bits of brown glass, and be hard and brittle.

Put this residuum into a glass retort, and distil, as usual, in a reverberating furnace with degrees of heat. There will come over a volatile oily spirit, a yellow oil, a volatile salt in a dry form, and, at last, a black thick oil. There will be left in the retort a charred matter.

Reduce also into the smallest pieces you can the hard yolks of the eggs which you separated from the whites. Set them in a pan over a gentle fire: stir them with a stick till they turn a little brown, and discharge a substance like melted marrow. Then put them into a new, strong, canvass bag, and press them between two iron plates well heated; whereby you will obtain a considerable quantity of a yellow oil.

Let what remains in the bag be distilled in a retort set in a reverberating furnace: it will give you the same principles as you got from the whites.

Of the two perfectly distinct substances that constitute the egg, the yolk contains the embryo of the chick, and is destined to hatch it: the white is to serve for the nourishment of the chick when it is formed.

These two matters, though they contain the very same principles, yet differ considerably from each other; and chiefly in this, that their principles are not in the same proportions.

The white of an egg contains so much phlegm, that it seems to consist almost totally thereof. All the aqueous liquor, obtained by distilling it in the *balneum mariæ*, is, properly speaking, nothing but pure water; for no chemical trial can discover in it either an acid or a volatile alkali; or any very perceptilbe oily part. And yet it must contain some oil, because the liquor that rises last is a little bitterish to the taste, and smells somewhat of empyreuma. But the principles from which it derives these properties are in too small quantities to be distinctly perceived.

If,

If, inſtead of diſtilling the hard white of an egg, with a view to draw off the great quantity of water it contains, you leave it ſome time in an air that is not too dry, the greateſt part of its moiſture ſeparates ſpontaneouſly, and becomes very ſenſible. In all probability this is the effect of a beginning putrefaction, which attenuates this ſubſtance, and breaks its contexture. The liquor thus diſcharged by the white of an egg thoroughly diſſolves the gum-reſins, and particularly myrrh. If you deſire to diſſolve myrrh in this manner, cut a hard-boiled egg in halves; take out the yolk; put the powdered gum-reſin into the cavity left by the yolk; join the two halves of the white; faſten them together with a thread, and hang them up in a cellar. In a few days time the myrrh will be diſſolved by the moiſture that iſſues from the white of the egg, and will drop into the veſſel placed underneath to receive it. This liquor is improperly called *oil of myrrh per deliquium.*

All the properties of the whites of eggs, as well as the principles obtained by analyſing them, are the ſame with thoſe of the lymphatic part of the blood; ſo that there is a great reſemblance between theſe two ſubſtances.

As to the yolk, it is plain from its analyſis, that oil is the predominant principle thereof. If the yolk of an egg be mixed with water, the oil with which it is replete, and which is by nature very minutely divided, diffuſes eaſily through the whole liquor, and remains ſuſpended therein by means of its viſcoſity. The liquor at the ſame time becomes milk-white like an emulſion, and is in fact a true animal emulſion.

In order to obtain the oil of eggs by expreſſion with the more eaſe, care muſt be taken to chuſe eggs that are ſeven or eight days old; becauſe they are then a little leſs viſcous. Nevertheleſs their viſcoſity is ſtill ſo great, that they will not eaſily yield their oil by expreſſion: and therefore, in order to attenuate and deſtroy entirely this viſcoſity, they muſt be torrefied before they are put to be preſſed.

The oil of eggs, like all other oily animal matters, ſeems analogous to the fat oils of vegetables. It hath all the properties that characteriſe thoſe oils. Its colour is yellow, and it ſmells and taſtes a little of the empyreuma, occaſioned by torrefying the yolks. It is rendered ſomewhat leſs diſagreeable by being expoſed to the dew for thirty or forty nights, if care be taken to ſtir it often in the mean time.

To conclude: all the principles both in the yolk and the white of an egg are the ſame as thoſe found in blood, fleſh, and all other matters that are perfectly animal.

Of the Excrements of Animals.

Dung analyſed. Inſtanced in human Excrements. Mr Homberg's Phoſphorus.

Take any quantity you pleaſe of human excrement, and diſtil it in a glaſs alembic ſet in the *balneum mariæ.* You will obtain an aqueous, clear, inſipid liquor; which will nevertheleſs have a diſagreeable odour. Having urged the diſtillation as far as is poſſible with the heat of this bath, unlute your veſſels, and you will find at the bottom of the cucurbit a dry matter, making about an eighth part only of what you put into it. Put this reſiduum into a glaſs retort, and diſtil in a reverberating furnace, with degrees of heat. You will obtain a volatile ſpirit, and a volatile ſalt, with a fetid oil; and a charred matter will be left in the retort.

This ſubſtance, conſiſting of matters ſubject to putrefaction, hath conſtantly a fetid ſmell, like that of all putrid matters; having been for ſome time confined in a warm, moiſt place, which we know promotes putrefaction, and even quickly produces it. Yet the analyſis thereof proves that it is not putrefied, or at leaſt not entirely ſo: for all putrefied matters contain a volatile alkali perfectly formed and extricated; and, as this principle riſes with leſs heat than that of boiling water, it always comes over firſt in diſtillation. Now we have ſeen that, with the heat of boiling water, it parts with nothing but an inſipid phlegm, containing no volatile alkali: a ſure proof that the fecal matter is not completely putrefied.

One of the methods by which Mr Homberg endeavoured to obtain from excrement a clear oil, without any bad ſmell, was to ſeparate its earthy and groſs parts, by filtering it before he diſtilled it. "For this purpoſe he diluted excrement newly diſcharged with hot water, uſing a quart of water to an ounce of feces. Then he let the mixture ſtand to cool, and the groſs parts falling to the bottom, he poured off the water by inclination. This liquor he filtered through brown paper, and evaporated to a pellicle over a gentle fire. There ſhot in it long cryſtals of four, five, and ſix ſides, which Mr Homberg thinks may be called the eſſential ſalt of excrement. They reſemble ſalt petre, in ſome meaſure, and deflagrate in the fire much like it; with this difference, that their flame is red, and they burn ſlowly; whereas the flame of ſalt-petre is white and very vivid: probably, ſays Mr Homberg, becauſe there is too much of an oily matter in the one, and leſs in the other.

"Mr Homberg diſtilled this ſalt in a glaſs retort with degrees of fire, and at laſt with a very violent one. At firſt there came over an aqueous liquor, ſharp and acid, which was followed by a brown fetid oil, ſmelling very ſtrong of empyreuma. This diſtillation he attempted four ſeveral times; and each time the matter in the retort took fire, juſt when the oil began to come off."

The ſalt which Mr Homberg obtained from excrement is very remarkable. Its nitrous character is by no means ambiguous: its deflagrating on live coals convinced Mr Homberg of its being a true nitre. But its conſtantly taking fire in the retort, as oft as diſtilled, is a ſure proof that it is a nitrous ſalt: for nitre only hath the property of thus taking fire in cloſe veſſels, and making other combuſtible matters burn along with it.

The proceſs, by which Mr Homberg at laſt obtained from excrement a clear oil without any bad ſmell, is curious, and worthy of a place here, on account of the views and occaſions of reflection which it may open.

"Mr Homberg having tried in vain, by diſtilling excrement a great many different ways, to obtain from it ſuch an oil as he wanted, reſolved to employ fermenta-

tion, the effect whereof is to change the diſpoſition of the principles of mixts. With this view he dried ſome excrement in the water-bath, and, having pulveriſed it, poured thereon ſix times its weight of phlegm that had been ſeparated from it by diſtillation, and put the whole into a large glaſs cucurbit, covered with an inverted veſſel that fitted exactly into it, and was cloſe luted. This veſſel he ſet in a *balneum mariæ* for ſix weeks, keeping up ſuch a gentle heat as would not burn one's hand; after which he uncovered the cucurbit, and having fitted thereto a head and a receiver, diſtilled off all the aqueous moiſture in the *balneum mariæ* with a very gentle heat. It had now loſt almoſt all its bad ſmell, which was changed into a faint one. It came over ſomewhat turbid, whereas it was very clear when put into the cucurbit. Mr Homberg found this water to have a coſmetic virtue: he gave ſome of it to perſons whoſe complexion, neck, and arms, were quite ſpoiled, being turned brown, dry, rough, and like a gooſe ſkin: they waſhed with it once a day, and, by continuing the uſe of this water, their ſkin became very ſoft and white.

" The dry matter left in the cucurbit after the firſt diſtillation, had not the leaſt ſmell of feces: on the contrary, it had an agreeable aromatic odour; and the veſſel in which Mr Homberg had digeſted it, being left open in a corner of his laboratory, acquired in time a ſtrong ſmell of ambergris. It is ſurpriſing, as Mr Homberg juſtly obſerves, that digeſtion alone ſhould change the abominable ſmell of excrement into an odour as agreeable as that of ambergris.

" This dry matter he powdered coarſely, and put two ounces thereof at once into a glaſs retort that would hold about a pound or a pound and a half of water. This he diſtilled in a ſand-bath with a very gentle heat. A ſmall quantity of an aqueous liquor came over firſt, and then an oil as colourleſs as ſpring-water. Mr Homberg continued the ſame gentle degree of heat till the drops began to come off a little rediſh; and then he changed the receiver, ſtopping that which contained the clear oil very cloſe with a cork. Having carried on the diſtillation with a fire gradually augmented, there came over a conſiderable quantity of red oil; and there remained in the retort a charred matter which burnt very readily."

The clear oil, without any ill ſmell, which Mr Homberg obtained from the fecal matter by this proceſs, was the very thing he was in ſearch of, and which he had been aſſured would convert mercury into fine fixed ſilver; yet he ingenuouſly owns, that, whatever way he applied it, he could never produce any change in that metallic ſubſtance. We ſhall now proceed to the other diſcoveries made by Mr Homberg on this occaſion.

In his attempt to obtain a clear oil from excrement, he diſtilled it with different additaments, and amongſt the reſt with vitriol and alum. He found that the matters left in the retort, when he made uſe of theſe ſalts, being expoſed to the open air, took fire of themſelves; that they kindled combuſtible matters; in a word, that they were a true phoſphorus, of a ſpecies different from all then known. Purſuing theſe firſt hints, he ſought and found the means of preparing this phoſphorus by a way much more expeditious, certain, and eaſy. His proceſs is this.

" Take four ounces of feces newly excreted: mix therewith an equal weight of roch alum coarſely powdered: put the whole into a little iron pan that will hold about a quart of water, and ſet it over a gentle fire under a chimney. The mixture will melt, and become as liquid as water. Let it boil with a gentle fire, conſtantly ſtirring it, breaking it into little crumbs, and ſcraping off with a ſpatula whatever ſticks to the bottom or ſides of the pan, till it be perfectly dry. The pan muſt from time to time be removed from the fire, that it may not grow red hot; and the matter muſt be ſtirred, even while it is off the fire, to prevent too much of it from ſticking to the pan. When the matter is perfectly dried, and in little clots, let it cool, and powder it in a metal mortar. Then put it again into the pan, ſet it over the fire, and ſtir it continually. It will again grow a little moiſt, and adhere together in clots, which muſt be continually roaſted and bruiſed till they be perfectly dry; after which they muſt be ſuffered to cool, and then be pulveriſed. This powder muſt be returned a third time to the pan, ſet on the fire, roaſted, and perfectly dried: after which it muſt be reduced to a fine powder, and kept in a paper in a dry place. This is the firſt or preparatory operation.

" Take two or three drams of this powder. Put it into a little matras, the belly of which will hold an ounce, or an ounce and half of water, and having a neck about ſix or ſeven inches long. Order it ſo that your powder ſhall take up no more than about a third part of the matras. Stop the neck of the matras ſlightly with paper: then take a crucible four or five inches deep: in the bottom of the crucible put three or four ſpoonfulls of ſand: ſet the matras on this ſand, and in the middle of the crucible, ſo as not to touch its ſides. Then fill up the crucible with ſand, ſo that the belly of the matras may be quite buried therein. This done, place your crucible with the matras in the midſt of a little earthen furnace, commonly called a *ſtove*, about eight or ten inches wide above, and ſix inches deep from the mouth to the grate. Round the crucible put lighted coals about half way up, and when it hath ſtood thus half an hour, fill up with coals to the very top of the crucible. Keep up this fire a full half hour longer, or till you ſee the inſide of the matras begin to be red. Then increaſe your fire, by raiſing your coals above the crucible. Continue this ſtrong heat for a full hour, and then let the fire go out.

" At the beginning of this operation denſe fumes will riſe out of the matras, through the ſtopple of paper. Theſe fumes iſſue ſometimes in ſuch abundance as to puſh out the ſtopple; which you muſt then replace, and ſlacken the fire. The fumes ceaſe when the inſide of the matras begins to grow red; and then you may increaſe the fire without any fear of ſpoiling your operation.

" When the crucible is ſo cold that it may be ſafely taken out of the furnace with one's hand, you muſt gradually draw the matras out of the ſand, that it may cool ſlowly, and then ſtop it cloſe with a cork.

" If the matter at the bottom of the matras appear to be

be in powder when ſhaken, it is a ſign the operation hath ſucceeded: but if it be in a cake, and doth not fall into powder on ſhaking the matras, it ſhews that your matter was not ſufficiently roaſted and dried in the iron pan during the preparatory operation."

Mr Lemeri hath ſhewn, that excrement is not the only matter capable of producing this phoſphorus with alum; but that, on the contrary, almoſt all animal and even vegetable matters are fit for this combination; that though Mr Homberg mixed alum in equal quantities only with the fecal matter, it may be uſed in a much greater proportion, and, in certain caſes, will ſucceed the better; that, according to the nature of the ſubſtances to be worked on, the quantity of that ſalt may be more or leſs increaſed; and that whatever is added, more than the doſe requiſite for each matter, ſerves only to leſſen the virtue of the phoſphorus, or even deſtroys it entirely; that the degree of fire applied muſt be different according to the nature of thoſe matters; and, laſtly, that ſalts containing exactly the ſame acid with that of alum, or the acid of thoſe ſalts ſeparated from its baſis and reduced into ſpirit, do not anſwer in the preſent operation: which ſhews, ſays Mr Lemeri, that many ſulphureous matters may be ſubſtituted for excrement in this operation; but that there are no ſalts, or very few, if any, that will ſucceed in the place of alum.

This phoſphorus, made either by Mr Homberg's or by Mr Lemeri's method, ſhines both by day and by night. Beſides emitting light, it takes fire ſoon after it is expoſed to the air, and kindles all combuſtible matters with which it comes in contact; and this without being rubbed or heated.

Meſſ. Homberg and Lemeri have given the moſt probable and the moſt natural explanation of the cauſe of the accenſion and other phenomena of this phoſphorus. What they ſay amounts in ſhort to what follows.

Alum is known to be a neutral ſalt, conſiſting of the vitriolic acid and a calcareous earth. When this ſalt is calcined with the fecal matter, or other ſubſtances abounding in oil, the volatile principles of theſe ſubſtances, ſuch as their phlegm, their ſalts, and their oils, exhale in the ſame manner as if they were diſtilled; and there is nothing left in the matras, when thoſe principles are diſſipated, but a charred matter, like that which is found in retorts wherein ſuch mixts have been decompoſed by diſtillation.

This remainder therefore is nothing but a mixture of alum and charcoal. Now, as the acid of this ſalt, which is the vitriolic, hath a greater affinity with the phlogiſton than with any other ſubſtance, it will quit its baſis to unite with the phlogiſton of the coal, and be converted by that union into a ſulphur. And this is the very caſe, of which we have certain proofs in the operation for preparing this phoſphorus; for when, after the volatile principles of the oily matter are drawn off, the fire is increaſed, in order to combine cloſely together the fixed parts that remain in the matras, that is, the alum and the charred matter, we perceive at the mouth of the matras a ſmall blue ſulphureous flame, and a pungent ſmell of burning ſulphur. Nay, when the operation is finiſhed, we find a real ſulphur ſticking in the neck of the matras; and, while the phoſphorus is burning, it hath plainly a ſtrong ſulphureous ſmell. It is therefore certain, that this phoſphorus contains an actual ſulphur; that is, a matter diſpoſed to take fire with the greateſt eaſe. But though ſulphur be very inflammable, it never takes fire of itſelf, without being either in contact with ſome matter that is actually ignited, or elſe being expoſed to a conſiderable degree of heat. Let us ſee then what may be the cauſe of its accenſion, when it is a conſtituent part of this phoſphorus.

We mentioned juſt now, that the acid of the alum quits its baſis, in order to form a ſulphur by combining with the phlogiſton of the coal. This baſis we know to be an earth capable of being converted into lime; and that it is actually converted into quick-lime by the calcination neceſſary to produce the phoſphorus. We know that new made lime hath the property of uniting with water ſo readily, that it thereby contracts a very great degree of heat. Now when this phoſphorus, which is partly conſtituted of the baſis of the alum converted into quick-lime, is expoſed to the air, the lime inſtantly attracts the moiſture of which the air is always full, and by this means, probably, grows ſo hot as to fire the ſulphur with which it is mixed. Perhaps alſo the acid of the alum is not totally changed into ſulphur: ſome part thereof may be only half-diſengaged from its baſis, and in that condition be capable of attracting ſtrongly the humidity of the air, of growing very hot likewiſe by imbibing the moiſture, and ſo of contributing to the accenſion of the phoſphorus.

There is alſo room to think that all the phlogiſton of the charred matter is not employed in the production of ſulphur in this phoſporus, but that ſome part of it remains in the ſtate of a true coal. The black colour of the unkindled phoſphorus, and the red ſparkles it emits while burning, ſufficiently prove this.

Human Urine analyſed.

Put ſome human urine into a glaſs alembic; ſet it in a water-bath, and diſtil till there remain only about a fortieth part of what you put in; or elſe evaporate the urine in a pan ſet in the *balneum mariæ* till it be reduced to the ſame quantity. With this heat nothing will exhale but an inſipid phlegm, ſmelling however like urine. The reſiduum will, as the evaporation advances, become of a darker and darker ruſſet, and at laſt acquire an almoſt black colour. Mingle this reſiduum with thrice its weight of ſand, and diſtil it in a retort ſet in a reverberating furnace, with the uſual precautions. At firſt there will come over a little more inſipid phlegm like the former. When the matter is almoſt dry, a volatile ſpirit will riſe. After this ſpirit, white vapours will appear on increaſing the fire: a yellow oily liquor will come off, trickling down in veins; and together with this liquor a concrete volatile ſalt, which will ſtick to the ſides of the receiver. At laſt there will come over a deep-coloured fetid oil. In the retort there will remain a ſaline earthy reſiduum, which being lixiviated will yield ſome ſea-ſalt.

Of

Of the Volatile Alkali.

Volatile Alkalis rectified and depurated.

Mix together the ſpirit, the volatile ſalt, the phlegm, and the oil, obtained from any ſubſtance whatever. Put the whole into a large wide-mouthed glaſs body, and thereto fit a head with a large beak. Set this alembic in a water-bath, lute on a receiver, and diſtil with a very gentle heat. There will aſcend a ſpirit ſtrongly impregnated with volatile alkali, and a volatile ſalt in a concrete form, which muſt be kept by itſelf. Then increaſe your heat to the degree of boiling water; whereupon there will riſe a ſecond volatile ſpirit, ſomewhat more ponderous than the former, with a light oil that will ſwim on its ſurface, and a little concrete volatile ſalt. Proceed till nothing more will riſe with this degree of heat. Keep by itſelf what came over into the receiver. At the bottom of the cucurbit you will find a thick fetid oil.

Into ſuch another diſtilling veſſel put the ſpirit and ſalt that roſe firſt in this diſtillation, and diſtil them in the *balneum mariæ* with a heat ſtill gentler than before. A whiter, purer, volatile ſalt will ſublime. Continue the diſtillation till an aqueous moiſture riſe, which will begin to diſſolve the ſalt. At the bottom of the veſſel will be left a phlegm, with a little oil floating on it. Keep your ſalt in a bottle well ſtopped.

Volatile Alkalis combined with Acids. Sundry Ammoniacal Salts. Sal Ammoniac.

On a volatile ſpirit or ſalt pour gradually any acid whatever. An efferveſcence will ariſe, and be more or leſs violent according to the nature of the acid. Go on adding more acid in the ſame manner, till no efferveſcence be thereby excited, or at leaſt till it be very ſmall. The liquor will now contain a ſemi-volatile neutral ſalt, called an *ammoniacal ſalt*; which may be obtained in a dry form by cryſtalliſing as uſual, or by ſubliming it in cloſe veſſels, after the ſuperfluous moiſture hath been drawn off.

Volatile alkalis have the ſame properties with fixed alkalis, fixity only excepted: ſo that a volatile alkali muſt produce an efferveſcence when mixed with acids, and form therewith neutral ſalts, differing from each other in nothing but the nature of the acid in their compoſition.

It muſt be obſerved, that the point of ſaturation is very difficult to hit on this occaſion; owing probably to the volatility of the alkali, which, being much lighter than the acid, tends always to poſſeſs the uppermoſt part of the mixture, while the acid ſinks to the bottom: whence it comes to paſs, that the lower part of the liquor is ſometimes overcharged with acid, while the upper part is ſtill very alkaline. But it is moſt eligible that the alkali ſhould predominate in the mixture; becauſe the exceſs of this principle eaſily flies off while the moiſture is evaporating in order to the cryſtalliſation or ſublimation of the ammoniacal ſalt; which being only ſemi-volatile, reſiſts the heat longer, and remains perfectly neutral.

If the vitriolic acid be combined with a volatile alkali, and the mixture diſtilled in a retort to draw off the ſuperfluous moiſture, a liquor comes over into the receiver which ſmells ſtrong of a ſulphureous acid. Now, as the acid of vitriol never becomes ſulphureous, but when it is combined with an inflammable matter, this experiment is one of thoſe which demonſtrate that volatile alkalis contain a very ſenſible quantity of inflammable matter. This ſame liquor taſtes of an ammoniacal ſalt; which proves that it carries up with it ſome of the neutral ſalt contained in the mixture. The reſt of this ſalt, which is called *Glauber's ſecret ſal ammoniac*, or *vitriolic ſal ammoniac*, ſublimes into the neck of the retort. It is very pungent on the tongue; it crackles a little when thrown on a red-hot ſhovel, and then flies off in vapours.

The ammoniacal ſalt formed by the acid of nitre exhibits much the ſame phenomena; but it requires greater care in drying and ſubliming it, becauſe it hath the property of detonating all alone, without the addition of any other inflammable matter: and it will infallibly do ſo, if too ſtrong a fire be applied towards the end of the operation, when it begins to be very dry. This property of detonating by itſelf it derives from the inflammable matter contained in the volatile alkali which ſerves for its baſis: and this is another demonſtrative proof of the exiſtence of ſuch an inflammable matter in the volatile alkali. This ſalt is called *nitrous ammoniacal ſalt*.

With the vegetable acids, that of vinegar for inſtance, is formed an ammoniacal ſalt of a ſingular nature, and which can ſcarce be brought to a dry form.

A volatile alkali, combined to the point of ſaturation with the acid of ſea-ſalt, forms another neutral ſalt, which takes a concrete form either by ſublimation or cryſtalliſation. The cryſtals of this ſalt are ſo very ſoft and fine, that a parcel of it looks like cotton or wool. This is the ſalt properly called *ſal ammoniac*. It is of great uſe in chemiſtry and in manufactures; but that which is daily conſumed in great quantities is not made in the manner above mentioned. It would come extremely dear, if we had no other way of procuring it, but by forming it thus with the acid of ſea-ſalt and a volatile alkali. This ſalt, or at leaſt the materials of which it is formed, may be found in the fuliginoſities and ſoots of moſt animal, and of ſome vegetable ſubſtances. The greateſt part of what we uſe comes from Egypt, where vaſt quantities thereof are made.

The method of preparing ſal ammoniac in Egypt was not known among us till Meſſ. Lemaire and Granger. Their memoirs inform us, that chimney-ſoot alone, without any additament, is the matter from which they obtain their ſal ammoniac; that thoſe chimneys under which nothing is burnt but cow's-dung, furniſh the beſt ſoot. Six and twenty pounds of that ſoot yield uſually ſix pounds of ſal ammoniac.

"The operation takes up about fifty, or two and fifty hours. The veſſels in which they put the ſoot are ballons of very thin glaſs, terminating in a neck of fifteen or ſixteen lines long, and an inch in diameter: but they are not all of the ſame ſize. The leaſt contain twelve pounds of ſoot, and the greateſt fifty; but they fill them only three quarters full, in order to leave room for the ſublimation of the ſalt.

"The furnace, in which they place theſe ballons, conſiſts

confifts of four walls built in a quadrangular form. The two front-walls are ten, and the fides nine foot long: but they are all five foot high, and ten inches thick. Within the quadrangle formed by thefe walls, three arches run lengthwife from end to end thereof, at the diftance of ten inches afunder. The mouth of this furnace is in the middle of one of its fronts, and of an oval form; two foot four inches high, and fixteen inches wide.

" The ballons lie in the fpaces between the arches of the furnace, which ferve inftead of a grate to fupport them. Four of them are ufually placed in each interval; which makes fixteen for one furnace. They are fet at the diftance of about half a foot from each other, and fecured in their places with brick and earth. But they leave about four inches on the upper part of the ballon uncovered, with a view to promote the fublimation, as they alfo do fix inches of the inferior part, that the heat may the better act on the matters to be fublimed. Things being thus prepared, they firft make a fire with ftraw, which they continue for an hour. Afterwards they throw in cow's-dung made up in fquare cakes like bricks. (The want of wood in this country is the reafon that they generally make ufe of this fuel.) Thefe cakes of dung add to the violence of the fire, which they continue in this manner for nineteen hours; after which they increafe it confiderably for fifteen hours more; and then they flacken it by little and little.

" When the matter contained in the veffels begins to grow hot, that is, after fix or feven hours baking, it emits a very thick and ill-fcented fmoke, which continues for fifteen hours. Four hours after that, the fal ammoniac is obferved to rife in white flowers, which adhere to the infide of the neck of the veffel; and thofe who have the direction of the operation take care from time to time to pafs an iron rod into the neck of the ballon, in order to preferve a paffage through the faline vault, for giving vent to fome blueifh vapours, which conftantly iffue out of the veffel during the whole operation."

From this hiftory of the preparation of fal ammoniac it appears, that foot, and particularly the foot of animal matters, either contains abundance of this falt perfectly formed, and waiting only for fublimation to feparate it therefrom, or at leaft that it contains the proper materials for forming it; and that during the operation, which is a kind of diftillation of foot, thefe materials combine together and fublime.

We fhewed, in our analyfis of foot, that this fubftance yields by diftillation a great deal of volatile alkali; and this is an ingredient which makes at leaft one half of fal ammoniac. As to the other principle of this falt, the marine acid, this alfo muft needs exift in foot: but it is not fo eafy to conceive how it fhould come there.

It is very true that vegetable and animal fubftances, the only ones that produce foot in burning, contain fome portion of fea-falt: but then this falt is very fixed, and feems unfit to rife with the acid, the oil, and the fubtile earth, of which the volatile alkali is formed. Therefore we muft fuppofe either that its elevation is procured by the force of the fire, aided by the volatility of the matters that exhale in burning; or that, being decompofed by the violence of the combuftion, its acid alone rifes with the other principles above mentioned. The latter feems probable enough: for though in the common operations of chemiftry the bare force of fire doth not feem fufficient to decompofe fea-falt; yet the example of fea-plants, which, before burning, contain this falt in abundance, and whofe afhes contain fcarce any at all, but are replete with its fixed part, that is, with its alkaline bafis, feems to prove, that, when this falt is intimately mixed with inflammable matters, it may be deftroyed by burning; fo that its acid fhall defert its bafis, and fly off with the foot.

Before the exact method of procuring fal ammoniac was known, it was generally imagined that the manufacturers mixed fea-falt, and even urine, with the foot; becaufe thefe two fubftances contain the principles of which this falt confifts. But, befides that the contrary now certainly appears from the above mentioned memoirs, it hath been fhewn by Mr Duhamel, who hath publifhed feveral memoirs and experiments concerning the compofition and decompofition of fal ammoniac, from which we have partly taken what we have already faid on this fubject; it hath been fhewn, in the firft of thefe memoirs, that the addition of fea-falt to the foot, from which fal ammoniac is to be extracted, contributes nothing to its production, and cannot increafe its quantity. That alone, therefore, which was originally contained in the matters that produced the foot, enters as a principle into the compofition of fal ammoniac.

Sal ammoniac is fometimes found perfectly formed in the neighbourhood of vulcanos. This falt is probably produced from the fuliginofities of vegetable or animal matters confumed by the fire of the vulcano.

Sal ammoniac is often impure, becaufe it carries up with it, in fublimation, fome of the black charred matter which ought to be left at the bottom of the veffel: but it is eafily purified. For this purpofe you need only diffolve it in water, filter the folution, then evaporate and cryftallize; by which means you will have a very white and very pure fal ammoniac. You may if you pleafe, fublime it again in a cucurbit and blind head, with a fire not too brifk. Some of it will rife in the form of a light white powder, called *flowers of fal ammoniac*. Thefe flowers are no other than true fal ammoniac, which hath fuffered no decompofition; becaufe the bare action of fire is not capable of feparating the acid and the volatile alkali, of which this neutral falt confifts. When you intend to decompofe it, you muft ufe the means to be mentioned hereafter.

Though fal Ammoniac be only femi-volatile, and requires a confiderable heat to fublime it, yet it hath the property of carrying up with it matters that are veryfixed and ponderous; fuch as metallic fubftances, and fome kinds of earths. For medicinal ufes we fublime therewith iron, lapis hæmatites, the copper in blue vitriol, &c. and then it takes different names, as *martial flowers of fal ammoniac*, *ens veneris*, and other fuch denominations, which it borrows from the matters fublimed with it.

Sal Ammoniac decompounded by acids.

INTO a large tubulated retort put a ſmall quantity of ſal ammoniac in powder: ſet your retort in a furnace, and lute on a large ballon, as in the diſtillation of the ſmoking acids of nitre and ſea-ſalt. Through the hole in your retort pour a quantity of oil of vitriol or ſpirit of nitre equal in weight to your ſal ammoniac. An effervеſcence will inſtantly follow. The mixture will ſwell, and diſcharge white vapours which will come over into the receiver. Stop the whole in the retort immediately, and let the firſt vapours paſs over, together with ſome drops of liquor, which will diſtil without fire. Then put a few coals into the furnace, and continue the diſtillation with a very gentle heat; which however muſt be increaſed little by little till nothing more will come over. When the operation is finiſhed, you will find in the receiver a ſpirit of ſalt if you made uſe of oil of vitriol; or an *aqua regis*, if the ſpirit of nitre was employed: and in the retort will be left a ſaline maſs, which will be either a glauber's ſecret ſal ammoniac, or a nitrous ſal ammoniac, according to the nature of the acid uſed to decompound the ſal ammoniac.

Sal ammoniac decompounded by fixed Alkalis. Volatile ſalt. The Febrifuge of Sylvius.

INTO a glaſs alembic or retort put ſal ammoniac and ſalt of tartar pulveriſed and mixed together in equal quantities. Set your veſſel in a proper furnace, and immediately lute on a large receiver. A little volatile ſpirit will aſcend; and a volatile alkali, in a concrete form, very white and beautiful, will ſublime into the head, and come over into the receiver, in quantity near two thirds or three fourths of the ſal ammoniac uſed. Continue the diſtillation, increaſing the fire by degrees till nothing more will ſublime. Then unlute the veſſels. Put up your volatile ſalt immediately into a wide mouthed bottle, and ſtop it cloſe with a cryſtal ſtopple. At the bottom of the retort or cucurbit you will find a ſaline maſs, which, being diſſolved and cryſtalliſed, will form a ſalt nearly cubical, having the taſte and other properties of ſea-ſalt. This is the *ſal febrifugum ſilvii*.

Sal Ammoniac decompounded by abſorbent Earths and Lime. Fixed Sal Ammoniac.

LET one part of ſal ammoniac and three parts of lime ſlaked in the air be pulveriſed ſeparately, and expeditiouſly mixed together. Put this mixture immediately into a glaſs retort, ſo large that half of it may remain empty. Apply thereto a capacious receiver, with a ſmall hole in it to give vent to the vapours, if needful. Let your retort ſtand in the furnace about a quarter of an hour, without any fire under it. While it ſtands thus, a great quantity of inviſible vapours will riſe, condenſe into drops, and form liquor in the receiver. Then put two or three live coals in your furnace, and gradually increaſe the fire till no more liquor will riſe. Now unlute your veſſels, taking all poſſible care to avoid the vapours, and quickly pour the liquor out of the receiver into a bottle, which you muſt ſtop with a cryſtal ſtopple, rubbed with emery. There will remain, at the bottom of the retort, a white maſs, conſiſting of the lime employed in the diſtillation, together wit the acid of the ſal ammoniac: this is called *fixed ſal ammoniac*.

Volatile Alkalis combined with oily matters. A Volatile Oily Aromatic ſalt.

PULVERISE and mix together equal parts of ſal ammoniac and ſalt of tartar: put the mixture into a glaſs or ſtone cucurbit: pour on it good ſpirit of wine till it riſe half an inch above the matter. Mix the whole with a wooden ſpatula; apply a head and a receiver, and diſtil in a ſand-bath, gently heated, for two or three hours. A volatile ſalt will riſe into the head; and then the ſpirit of wine will diſtil into the receiver, carrying with it a portion of the volatile ſalt.

When nothing more will come over, let your veſſels cool; then unlute them, ſeparate the volatile ſalt, and weigh it directly. Return it into a glaſs cucurbit, and for every ounce thereof add a dram and a half of eſſential oil, drawn from one or more ſorts of aromatic plants. Stir the whole with a wooden ſpatula, that the eſſence may incorporate thoroughly with the volatile ſalt. Cover the cucurbit with a head, fit on a receiver, and, having luted it exactly, diſtil in a ſand-bath, as before, with a very gentle heat. All the volatile ſalt will riſe, and ſtick to the head. Let the fire go out, and when the veſſels are cooled take your ſalt out of the head. It will have an odour compounded of its own proper ſmell, and the ſmell of the eſſence with which it is combined. This is an *aromatic oily ſalt*. Put it into a bottle ſtopped cloſe with a cryſtal ſtopple.

A TABLE.

; and the manner in which they are obtained, pointed out.

ſolvent of all the acids. Obtained chiefly from ſulphur by inflammation.
powerfully as a ſolvent than when in its fixt ſtate.
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ſtate. All theſe vegetable acids are much leſs corroſive, and leſs powerful

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A TABLE, Shewing the manner in which natural bodies, conſidered in a chemical view, may be divided into claſſes: With their ſeveral ſubdiviſions; their properties defined; and the manner in which they are obtained, pointed out.

NATURAL BODIES, conſidered as the objects of CHEMISTRY, may be divided into the ſix following claſſes, *viz.*

1. SALINE. Theſe are ſoluble in water, ſapid, and not inflammable. They are either
   - SIMPLE, are thoſe which can be no further analized by chemiſtry; and are of two ſorts, *viz.*
     - ACIDS. Theſe are diſtinguiſhed by turning ſyrup of violets red, and forming with alkalis neutral ſalts. The different acids yet known are theſe.
       - *Vitriolic.*
         - *Fixed.* The moſt ponderous of all fluids next to mercury, and the moſt fixed in the fire, and moſt powerful as a ſolvent of all the acids. Obtained chiefly from ſulphur by inflammation.
         - *Volatile.* Obtained alſo from ſulphur by inflammation, air being admitted during the operation. This acts leſs powerfully as a ſolvent than when in its fixt ſtate.
       - *Nitrous,* or *Aquafortis.* A volatile fluid of a reddiſh colour, emitting noxious fumes when in its concentrated ſtate. The next acid in ſtrength to the vitriolic. Obtained chiefly from nitre.
       - *Muriatic,* or *acid of ſea-ſalt.* A volatile fluid of a beautiful yellow colour. Inferior in power to the former. Obtained from ſea-ſalt.
       - *Vegetable.*
         - *Native.* This is obtained by expreſſion or diſtillation from vegetables; as lemon-juice, citron, ſorrel, &c.
         - *Fermented.*
           - *Tartar.* A dry hard ſubſtance, depoſited on the ſides of veſſels in which wine is fermented.
           - *Vinegar.* By allowing any fermentable liquor to proceed in the fermentation till it is paſt the vinous ſtate. All theſe vegetable acids are much leſs corroſive, and leſs powerful as ſolvents, than any of the former.
       - *Acid of urine.* Obtained by evaporating urine. This is in a dry form; and much leſs known in arts than the former.
       - *Acid of amber.* Obtained from amber in a ſolid form. This is likewiſe little known in arts.
       - *Acid of ants.* Obtained from the animal from which it has its name, by diſtillation, in a fluid form. It is alſo little known.
       - *Acid of borax,* or *ſedative ſalt.* Obtained from borax, in a ſolid ſtate and ſcaly-like form.
       - *Acid of arſenic.* Obtained likewiſe from arſenic.
       - *Acid of animals.* Obtained from all animal-ſubſtances in diſtillation.
     - ALKALIS, turn ſyrup of violets green, and with acids form neutrals; and are divided into
       - *Fixt*
         - *Vegetable,* or *potaſh.* Always obtained from the aſhes of burnt vegetables. A deliqueſcent ſalt.
         - *Foſſile.* A ſolid cryſtalline ſalt; ſometimes found native, as the natrum of Egypt; and ſometimes by burning ſea-weed, as kelp.
       - *Volatile.* This is obtained from ſal ammoniac, from the ſoot of burning bodies, and from the putrefactive fermentation. It is naturally in a ſolid ſtate.
   - COMPOUND, conſiſting of two or more chemical elements. Divided into
     - *Neutral ſalts.* Theſe are always compoſed of an acid and an alkali; and are of many different kinds, as may be ſeen in the following table.
     - *Metallic ſalts,* are thoſe which are formed by an acid and a metal. The principal of theſe are vitriols; the others may be ſeen in the following table.
     - *Earthy ſalts.* Compoſed of an acid joined to ſome earthy baſis, as in allum and gypſum. See the following table.
     - *Eſſential ſalts,* are obtained from vegetables; and contain an acid, joined with the juices of the plant in a particular manner not to be imitated by art. Of this kind is ſugar, manna, honey, and others of that ſort.
2. INFLAMMABLES, are thoſe bodies that continue to burn of themſelves if they are once ſet on fire. Divided into
   - OILS, are thickiſh viſcous fluids, not miſcible with water. Divided into
     - *Animal, Vegetable,* both of which are divided into
       - *Expreſſed.* Theſe are of a mild and bland taſte, inodorous, and not ſoluble in alcohol. They are obtained by expreſſion; as, oil of olives, rapſeed, almonds, &c. Animal-fats are of the ſame nature, as is alſo wax.
       - *Eſſential,* are always obtained by diſtillation, and are poſſeſſed of the taſte and odor of the ſubſtance from which they are drawn, and are ſoluble in alcohol. Of this kind are oil of cloves, ſpike, &c. The oil of ants is an example in the animal-kingdom.
       - *Empyreumatic,* are obtained by a conſiderable degree of heat; and are of an acrid taſte and burnt-like flavour, as oil of hartſhorn. Theſe are ſoluble in ſpirit of wine.
     - *Foſſile.* Theſe are found in the earth in their native ſtate; and are called, when pure, *naptha;* which is of an acrid taſte, and extremely volatile; not miſcible with alcohol. A great many inflammable foſſils contain this; as, bitumens, pit-coal, &c.
   - SULPHUR, or *brimſtone.* A dry friable ſubſtance, not miſcible with water. It is found in many mineral ſubſtances, metallic ores, &c.; but it is for the moſt part obtained from pyrites.
   - ALCOHOL, or *ardent ſpirits.* A fluid of an acrid and volatile nature, miſcible with water. Obtained from fermented vegetable juices by diſtillation; as, from the juice of the grape, malt-liquors, rice, &c.
3. METALLIC, are bodies of a hard and ſolid texture, fuſible in the fire, and reſuming their proper form after that; not miſcible with water, nor inflammable. Divided into
   - METALS. Theſe are malleable. Divided into
     - *Gold.* The moſt ponderous and ductile, and the moſt fixed in the fire, of all bodies; of a yellow colour. It is more commonly found in its metallic ſtate than any other metal. There is no proper ore of it: But it is found in ores of ſilver; and almoſt all ſands contain ſome of it.
     - *Silver.* It is of a ſhining white colour, and next to gold in weight, malleability, and fixity. Sometimes found in its native ſtate; more frequently in that of an ore, with ſulphur, ſometimes arſenic; aſſuming different appearances.
     - *Lead.* Of a dull bluiſh colour, exceeding ſoft, and eaſily malleable, and next to the foregoing metals in weight. Almoſt never found in its metallic ſtate; uſually in an ore with ſulphur or arſenic, but ſeldom with ſulphur alone. The principal ores of it are the cubic, called *galena,* and the glaſſy called *ſparr.*
     - *Copper.* Of a reddiſh colour; hard and ſonorous; admits of being extended greatly under the hammer, either hot or cold. It is difficult of fuſion. This is generally found in the ſtate of an ore with ſulphur. The ores of it are of great variety, and extremely beautiful; blue, red, green, yellow, &c.
     - *Tin.* A white ſoft metal, the lighteſt of all this claſs, and very ductile. The ores of this metal are generally arſenical, and aſſume a cryſtalline appearance. The colour moſt uſually a dark brown, and ſometimes very beautiful.
     - *Iron.* A grey-coloured metal, extremely ductile when hot; the lighteſt metal except tin. It is the only metal that admits of being welded, and tempered by cooling. It is found in almoſt every body, and its ores are infinitely various.
   - SEMI-METALS, are brittle, and do not ſtretch under the hammer; and are,
     - *Mercury.* A white opaque metallic body. Fluid, except in a very intenſe degree of cold; of great gravity, and eaſily volatilized in heat. It is ſometimes found in its fluid form; but uſually in a beautiful red ore with ſulphur, called *cinnabar.*
     - *Zinc.* A bluiſh white ſubſtance, of a fibrous texture, conſiderably hard and ſonorous, and has a ſmall degree of ductility; eaſily fuſed and volatilized. Lapis calaminaris is its principal ore.
     - *Antimony.* A blackiſh ſubſtance, of a fibrous needle-like texture; hard and brittle, and conſiderably heavy; not difficult of fuſion, and eaſily converted into glaſs. Its only ore is with ſulphur, which is the crude antimony of the ſhops.
     - *Biſmuth,* or tin-glaſs. A white, ponderous, hard, brittle, and ſonorous body, of a plated texture; eaſily fuſed and vitrified. It is only reduced to an ore by arſenic. Its appearance much the ſame as the regulus.
     - *Arſenic.* A bright ſparkling whitiſh-coloured ſemi-metal; of a plated texture, very brittle, and extremely volatile. It is generally found in the ores of other metals.
     - *Platina.* A white ſemi-metal, reſembling ſilver in its colour; nearly of the ſame ſpecific gravity and fixity with gold, and reſiſting the teſts which have uſually been applied for diſcovering the purity of gold, ſuppoſed from hence to be the *ſmiris* of the ancients. Found in the Weſt Indies. Of its ores we know nothing.
     - *Cobalt.* A brittle ſemi-metal; fuſible in a moderate heat, and eaſily converted into a fine blue-coloured glaſs called *ſmalt.* This is always obtained from an arſenical ore, which is likewiſe called *cobalt.*
     - *Nickel.* A reddiſh white ſubſtance, of a cloſe texture, and very bright; eaſily fuſed, but difficult to vitrify. Of its ores we know nothing.
4. EARTHY. Theſe are ſolid bodies; not ſoluble in water; not inflammable; and, if fuſed in the fire, never again reſume their earthy form, but take that of glaſs. Divided into
   - ABSORBENT. Theſe are capable of being united with acids; and are either
     - *Calcarious.* Thoſe that can be converted into quick-lime.
       - *Lime-ſtone,* or *marble.* This is of infinite variety of colours and texture. Marble is the hardeſt and fineſt. Thoſe kinds of lime-ſtone which feel unctuous to the touch are generally impregnated with clay; thoſe that feel gritty, or where the lime is hard and weighty, contain ſand: This is beſt for building, the other for manure.
       - *Chalk.* A ſoft, friable, white ſubſtance. This is much freer of any heterogeneous mixture than any lime-ſtone, and is eaſily calcined into quick-lime. This is probably nothing elſe than lime-ſtone ſuddenly concreted without being cryſtallized.
       - *Sea-ſhells,* are likewiſe a calcarious earth, and yield a very fine quick-lime. Theſe are uſed in medicine.
     - *Not calcarious.*
       - *Magneſia alba.* A white earth, uſually found combined with the vitriolic acid, and forming bitter purging ſalt. It is likewiſe obtained from the mother-lye of nitre, the aſhes of burnt vegetables, &c.
       - *Earth of allum.* A particular kind of abſorbent earth, found in many places mixed with ſulphureous pyrites, as in Yorkſhire, &c. Clay of any kind may, by a particular proceſs, be converted into this earth.
       - *Earth of animals,* &c. This is obtained by the calcination of animal-ſubſtances. It can hardly be converted into glaſs; and is therefore uſed as a baſis to white enamels, &c.
   - CRYSTALLINE, or *Vitreſcent.* Theſe are hard, and ſtrike fire with ſteel; may be calcined in the fire; but are not ſoluble in acids.
     - Of this kind are *ſand, flint,* &c. found plentifully every where. With alkaline ſubſtances they are eaſily converted into glaſs, and hence are termed *vitreſcent.*
     - *Precious ſtones* of all kinds are likewiſe referable to this claſs; but they are of a much greater degree of hardneſs and tranſparency than the others.
   - ARGILLACEOUS. Theſe are diſtinguiſhed by acquiring a very hard conſiſtence when formed into a paſte with water, and expoſed to a conſiderable degree of heat; not ſoluble in acids.
     - *Common clay;* is of many different colours, but chiefly red or yellow or white. The pureſt clay is that which burns white in the fire.
     - *Medical boles,* of different ſorts. Only a purer kind of clay; ſometimes mixed with a little iron or other matters.
     - *Lapis nephriticus,* or ſteatite, are indurated clays, found in various parts. Theſe are at firſt ſoft, and readily cut; but turn extremely hard in the air. Many other varieties of theſe earths might be mentioned; but as theſe do not differ in their chemical properties ſo much as in their external appearance, and being all mixed with one another, they more properly belong to the natural hiſtorian than the chemiſt.
5. WATER, a colourleſs inſipid fluid well known.
   - SIMPLE. *Pure rain-water.* This is never perfectly pure, but always contains a ſmall portion of mucilaginous matter, which it is impoſſible ever to get perfectly ſeparated.
   - MINERAL, are thoſe ſpring-waters impregnated with ſaline ſubſtances; the diverſity of which is exceeding great; but they all agree in having an acid joined with them. The moſt common ſorts are impregnated with ſulphur and iron.
6. AIR.
   - ELASTIC. This is a ſubtile elaſtic fluid, every where ſurrounding this earth, and forming our atmoſphere; and in this ſtate may be conſidered as a menſtruum for water and other volatile bodies; but as it only ſuſpends them, without altering their qualities, it cannot properly, in this ſtate, be conſidered as an object of chemiſtry.
   - FIXT. This is a fluid, ſuppoſed to be common air, which is abſorbed by bodies, and there fixed; forming with them a true chemical mixt, differing in its properties from what it was without it. The bodies whoſe qualities we certainly know to be altered by this, are alkalis and quick-lime; and it is demonſtratively preſent in metals; And it is probably owing to it that they retain their metallic form; but experiments are yet wanting here.

A TABLE. Shewing the several combinations that the SIMPLE CHEMICAL ELEMENTARY BODIES admit of with one another; the compound resulting from that mixture; and the manner in which the union is effected: With some account of the principal uses to which these are applied in arts or manufactures.

N. B. This mark *, put above any word, denotes that there is some difficulty in the process, or that the union is not very complete.

The VITRIOLIC ACID may be combined with these bodies, viz.

- ACIDS.
  - NITROUS ACID. A mixture which readily inflames oils. By solution, generating heat.
  - MURIATIC, VEGETABLE, and all other ACIDS yet known. By solution, generating heat. But these mixtures are applied to no particular use in medicine or arts.
- ALKALIS.
  - VEGETABLE.
    - *Vitriolated tartar.* By solution and crystallization, or double elective attraction from a great variety of bodies.
    - *Nitrum vitriolatum.* A vitriolated tartar obtained by distilling from nitre with the vitriolic acid.
    - *Sal polychrestum.* By deflagrating nitre with sulphur. There are many other kinds of vitriolated tartar, known formerly by different names, and supposed to be possessed of particular properties, but they are now neglected.
  - FOSSILE. *Glauber's salt.* By solution and crystallization. Much used in medicine as a gentle purgative.
  - VOLATILE. *Secret ammoniac.* By solution. Formerly supposed a most powerful menstruum for metals, *&c.* but without any just foundation.
- OILS.
  - EXPRESSED. A blackish gummy-like mass. By solution, generating a considerable heat. Native gums are supposed to owe their origin to a mixture of this kind.
  - ESSENTIAL. A dark-coloured resinous mass. A great heat and violent effervescence being produced by this mixture. Native resins supposed the same.
  - EMPYREUMATIC. Little known. By solution.
  - FOSSILE. A substance resembling amber. By solution.
- SULPHUR *. Here there is no proper union of substances; but if sulphur is boiled in this acid, it becomes less inflammable and more fixed than any ordinary sulphur.
- ALCOHOL.
  - *Vitriolic æther.* By careful solution and distillation, the æther being separated by the addition of water.
  - *Spiritus vitrioli dulcis.* By solution and distillation.
  - *Oleum destillatio dulcis.* By continuing the heat after the æther has arisen.
  - *Oleum anodynum minerale.* By redistilling the residuum of the last with alcohol. A medicine much celebrated by Hoffman.
  - *Sulphur.* By pushing the heat after the oil comes over. It is to be observed that this is produced in every combination of this acid with inflammables or metals.
- METALS.
  - GOLD *. Imperfectly. By a particular process after being separated from aqua regia.
  - SILVER *. By solution, after it has been precipitated from the nitrous acid by alkalis. The fumes which arise in this solution are inflammable.
  - COPPER. *Blue vitriol.* This is sometimes a native production, but in this way it is never pure. It is artificially prepared by solution in a very concentrated acid, and crystallizing it.
  - IRON.
    - *Green vitriol*, or *copperas.* Obtained at large by a particular process from pyrites; or by solution, *&c.* in a diluted acid. This is the basis of all black dyes, ink, *&c.* as it strikes a black colour with vegetable astringents.
    - *Salt of steel.* By calcining the crystals of green vitriol till they are converted into a white powder.
    - *Colcothar of vitriol.* By continuing the calcination till it assumes a brown colour.
  - LEAD.
    - *Saturnus vitriolicus.* A solution in a boiling heat, but is again precipitated when cold.
    - An indissoluble concrete. By precipitation from the nitrous acid.
  - TIN. *Jupiter corrosivus.* By a boiling heat in a concentrated acid.
- SEMI-METALS.
  - ANTIMONY *. *A metallic salt.* By elective attraction from butter of antimony.
  - ZINC. *White vitriol.* Often found in its native state. Artificially made by solution and crystallization in a diluted acid. Used by painters for drying.
  - BISMUTH. A corroded calx. By solution in a concentrated acid.
  - ARSENIC. - - - By ditto.
  - MERCURY.
    - *Ignis Gehenne*, or infernalis of Paracelsus. By a boiling heat, and repeated coctions with fresh acid when it is evaporated.
    - *Turpeth mineral*, or mercurius precipitatus flavus. By evaporating to driness, and then washing with water.
  - COBALT. A rose-coloured mixture. By solution. If this is precipitated by a fixt alkali, and again dissolved, the liquor appears of a beautiful red.
- EARTHS.
  - CALCARIOUS EARTHS.
    - A corroded calx. By simple corrosion. This when perfectly edulcorated with water is found to be a true gypsum.
    - *Selenites.* By precipitation from a very dilute solution of chalk in the nitrous acid, by means of the vitriolic acid.
    - *Gypsum*, or *Paris-plaster.* Often found in a native state. May be artificially formed by precipitating from a solution of chalk in a very concentrated nitrous acid. Used as a cement; for taking impressions from medals, *&c.*
    - *Talc, asbestos, &c.* A native production which cannot be perfectly imitated by art. Used for holding objects in microscopes, making incombustible cloth, *&c.*
  - MAGNESIA. *Epsom*, or *magnesia Glauber's salt.* By solution and crystallization. Much used in medicine for the same purposes as real Glauber's salt.
  - EARTH of ALUM. *Alum.* By solution, crystallization, *&c.* Used by dyers as a preparatory for taking on the colours, papermakers, goldsmiths, *&c.*
  - EARTH of ANIMALS, OSTEOCOLLO, *&c.* By solution. The mixtures of these are not applied to any particular use.
  - CLAY *. *Alum.* By digesting pure clay for some time in this acid, and exposing it for some time to the air, an alum is produced; and, if the clay is precipitated from this aluminous concrete, it is found to be a pure earth of alum, soluble in all acids.
  - FLINT *. A thickish coagulum. By digesting the liquor silices in the vitriolic acid.
- WATER. An acidulated water. Sometimes, though seldom, found issuing along with native springs. Applied to no particular use.

NITROUS ACID.

- ACIDS.
  - VITRIOLIC, as above.
  - MURIATIC. *Aqua regia.* By solution. This is the only proper menstruum for gold; and it is a solution of tin in this menstruum which is the basis of the scarlet dye.
  - VEGETABLE, and all others. By ditto. These compounds have no particular names, nor are applied to any particular uses in medicine or arts.
- ALKALIS.
  - VEGETABLE. *Common nitre.* A native production. Made artificially by solution and crystallization. This deflagrates with oily or metallic bodies, and is the foundation of gun-powder.
  - FOSSILE. *Cubic nitre.* By solution.
  - VOLATILE. *Nitrous ammoniac.* By solution. This differs from all the other ammoniacal salts by being soluble in alcohol.
- OILS.
  - EXPRESSED. A thick bituminous-like substance. Upon the mixture a considerable degree of heat is generated, and sometimes, though very seldom, actual flame is produced.
  - ESSENTIAL. Ditto. A more violent heat is generated upon the mixture with these oils than any other, and with many of them an actual flame is produced.
  - EMPYREUMATIC. This mixture has no name, nor is it applied to any remarkable use in arts.
  - FOSSILE. - - Ditto.
- ALCOHOL.
  - *Nitrous æther.* By digesting; the æther arising to the surface.
  - *Spiritus nitri dulcis.* By digesting a little, and then distilling.
- METALS.
  - GOLD *. *Slightly impregnated.* By a boiling heat in close vessels, after the ordinary method of separating silver from gold by the nitrous acid. It spontaneously subsides in the air.
  - SILVER.
    - *A fluid solution.* By solution. This when diluted with water stains hair and bones black; as also marble, agate, jasper, *&c.* of different colours.
    - *Sal metallorum.* By solution and crystallization.
    - *Catharticum lunare, lunar caustic*, or *lapis infernalis.* By inspissitating the solution to driness.
  - COPPER. A green-coloured solution. By solution.
  - IRON. A greenish solution, if a diluted acid is employed; if otherwise, it is of a yellowish colour: evaporated to driness, it deliquates in the air.
  - LEAD.
    - A yellow solution. By dissolving in a diluted acid. If much water is added, the metal is precipitated.
    - *Saturni fulminans.* By inspissating the solution. This explodes when put upon the fire with greater force than nitre, and has been proposed to be used as an ingredient in gun-powder to augment its force.
  - TIN. A solution or corroded calx. By a careful solution without heat it remains suspended; if otherwise, it falls down in form of a calx. This is commonly supposed to be the composition used in dying scarlet; but by mistake: for it is a solution of tin in aqua regia that communicates that fine colour to cochineal. The same solution is the basis of the powder which tinges glass of a ruby colour. It is the precipitate of gold from aqua regia by means of tin.
- SEMI-METALS.
  - BISMUTH.
    - A greenish solution. By using a concentrated acid. This might be applied in some cases in the art of dying; but is not yet come into general use.
    - *Magistery of bismuth.* By precipitating from the solution by means of water. This has been employed as a cosmetic, but is inefficacious and unsafe. If mixed with pometum, this stains hair of a dark colour without injuring it.
  - MERCURY.
    - A limpid solution, intensely corrosive. By solution.
    - *Red precipitate.* By evaporating the solution to driness, and then calcining till it becomes red.
    - *Mercurius corrosivus fusus.* By precipitating from the nitrous acid by fixt alkali.
    - *White precipitate.* - By ditto with the volatile alkali.
  - ZINC. A corroded solution. By the ordinary means.
  - ANTIMONY.
    - A colourless calx. By simple corrosion.
    - *Bezoardic mineral.* By distilling from butter of antimony, after having added the nitrous acid.
    - *Antimonium diaphoreticum.* By adding nitre to crude antimony, and deflagrating.
    - *Cerusa antimonii.* By deflagrating regulus of antimony with nitre.
  - COBALT.
    - A red liquor. By solution either in its calcined or metallic state.
    - *Rose-coloured crystals.* By adding muriatic acid, and allowing it to crystallize.
    - *Green sympathetic ink.* By dissolving these crystals in water. The solution is red when cold, and green when warm: when wrote with, it disappears when dry; but when held to the fire it becomes green, and again disappears when cold.
  - NICKEL. A green-coloured liquor. By solution.
- EARTHS.
  - CALCARIOUS.
    - *Deliquescent crystals.* - By ditto and crystallization.
    - *Baldwin's phosphorus.* By ditto and evaporating to driness.
  - EARTH of ALUM, and all other absorbent earths. By solution. The compounds have no names nor any remarkable properties hitherto discovered.
  - CRYSTALLINE EARTHS *. By solution after precipitation from the liquor silices.
- WATER. *Acidulated water.* By solution.

- ACIDS.
  - VITRIOLIC, and NITROUS. As in the former part of this table.
  - VEGETABLE, and all others yet known. By solution: but as none of these mixtures are applied to any particular purpose, we take no notice of them.
- ALKALIS.
  - VEGETABLE. *Digestive salt.* By solution and crystallization.
  - FOSSILE.
    - *Common salt.* Commonly obtained by evaporating sea-water to driness; or artificially made by mixing the acid and alkali, and crystallizing.
    - *Sal gem.* A native fossile salt, found in mines in Poland, Spain, *&c.* of the same nature as common salt, but more pure.
  - VOLATILE. *Common ammoniac.* Obtained at large by a particular process from soot. Artificially made by mixing the acid and alkali, and crystallizing.
- OILS *. By solution. The union here is but imperfect, nor have they any particular name.
- ALCOHOL. *Spiritus salis dulcis.* By digesting, and afterwards distilling. The acid here is never totally dulcified.
- METALS.
  - GOLD *. *A yellow liquor.* By boiling a calx of gold (in whatever way obtained) in this acid. It does not act upon it in its metallic state.
  - SILVER *.
    - *A fluid solution.* By dissolving the ore of silver in this acid. It does not act upon pure metallic silver.
    - *Luna cornea.* By elective attraction from the nitrous acid.
  - COPPER. *A green deliquescent inflammable salt.* By solution and inspissating to driness.
  - IRON. *Tinctura martis aurea.* By solution. The iron is in some measure rendered volatile by this operation.
  - LEAD.
    - A limpid solution. By a boiling heat, and frequent cohobations with fresh acid.
    - *Cornea Saturni.* By precipitation from the nitrous acid.
  - TIN *.
    - A corroded powder. By simple corrosion.
    - *Butter of tin.* By distilling from corrosive sublimate.

The MURI... ned with these bodies, viz.

ZINC. A solution of a very slight yellow colour. ... By employing a very concentrated acid.

The MURIATIC ACID can be combined with these bodies, *viz.*

- TIN *. { A corrod[...]
  - *Butter of tin.* By distilling from corrosive sublimate.
- MERCURY *. A colourless crystalline mass, extremely acrid. By corrosion, employing the fumes of a very concentrated acid.
- SEMI-METALS.
  - BISMUTH *. A solution very slightly impregnated. By employing a very concentrated acid.
  - ZINC. A solution of a very slight yellow colour.
  - ARSENIC *. *Butter of arsenic.* By distilling corrosive sublimate with arsenic; the arsenic uniting with the acid, and leaving the mercury.
  - MERCURY *.
    - *Mercur. corrosiv. albus.* By precipitation from the nitrous acid.
    - *Corrosive sublimate.* By subliming from sal ammoniac, common salt, or many other bodies.
    - *Mercurius dulcis.* By resubliming corrosive sublimate with more quicksilver.
    - *Mercurial panacea.* By subliming corr. sub. nine times, and digesting for some time in spirit of wine.
  - COBALT. A reddish solution. By the ordinary means. It becomes green by a gentle heat.
  - PLATINA *. A fluid solution. With difficulty effected, after having been precipitated from aqua regia by alkalis.
  - NICKEL. A green solution. By the ordinary means.
- EARTHY.
  - CALCARIOUS.
    - *Liquid shell.* By solution. A substance whose effects in medicine have been greatly extolled.
    - *Ol. calcis per deliquium.* By evaporating liquid shell to driness. It naturally deliquesces.
    - *Fixt ammoniac.* By solution and crystallization. This sometimes appears luminous in the dark when struck with a hammer.
  - OSTEOCELLO, MAGNESIA, and other absorbents. By solution; but the properties or uses of these are not known.
- WATER. *Acidulated water.* Generating heat by mixture.

VINEGAR, or VEGETABLE ACID can be combined with these bodies, *viz.*

- ACIDS. VITRIOLIC, NITROUS, and MURIATIC, as in the above table. It likewise unites with all other acids, generating heat; but the properties or uses of these are not known.
- ALKALIS.
  - VEGETABLE. *Regenerated tartar.* By solution and crystallization.
  - FOSSILE. *Polychrest of Rochelle.* By ditto.
  - VOLATILE. *Spiritus mendereri.* By solution.
- OILS *. The union here is imperfect, nor have any of them obtained particular names.
- ALCOHOL. A mixture much used for anointing sprains, &c.
- METALS.
  - SILVER *. *Lunar caustic.* By dissolving in this acid a precipitate of silver from the vitriolic acid by means of fixt alkali, and evaporating the solution to driness.
  - COPPER. *Verdegris.* By solution and crystallization; or at large, by stratifying copper plates with the husks of the grape.
  - IRON. *Sal martis aperiens.* By solution and crystallization.
  - LEAD.
    - *Ceruse.* By exposing, in certain circumstances, thin plates of lead to the fumes of vinegar.
    - *Saccharum Saturni.* By solution and crystallization.
  - TIN *. This is not properly dissolved; but the acid is evidently impregnated. By the ordinary means of solution.
- SEMI-METALS.
  - ZINC. A colourless solution of a sweetish taste. By digesting for some time.
  - MERCURY *.
    - *A fluid solution.* By employing a precipitate of mercury from the nitrous acid by alkalis.
    - *A red calx.* By long digestion with fluid mercury.
  - ANTIMONY *. *Vinum benedictum.* This is not a proper solution of the metal, but the acid is impregnated with an emetic quality.
  - ARSENIC. *Vinum arsenicum.* By ditto.
  - BISMUTH. An austere stiptic liquor. By strong coction.
- EARTHY.
  - CALCARIOUS EARTHS. *Earthy salts.* Not known in medicine or arts.
  - MAGNESIA. *Dr Black's purging salt.* By solution. It unites with all the other absorbent earths; but the properties of these mixts are unknown.
- WATER. *Acidulated water.*

ACID of URINE.

- ACIDS of all kinds. The nature of these not known.
- ALKALI. VOLATILE. A glass-like saline substance called *microcosmic salt.* The acid is always found in this state by evaporating urine.
- OILS. *Baldwin's phosphorus.* By distilling with substances that contain oils or inflammable matters.
- METALS.
  - LEAD. An inflammable malleable mass. By calcining the dry salt with lead.
  - TIN. A mass resembling zinc; and inflammable. By ditto.
  - IRON.
    - A true *phosphorus.* By ditto.
    - A bluish solution. By employing a watery solution of the acid.
  - COPPER. A corroded powder, or green solution. By a boiling heat in a watery solution of the acid.
- SEMI-METALS.
  - MERCURY. A semi-opaque mass. By fusion with the acid in its solid form.
  - ZINC.
    - A corroded powder, soluble in water. By solution in the acid in a watery situation.
    - A true *phosphorus.* By fusion with the dry acid.
  - ANTIMONY.
    - A solution in the ordinary way.
    - A brilliant striated mass. By fusion with the dry acid.
  - BISMUTH. A mixture but little changed in appearance from ordinary bismuth. By fusion.
  - ARSENIC. A whitish semi-transparent deliquescent mass. By fusion.
  - COBALT. A reddish tincture. By solution.
- VITRESCENT EARTHS. Glass of different sorts. By fusion.

ACID of AMBER.

- ALKALI.
  - FIXED. A neutral saline mass which would not crystallize. By solution.
  - VOLATILE.
    - A neutral ammoniacal oleaginous liquor, extremely volatile. By solution with a pure alkali.
    - *Liquor cornu cervi succinatus.* By solution, using salt of hartshorn.
- OIL. FOSSILE. *Amber.* A native production; but may be again artificially formed by uniting these together by solution.
- METALS.
  - COPPER. It dissolves very slowly in its metallic state; but corrodes it much more readily when calcined.
  - IRON. Dissolves a part into a colourless liquor, but corrodes a great deal more into a crocus.
- SEMI-METAL. ZINC. A fluid solution.
- The effects of this acid upon other bodies are not yet known.

ACID of ANTS.

- ACIDS of all kinds. The properties not known.
- ALKALIS.
  - FIXED. A deliquescent neutral salt. By solution and crystallization.
  - VOLATILE. A neutral liquor that would not crystallize.
- METALS.
  - SILVER *. By solution. The calx of silver precipitated from aqua fortis by alkalis; but does not act upon it in its metallic state.
  - COPPER. Beautiful green crystals. By dissolving and crystallizing calcined copper. It acts slowly upon it in its metallic state.
  - IRON. A metallic salt. It dissolves this metal with great facility.
  - LEAD *. A salt resembling Saccharum Saturni. By dissolving the red calx of lead. But it does not act upon it in its metallic state.
- SEMI-METAL. ZINC. Elegant crystals. By the ordinary means.
- The effects of this acid upon other bodies, or the uses to which these combinations might be applied, are not yet sufficiently known.

ACID of BORAX.

- ALKALI. FOSSILE. *Borax.* A native substance, which may be imitated by art. It is of great use in promoting the fusion of metals and earths.
- ALCOHOL. A solution with a considerable heat, which burns with a green flame.
- WATER. A solution in a considerable heat. The other mixtures with this acid not known.

ACID of ANIMALS. We know as yet but little of the nature of this acid; and its combinations with other bodies have not hitherto been examined.

The FIXED ALKALI, whether VEGETABLE or FOSSILE, can be united with the following bodies; but the vegetable is best known.

- ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable; and acid of Urine, of Amber, of Ants, of Borax; as in the former part of this table.
- ALKALIS of all sorts. The uses of these mixtures are not known.
- OILS.
  - EXPRESSED. *Soap.* The best hard soap is made of olive-oil and fossile alkali. The ordinary white soap of this country is made of tallow and potash; black soap, with whale-oil and potash.
  - ESSENTIAL. *Saponaceous mass.* Best made by pouring spirit of wine upon caustic alkali and then oil, digesting and shaking.
  - EMPYREUMATIC. This mixture dissolves gold when precipitated from aqua regia; and is the basis of the fine colour called *Prussian blue;* and has various other properties, as yet but little known.
  - FOSSILE. This has no name, nor are the properties well known; but from some observations that have been made on native soapy waters, it is probable that it would keep linen much longer white than any other kind of soap.
- SULPHUR.
  - *Hepar sulphuris.* By injecting alkalis upon melted sulphur.
  - *Lac sulphuris.* By dissolving sulphur in an alkaline lixivium, and precipitating by an acid.
- METALS.
  - GOLD *. After having precipitated it from aq. regia it dissolves it, if the alkali has been calcined with animal-substances.
  - SILVER *. After having precipitated it from the nitrous acid, it dissolves it if the alkali has been calcined in contact with the flame.
  - TIN. A corroded powder. By the ordinary means of solution.
  - COPPER. By ditto.
  - LEAD. A fluid solution. By ditto. This stains hair black.
  - IRON *. A blood-coloured solution. By dropping a solution of iron in the nitrous acid, into an alkaline lixivium.
- SEMI-METALS.
  - MERCURY *. A fluid solution. After precipitating it from acids; if the alkali is in too large proportions, it then dissolves it, especially if the alkali has been calcined in contact with the flame.
  - ZINC *. By solution, after having precipitated it from the nitrous acid.
  - BISMUTH *. By solution, after having precipitated it from the nitrous acid.
  - ANTIMONY.
    - *Kermes mineral.* By dissolving antimony in an alkaline lixivium, filtering, and allowing it to stand in a cool place till it precipitates.
    - *Golden sulphur of antimony.* By dissolving a crude antimony in an alkaline lixivium, and precipitating by an acid.
    - *Hepar antimonii.* By deflagrating crude antimony with nitre.
    - *Crocus metallorum.* Is hepar antimonii pulverised and edulcorated with water.
    - *Diaphoretic antimony.* By deflagrating regulus of antimony with nitre.
    - *Antimoniated nitre.* By dissolving diaphoretic antimony in water, and allowing it to crystallize.
    - *Magistery of antimony.* By precipitating a solution of diaphoretic antimony by adding vinegar.
    - *Regulus antimonii medicinalis.* By fusing crude antimony with alkali. This is not properly a compound of alkali and antimony, but of another kind. But as it is a term much used, it was proper to explain it.
  - ARSENIC *. A metallic arsenical salt. By a particular elective attraction from regulus of antimony and nitre.
- EARTHS.
  - CHRYSTALLINE.
    - *Liquor silicum.* By fusion with twice their weight of alkalis.
    - *Glass.* By fusion with a much smaller proportion of alkali. This is the composition of crystal glass, and all others commonly used.
  - ABSORBENTS. Argillaceous, and all kinds of earths. *Glass.* By fusion; differing in quality according to the nature of the ingredients. Glass is likewise produced with it in fusion with metals.
- WATER. *Alkaline lixivium,* when caustic, or even the ordinary solution of mild alkali, is a fluid of great power in washing, blacking, &c.
- AIR. FIXT. *Mild alkali.* This is the general state in which alkalis are found; but if they are rendered caustic by means of quick-lime or otherwise, they again absorb it from the air, or from many other bodies, by elective attraction. When perfectly mild, this alkali may be made to assume a crystalline form.

The VOLATILE ALKALI, or SPIRIT of SAL AMMONIAC, can be united with these bodies, *viz.*

- ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable; of Urine, of Amber, of Ants.
- ALKALI, as above.
- OILS.
  - EXPRESSED. Has no name. By solution.
  - ESSENTIAL. *Sal volatile oleosum.* By ditto with some difficulty, unless the alkali is in a caustic state.
  - EMPYREUMATIC. A pungent oily substance, of great power in medicine. The principal one of this kind in use is spirit of hartshorn.
  - FOSSILE. A particular kind of soapy substance.
- SULPHUR. Smoking spirit of sulphur. By distilling sal ammoniac, quick-lime, and sulphur.
- ALCOHOL *. By distilling alcohol from volatile alkalis, it acquires a caustic fiery taste; but the union is not complete.
- METALS.
  - GOLD *.
    - *Aurum fulminans.* A powder obtained by precipitating it from aqua regia by volatile alkalis.
    - A liquid solution. By adding a large proportion of alkali after it has been precipitated from aqua regia. This deposites the gold when long exposed to the air. The curious vegetation called *arbor Dianæ* is formed by adding mercury to this solution.
  - SILVER *. A solution. After it has been precipitated from the nitrous acid.
  - COPPER.
    - A blue-coloured solution. By the ordinary means. This when evaporated to driness, and mixed with tallow, tinges the flame green.
    - Sapphire-coloured crystals. By crystallizing the solution.
    - *Venus fulminans.* By evaporating the solution to driness.
    - *Aqua cerulea sapphirina.* By mixing sal ammoniac, quick-lime, and thin plates of copper, with water, and allowing them to remain a night.
  - IRON. By ordinary solution.
  - LEAD. By ditto.
  - TIN. The mixts that are produced by these metals are little known.
- SEMI-METALS.
  - BISMUTH *. By solution, after having precipitated it from the nitrous acid.
  - ANTIMONY.
  - PLATINA *. By solution, after having precipitated it from aqua regia.
  - COBALT. A reddish liquor. By solution.
  - NICKEL. A blue liquor. By ditto.
- WATER. This solution might be of use in washing or bleaching; but, unless in particular cases, would be too expensive. It coagulates with alcohol.
- AIR. FIXT. Mild volatile alkali. The usual state in which it is found; nor has any method yet been discovered of rendering it solid but in this state.

EXPRESSED OILS.

- ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, as in the foregoing part of this table.
- ALKALIS: Fixt, and Volatile, as above.
- OILS: Effential, Empyreumatic, and Foffile. By mixture; but their ufes are not much known.
- SULPHUR. *Balfam of Sulphur.* By folution in a boiling heat.
- ALCOHOL. After expreffed oils are freed from foap or plaifters, they are foluble in alcohol; but not in their ordinary ftate.
- METALS.
  - TIN *. A kind of plaifter. By folution when the tin is in the ftate of a calx.
  - LEAD *. Ditto. By boiling the calx of lead in oils. This is ufed for cements in water-works. The common white paint is a mixture of this lefs perfect.
- SEMI-METALS. ZINC *. Ditto. By ditto.
- CALCARIOUS EARTHS. Ditto. By mixture when in a cauftic ftate.

ESSENTIAL OILS.

- ACIDS: Vitriolic, Nitrous, &c. as above.
- ALKALIS: Fixt, and Volatile, as above.
- OILS of all kinds. By folution or mixture.
- SULPHUR. A balfam of fulphur. By folution, imperfectly: better by adding effential oils to the folution made by expreffed oils or hepar fulphuris.
- ALCOHOL.
  - Imperfect mixture. By folution.
  - Aromatic waters. By diftillation.
- METALS.
  - COPPER. By folution.
  - LEAD. By ditto.
- WATER. Diftilled water of the fhops. By diftilling recent vegetable fubftances with water.

EMPYREUMATIC OILS.

- ACIDS: Vitriolic, and Nitrous, as above.
- ALKALIS: Fixt, and Volatile, as above.
- OILS of all kinds. By mixture.
- ALCOHOL. By folution. By repeated diftillations the oils are rendered much more fubtile.

FOSSILE OILS.

- ACIDS: Vitriolic, and Nitrous, as above.
- ALKALIS: Fixt, and Volatile, as above.
- OILS of all kinds. By mixture.
- SULPHUR. With fome difficulty, by folution.
- ALCOHOL. - - - By ditto.

SULPHUR.

- ACID *: Vitriolic; with the phenomena above defcribed.
- ALKALIS: Fixt, and Volatile, as above.
- OILS: Expreffed, Effential, and Foffile, as above.
- METALS.
  - SILVER. A mafs of a red like colour. By adding fulphur to red-hot filver, and fufing; found alfo with it in the ftate of an ore.
  - LEAD. A fparkling friable mafs, hardly fufible. By deflagrating fulphur with lead. This in a native ftate forms the ore of lead called *galena.*
  - COPPER. A black brittle mafs; eafily fufed. By adding fulphur to red-hot copper, or ftratifying with fulphur and fufing. Naturally in fome yellow pyrites.
  - IRON.
    - A fpungy-like drofs, eafily fufible. By putting fulphur to red-hot iron. This is alfo found naturally in the common yellow or brown pyrites.
    - A fulminating compound. By mixing filings of iron with fulphur, moiftening them with water, and preffing them hard, they in a few hours burft out into flame. This compofition has been employed for imitating earthquakes.
    - *Crocus martis.* By deflagrating with iron.
    - *Crocus martis aperiens.* By calcining the crocus martis in the fire till it affumes a red appearance.
    - *Crocus martis aftringens.* By pufhing the heat ftill further.
  - TIN. A dark-coloured mafs, refembling antimony. By fufion.
- SEMI-METALS.
  - MERCURY.
    - *Ethiops mineral.* By heating flowers of fulphur, and pouring the mercury upon it, and ftirring it well. Its natural ore is called *cinnabar.*
    - *Factitious cinnabar.* By applying the mercury and fulphur to each other in their pure ftate, and fubliming.
    - *Cinnabar of antimony.* By fubliming corrofive fublimate and crude antimony; or the refiduum, after diftilling butter of antimony.
  - BISMUTH. A faint greyifh mafs, refembling antimony. By fufion. If in its metalline ftate, the fulphur feparates in the cold; but not fo if the calx has been employed.
  - ANTIMONY. *Crude antimony.* By fufion.
  - ZINC *. A very brittle, dark-coloured, fhining fubftance. With fome difficulty, by keeping it long in a moderate fire, and covering it feveral times with fulphur, and keeping it conftantly ftirred.
  - ARSENIC.
    - *Yellow arfenic.* By fufing it with 1-10th its weight of fulphur.
    - *Red arfenic.* By ditto with 1-5th its weight of fulphur.
    - *Ruby of fulphur,* or arfenic, or golden fulphur. By fubliming when the proportions are equal.
    - *Orpiment.* A natural production; not perfectly imitable by art; compofed of fulphur and arfenic. Much ufed as a yellow paint.
  - NICKEL. A compound; compact and hard as lead; of a bright metallic appearance; internally yellow. By fufion.
- WATER. *Gas fylveftræ.* By receiving the fumes of burning fulphur in water. This ought rather to be called a union of the volatile vitriolic acid with water.

ALCOHOL.

- ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, and of Borax, as above.
- ALKALI *: Volatile, as above.
- OILS: Expreffed, Effential, Empyreumatic, and Foffile, as above.
- METALLIC calces, in fome particular cafes.
- WATER. By folution.

GOLD.

- ACIDS: Vitriolic *, Nitrous *, and Muriatic *. In the circumftances and with the phenomena above defcribed.
- ALKALIS: Fixt *, and Volatile *, as above.
- METALS.
  - SILVER. By fufion. And the fame is to be underftood of all the combinations of metals, unlefs particularly fpecified.
  - LEAD. A very brittle mafs. Gold is rendered pale by the leaft admixture with this.
  - TIN. Remarkably brittle. The fmalleft particle of tin falling upon a furnace renders all the gold or filver melted in it extremely brittle.
  - COPPER. Paler and harder than pure gold. This mixture is ufed in all our coins, the copper being called the alloy.
  - IRON. Silver-coloured, hard and brittle; very eafily fufed.
- SEMI-METALS.
  - MERCURY. Soft like a pafte called an *amalgamum.* By folution; it being in this cafe called *amalgamation*; and the fame is to be underftood of the folution of any other metal in quick-filver.
  - ZINC. A bright and whitifh compound, admitting of a fine polifh, and not fubject to tarnifh; for which qualities it has been propofed as proper for making fpeculi for telefcopes.
  - ARSENIC. Brittle; and the gold is thus rendered a little volatile.
  - ANTIMONY. A fine powder for ftaining glafs of a red colour. By calcination.
  - BISMUTH *. A brittle whitifh regulus; volatile in the fire.
  - PLATINA. Ductile, and of a dufky colour. This has been employed to debafe gold, as it is of the fame fpecific gravity, and is not difcoverable by the ufual tefts for difcovering the purity of gold.
  - COBALT.
  - NICKEL. White and brittle.

SILVER.

- ACIDS: Vitriolic *, Nitrous, Muriatic *, Vegetable *, and Acid of Ants *, as above.
- ALKALIS: Fixt *, and Volatile *, as above.
- SULPHUR, as above.
- METALS.
  - GOLD, as above.
  - LEAD. Very brittle.
  - TIN. Extremely brittle, as much fo as glafs.
  - COPPER. Harder than filver alone. Ufed in fmall proportions as alloy in coins.
  - IRON. A hard whitifh compound.
- SEMI-METALS.
  - MERCURY *. By amalgamation with filver-leaf, or calx of filver precipitated by copper, but not by falts. This is ufed for filverizing on other metals, in the fame way as the amalgamum of gold.
  - ZINC. Hard, fomewhat malleable, and of a white colour.
  - ANTIMONY. A brittle mafs.
  - BISMUTH. A whitifh femi-malleable body.
  - ARSENIC. Brittle; the filver being rendered in part volatile.
  - PLATINA. Pretty pure and malleable. Difficult of fufion; and in part feparates when cold.
  - COBALT.
- CHRYSTALLINE EARTHS, and other vitreous matters. A fine yellow opaque glafs. The fineft yellow paint for porcelain is procured from a glafs mixed with filver.

LEAD.

- ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Ants *, as above.
- ALKALIS: Fixt, and Volatile, as above.
- OILS: Expreffed *, and Effential, as above.
- SULPHUR, as above.
- METALS.
  - GOLD and Silver, as above.
  - TIN. A little harder than either of the metals, and eafily fufed: hence it is ufed as a folder for lead; and it forms the principal ingredients of pewter. If the fire is long continued, the tin floats on the furface.
  - COPPER *. Brittle and granulated, like tempered iron or fteel when broke. By throwing pieces of copper into melted lead. The union here is very flight.
  - IRON *. An opaque brownifh glafs. By a great degree of heat if the iron has been previoufly reduced to the ftate of a calx; but never in its metallic ftate.
- SEMI-METALS.
  - MERCURY *. By amalgamation. Effected only in a melting heat, unlefs fome bifmuth has been previoufly united with the mercury.
  - ZINC. Hard and brittle. By pouring zinc on melted lead. If the zinc is firft melted, and the lead injected upon it, it then deflagrates.
  - ANTIMONY *.
  - BISMUTH. A grey-coloured femi-malleable body, eafily fufed; and thence ufed as a folder for lead or tin.
  - ARSENIC.
    - A grey-coloured brittle mafs; eafily fufed, and extremely volatile.
    - A hyacinth-coloured glafs. By fufion in a confiderable heat. This glafs is eafily fufed; and is a much more powerful flux than pure glafs of lead.
  - PLATINA. Of a leafy or fibrous texture, and purplifh or blue colour, when expofed to the air. If a large proportion of platina is ufed, it feparates in the cold.
  - COBALT. The nature of this compound is not known.
  - NICKEL. A brittle metallic body.
- CRYSTALLINE EARTHS. A thin glafs. By fufion in a moderate heat.

TIN.

- ACIDS: Vitriolic *, Nitrous *, Muriatic, Vegetable *, of Urine, as above.
- ALKALIS: Fixt, and Volatile, as above.
- OIL: Expreffed *, as above.
- SULPHUR, as above.
- METALS.
  - GOLD, Silver, and Lead, as above.
  - COPPER. A brittle mafs. When the copper is in fmall proportions, it is firmer and harder than pure tin. This in right proportions with a little zinc, forms bell-metal.
  - IRON. A white brittle compound. By heating filings of iron red-hot, and pouring melted tin upon them. A metal refembling the fineft filver is made of iron, tin, and a certain proportion of arfenic.
- SEMI-METALS.
  - MERCURY. This amalgamum forms foils for mirrors; and forms the yellow pigment called *aurum mofaicum.* By being fublimed with fulphur and fal ammoniac.
  - ZINC. Hard and brittle. When the zinc is in fmall proportions, it forms a very fine kind of pewter.
  - ANTIMONY *. *Regulus veneris.* By elective attraction from copper and crude antimony.
  - BISMUTH. Bright, hard, and fonorous, when a fmall proportion of bifmuth is ufed. This is very eafily fufed; and employed as a folder.
  - ARSENIC. A fubftance in external appearance refembling zinc.
  - PLATINA. A coarfe hard metal which tarnifhes in the air.
  - COBALT. By fufion.
  - NICKEL. A brittle metallic mafs.
- CRYSTALLINE EARTHS, or other vitreous matters. An opaque white vitreous mafs, which forms the bafis of white enamels.

- ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.
- ALKALIS: Fixt, and Volatile, as above.
- OIL: Effential, as above.
- SULPHUR, as above.
- METALS.
  - GOLD, Silver, Lead *, and Tin, as above.
  - IRON. Harder and paler than copper. [illegible]

SULPHUR, as above.
COPPER. METALS: Gold, Silver, Lead *, and Tin, as above.
METAL. Iron. Harder and paler than copper. Eaſily fuſed.

SEMI-METALS.
- Mercury *. A curious amalgum. Soft at firſt, but afterward brittle. By triturating mercury with verdigris, common ſalt, vinegar, and water.
- Zinc.
  - *Braſs.* Commonly made by cementation with calamine. The larger the proportion of zinc, the paler, harder, and more brittle is the braſs.
  - *Prince's metal, pinſhbeck,* and other metals reſembling gold. By employing zinc in ſubſtance in ſmall proportions. The beſt pinſhbeck about 1-4th of zinc.
  - *Spelter.* A native ſubſtance, found in Cornwall, conſiſting of zinc and copper, and uſed as a ſolder.
- Antimony. By fuſion.
- Bismuth. A paliſh brittle maſs. Somewhat reſembling ſilver.
- Arsenic. *White copper.* By pouring arſenic, fuſed with nitre, upon copper in fuſion. If too large a proportion of arſenic is uſed, it makes the compound black and apt to tarniſh.
- Platina. A white and hard compound, which does not tarniſh ſo ſoon as pure copper, and admits of a fine poliſh.
- Cobalt. White and brittle.
- Nickel. White and brittle, and apt to tarniſh.

IRON.
ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.
ALKALIS: Fixt *, and Volatile, as above.
SULPHUR, as above.
METALS: Gold, Silver *, Lead *, Tin, and Copper, as above.
SEMI-METALS.
- Zinc. A white ſubſtance reſembling ſilver.
- Antimony. The magnetic quality of the iron is totally deſtroyed in this compound.
- Bismuth. In a ſtrong heat, this emitteth flames.
- Arsenic. A whitiſh, hard, and brittle compound. By fuſing with ſoap or tartar. A metal reſembling fine ſteel is made by fuſing caſt iron with a little arſenic and glaſs.
- Platina. With caſt iron it forms a compound remarkably hard, ſomewhat ductile, and ſuſceptible of a fine poliſh.
- Cobalt. A compound remarkably ductile. By fuſion in a moderate heat.
- Nickel. A brittle maſs.

VITRESCENT EARTHS. A tranſparent glaſs. In general blackiſh; but ſometimes yellow, green, or blue. The colour is influenced by the degree of heat as well as nature of the ingredients.

MERCURY.
ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable *, of Urine, as above.
ALKALI: Fixt *, as above.
SULPHUR, as above.
METALS: Gold, Silver *, Lead *, Tin, and Copper, as above.
SEMI-METALS.
- Zinc. An amalgum. Soft or hard, according to the proportions employed.
- Antimony *. By melting the regulus, and pouring it upon boiling mercury. By frequently diſtilling from this amalgum, the mercury is rendered much more pure, and is then called *animated mercury.*
- Bismuth. A ſilverizing for iron. By putting this amalgum upon iron, and evaporating the mercury. It has much the appearance of ſilver.
- Platina. The compound reſulting from this mixture is not known.
- Cobalt. By mixing firſt with nickel, and then adding mercury.

ZINC.
ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.
OIL: Expreſſed *, as above.
SULPHUR *, as above.
METALS: Gold, Silver, Lead, Tin, Copper, and Iron, as above.
SEMI-METALS.
- Mercury, as above.
- Antimony. This mixture is applied to no particular uſe.
- Arsenic. A black and friable maſs.
- Platina. A hard ſubſtance.
- Cobalt. The particular nature and properties of this mixt is not known.

ANTIMONY.
ACIDS: Vitriolic *, Nitrous, Vegetable *, and Urinous. With the phenomena, and by the means above deſcribed.
ALKALIS: Fixed and Volatile, as above.
SULPHUR, as above.
METALS: Gold, Silver, Lead, Tin *, Copper, and Iron, as above.
SEMI-METALS.
- Mercury, and Zinc, as above.
- Bismuth, A maſs reſembling regulus of antimony.
- Arsenic. The nature and qualities of this mixt are not known.
- Platina. A hard maſs.
- Cobalt. Nature unknown.
- Nickel. Ditto.

VITREOUS EARTHS. A thin penetrating glaſs; which is a powerful flux of metals.

BISMUTH.
ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, and urinous; with the phenomena, &c. above deſcribed.
ALKALIS: Fixed *, and Volatile *, as above.
SULPHUR, as above.
METALS: Gold, Silver, Lead, Tin, Copper, and Iron, as above.
SEMI-METALS.
- Mercury and Antimony, as above.
- Arsenic. Nature not known.
- Platina. This mixture changes its colour much on being expoſed to the air.
- Cobalt *. By mixing firſt with nickel or regulus of antimony, and then adding cobalt; but it cannot be united by itſelf.
- Nickel. This mixt is not known.

VITREOUS MATTERS. A yellow glaſs. The ore of biſmuth affords with theſe a blue glaſs; but this is probably owing to ſome mixture of cobalt with it.

ARSENIC.
ACIDS: Vitriolic, Muriatic *, Vegetable *, and Urinous; with the phenomena, &c. above mentioned.
ALKALIS: Fixt, and Volatile; with the phenomena, and by the means mentioned above.
SULPHUR, as above.
METALS: Gold, Silver, Lead, Tin, Copper, and iron, as above.
SEMI-METALS.
- Zinc, Antimony, and Biſmuth, as above.
- Platina.
- Cobalt.
- Nickel. The phenomena attending theſe mixtures have not been as yet particularly obſerved.

VITREOUS MATTERS. A glaſs which greatly promotes the fuſion of other matters. The arſenic muſt firſt be prepared by diſſolving and precipitating from alkalis.

PLATINA.
ACIDS: Muriatic *; with the phenomena, &c. mentioned above.
ALKALI: Volatile, as above.
METALS: Gold, Silver, Tin, Copper, and Iron, as above.
SEMI-METALS.
- Mercury, Zinc, Biſmuth, and Arſenic, as above.
- Cobalt.
- Nickel. The phenomena attending theſe mixtures not yet obſerved.

COBALT.
ACIDS: Vitriolic, Nitrous, Muriatic, and Urinous; with the phenomena, &c. as above deſcribed.
ALKALI: Volatile, as above.
METALS: Gold, Silver, Lead, Tin, Copper, and Iron, as above.
SEMI-METALS.
- Mercury *, Zinc, Antimony, Biſmuth *, Arſenic, and Platina, as above.
- Nickel. The properties of this compound not known.

EARTHY. Calx of Flint.
- *Zaffre.* By mixing calcined cobalt with calx of flint, and moiſtening them with water, and preſſing them cloſe in wooden tubs.
- *Smalt.* By vitrifying theſe with the addition of a little potaſh.

NICKEL.
ACIDS: Nitrous, and Muriatic; with the phenomena, &c. as mentioned above.
ALKALI: Volatile, as above.
SULPHUR, as above.
METALS: Gold, Lead, Tin, Copper, and Iron, as above.
SEMI-METALS: Antimony, Biſmuth, Arſenic, Platina, and Cobalt, as above.

ABSORBENT EARTHS.
ACIDS: Vitriolic, Nitrous, Muriatic, and Vegetable; with the phenomena, and by the aſſiſtances above mentioned.
ALKALIS: Fixed, as above.
EARTHY.
- Crystalline. By this mixture they are both much eaſier melted into glaſs than by themſelves, but not without the addition of ſome alkali.
- Argillaceous. This mixture eaſily runs into a glaſs without any addition.

WATER. *Lime-water.* By ſolution. It is ſometimes found flowing out of the earth in ſprings; and as it always quits the water when expoſed to the air, it is there depoſited on the banks of the ſtreams, forming the ſtony incruſtations called *petrifications:* And filtring through the pores of the earth, and dropping through the roofs of ſubterraneous caves, it forms the curious incruſtations found hanging from the roof of ſuch places; ſometimes aſſuming forms ſtupenduouſly magnificent.

AIR. Fixt. *Lime-ſtone.* It is from the quality that quick-lime has of abſorbing its air, and again with it reſuming its ſtony conſiſtence, that it is fitted for a cement in building; and the great hardneſs of the cements in old buildings is owing to the air being more perfectly united with theſe than in newer works.

CRYSTALLINE or VITRESCENT EARTHS.
ACIDS: Vitriolic *, and Nitrous *; with the phenomena, &c. as above mentioned.
ALKALI: Fixed, as above.
METALS: Lead, Tin, Copper, and Iron, as above.
SEMI-METALS: Antimony, Biſmuth, Arſenic, and Cobalt, as above.
ABSORBENT EARTHS: as above.
ARGILLACEOUS EARTHS. A maſs running into glaſs in a moderate heat.
WATER. Although this is not ſoluble in water by any operation that we are acquainted with, yet, from its cryſtalline form, it is probable that it has been once ſuſpended; and certainly it is ſo at this day in thoſe petrifying ſprings whoſe incruſtations are of the cryſtalline ſort.

ARGILLACEOUS EARTHS, with Abſorbent and Cryſtalline Earths, as above. With water it only unites into a paſte of a mechanical nature.

EXPLANATION OF THE TABLES.

It was imagined, that a ſyſtematic view of the ſeveral chemical bodies, arranged under diſtinct claſſes, would be of uſe to convey a clear idea of this ſubject to the mind, and ſerve to impreſs it better upon the memory of the reader; and with this view the firſt table was compoſed, the ſeveral parts of which are ſo plain as to admit of no explanation.

The ſame cauſes induced us to think, that a ſyſtematic view of the ſeveral compounds reſulting from the mixture of theſe ſimple bodies would be agreeable to the public; and on that account the ſecond table was compiled; in which we have followed the ſame general arrangement as in the firſt: Shewing, in the firſt place, the ſeveral bodies with which the vitriolic acid can be combined; then proceeding to the nitrous acid, the muriatic, &c. through all the other claſſes, in the ſame order as in the foregoing table.--- In the firſt column, then, on the left hand, is placed a ſimple body, which can be united with ſome one or more individuals of each of thoſe ſpecies which are put in the ſecond column, and the particular ſubſtance of each ſpecies with which it can be united is put in the third column; after which is placed the name and properties of the compound, the operation by which they are united, &c. And in the enumeration of theſe bodies with which any one can be combined, they are placed in the ſame order as is generally obſerved; beginning with acids, and proceeding to alkalis, oils, ſulphur, &c. through all the claſſes. An example of the manner of reading the table will make all this plain.

At the top of the firſt column, on the left hand, is placed the *Vitriolic Acid,* which can be combined with ſome particular kind of each of thoſe ſpecies of bodies enumerated in the ſecond column, included within the crotchet oppoſite to it. By this it appears that it can be combined with acids, alkalis, oils, ſulphur, alcohol, metals, ſemi-metals, earths, and water. The particular kinds of each claſs with which it can be united are placed in the third column; by which it appears, that of the claſs of acids it can be united with the nitrous acid, and with it form a mixture, the only property of which, that has been obſerved, is, that it readily inflames oils. It likewiſe unites with the muriatic and all other acids, as there mentioned. Under the claſs of alkalis, it appears that it can be united with the vegetable, foſſile, and volatile alkalis. With the firſt of which it forms the ſubſtance called *vitriolated tartar,* and the two other ſubſtances there enumerated, by the operations there mentioned. With the foſſile alkali it forms *Glauber's ſalt;* and with the volatile alkali, *ſecret ſal ammoniac;* by the means there mentioned. All the other articles throughout the table are to be read in the ſame manner.

In the ſame way we proceed through the whole of the table, taking each ſimple chemical body in its order, and, placing it in the firſt column, ſhew what others it can be united with. But it is to be obſerved, that as we advance in the table we put down only the names of thoſe ſubſtances which have been already examined; becauſe under each of theſe the particular mixts formed by this union have been already deſcribed. Thus, looking along the firſt column till you come to *Fixt Alkali,* you find in the ſecond column, at the top of the crotchet belonging to this article, *Acids,* and, following it, Vitriolic, Nitrous, Muriatic, &c. with a reference to the foregoing parts of the table; and if you look back to the article *Vitriolic Acid,* under the article *Alkalis* in the ſecond column, you find both the vegetable and foſſile, with the compounds reſulting from this mixture, ſo that it was unneceſſary to repeat it over again under the article *Alkali.* By the ſame means the union of this with the nitrous and other acids are found under each particular acid. And the ſame method is to be obſerved with regard to every reference to the end of the table.

We once propoſed to have omitted mentioning any of theſe articles which had been already deſcribed, from which the references are made; but were induced to place them as in the table, becauſe by means of theſe it is eaſy to ſee, at one view, all the bodies that any one particular body can be united with; whereas, without this, if any one had wanted to know this particular, he behoved to have turned to every article that preceded it. For example, if the article *Biſmuth* was to be examined with this view; turn to it, in the firſt column near the end; at once you ſee with what particular acids, alkalis, ſulphur, and metals, it can be joined with; whereas if theſe had been here omitted, it would have been neceſſary to have conſulted every article preceding it before you could have known which it could, and which it could not be united with.

It is unneceſſary to ſay much about the uſes that may be made of this table, as they are pretty obvious. The principal one is to ſhow, at one view, what bodies any one can be united with, as in the example juſt now given. Again, if it was wanted to know if any one particular ſubſtance could unite with any other particularly ſpecified, it is here at once ſeen. Let it be (*e. g.*) required to know if copper and zinc can be united; turn to the article *Copper* in the firſt column, and ſearch among the ſemi-metals; you there find *Zinc,* and ſee that this compound forms braſs, prince's-metal, and ſpelter. And in the ſame way any other ſubſtance may be examined. If, on the other hand, by glancing along the compounds (which are here printed in italics) you meet with any particular ſubſtance whoſe compoſition you want to know, it is at once diſcovered. Thus, for example, common nitre has catched your eye, of whoſe compoſition you would wiſh to be informed. By looking to the left hand, you find *Vegetable Alkali* (which in the firſt table is ſhown to be the ſame with *Potaſh*); and by looking to the firſt column oppoſite to it, you find the *Nitrous Acid* (or *Aq. Fortis*); from which you at once are informed that it is compoſed of aq. fortis and potaſh.

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CHEMOSIS, a diſeaſe of the eyes, proceeding from an inflammation, when the white of the eye ſwells above the black, and overtops it to ſuch a degree, that there appears a ſort of gap between them.

Others define it to be an elevation of the membrane which ſurrounds the eye, and is called the white; being an affection of the eye, like white fleſh.

CHENOPODIUM, in botany, a genus of the pentandria digynia claſs. The calix conſiſts of five leaves; it has no corolla; and there is but one lenticular ſeed. There are 18 ſpecies, 13 of which are natives of Britain, *viz.* the bonus henricus, common Engliſh mercury, or all-good; the urbicum, or upright blite; the rubrum, or ſharp-leaved gooſe-foot; the murale, common gooſe-foot, or ſow-bane; the hybridum, or maple-leaved blite; the album, or common orache; the viride, or green blite; the ſerotinum, or late-flowered blite; the glaucum, or oak-leaved blite; the vulvaria, or ſtinking orache; the polyſpermum, round-leaved blite, or all-ſeed; the maritimum, ſea blite, or white glaſs-wort; and the fruticoſum, ſhrub ſtone-crop, or glaſs-wort. The leaves of the vulvaria, or ſtinking orache, are ſaid to be an excellent anti hyſteric.

CHEPELIO, an iſland in the bay of Panama, and province of Darien, in South America, ſituated about three leagues from the city of Panama, which it ſupplies with proviſions: W. long. 81°, N. lat. 9°.

CHEPSTOW, a market-town in Monmouthſhire, ſituated on the river Wye, near its mouth, about ten miles ſouth of Monmouth: W. long. 2° 40′, N. lat. 51° 40′.

CHEQ, or CHERIF, the prince of Mecca, who is, as it were, high-prieſt of the law, and ſovereign pontiff of all the Mahometans, of whatever ſect or country they be. See CALIPH.

The grand ſignior, ſophies, moguls, khans of Tartary, *&c.* ſend him yearly preſents, eſpecially tapeſtry to cover Mahomet's tomb withal, together with a ſumptuous tent for himſelf, and vaſt ſums of money to provide for all the pilgrims during the ſeventeen days of their devotion.

CHERBURG, a port-town of France, in the province of Normandy, ſituated on a bay of the Engliſh channel, oppoſite to Hampſhire, in England: W. long. 1° 40′, N. lat. 49° 45′.

CHEREM, in Jewiſh antiquity, the ſecond and greater ſort of excommunication among the Jews.

The cherem deprived the excommunicated perſon of almoſt all the advantages of civil ſociety: he could have no commerce with any one, could neither buy nor ſell, except ſuch things as were abſolutely neceſſary for life; nor reſort to the ſchools, nor enter the ſynagogues; and no one was permitted to eat or drink with him.

The ſentence of cherem was to be pronounced by ten perſons, or at leaſt in the preſence of ten: but the excommunicated perſons might be abſolved by three judges, or even by one, provided he were a doctor of the law. The form of this excommunication was loaded with a multitude of curſes and imprecations, taken from different parts of the ſcripture.

CHERESOUL, the capital of Curdiſtan, in Aſiatic Turky, and the ſeat of the beglerbeg, or viceroy, of the province: E. long. 45°, N. lat. 36°.

CHERLERIA, in botany, a genus of the decandria trigynia claſs. The calix conſiſts of five leaves; it has five petals leſs than the leaves of the calix, and five bifid nectaria; the antheræ are alternately barren; and the capſule has three cells and as many valves. There is but one ſpecies, *viz.* the ſedoides, a native of Switzerland.

CHERLESQUIOR, in Turkiſh affairs, denotes a lieutenant-general of the Grand Signior's armies.

CHERMES, in zoology, a genus of inſects belonging to the order of inſecta hemiptera. The roſtrum is ſituate on the breaſt; the feelers are longer than the breaſt; the four wings are deflected; the breaſt is gibbous; and the feet are of the jumping kind. There are 17 ſpecies, and the trivial names are taken from the plants which they frequent, as the chermes graminis, or graſs-bug; the chermes ulmi, or elm-bug, *&c.*

CHERRY TREE, in botany. See PRUNUS.

CHERRY-ISLE, in geography, an iſland ſituated in the north or frozen ocean, between Norway and Greenland: E. long. 20°, N. lat 75°.

CHERSO, the capital of an iſland of the ſame name, in the gulf of Venice, and ſubject to the Venetians: E. long 15°, N lat 45° 25′.

CHERSONESUS, among geographers, the ſame with a peninſula. See PENINSULA

CHERTSEY, a market-town of Surry, about ſeven miles weſt of Kingſton: W. long. 30′, N. lat. 51° 25′.

CHERUB, or CHERUBIN, a celeſtial ſpirit, which in the hierarchy is placed next to the ſeraphim. See HIERARCHY.

The ſeveral deſcriptions which the ſcripture gives us of cherubins, differ from one another; but all agree in repreſenting a figure compoſed of various creatures, as a man, an ox, an eagle, and a lion.

CHERVIL, in botany. See CHÆROPHYLLUM.

CHERWEL, a river, which, ariſing in Northamptonſhire, runs ſouthwards by Banbury, and unites its waters with thoſe of the Iſis, near Oxford.

CHESHAM, a market-town of Buckinghamſhire, about nine miles ſouth-eaſt of Aileſbury: W. long. 35′, N. lat. 51° 36′.

CHESHIRE, a maritime county of England, bounded by Staffordſhire on the eaſt, and by the Iriſh ſea on the weſt: its chief commodities are ſalt and cheeſe, the laſt of which is much eſteemed all over Britain.

CHESNUT-TREE, in botany. See FAGUS.

CHESS, an ingenious game, performed with different pieces of wood, on a board divided into ſixty-four ſquares or houſes; in which chance has ſo ſmall a ſhare, that it may be doubted whether a perſon ever loſt but by his own fault.

Each gameſter has eight dignified pieces, *viz.* a king, a queen, two biſhops, two knights, and two rooks; alſo eight pawns: all which, for diſtinction ſake, are painted of two different colours, as white and black.

As

As to their difpofition on the board, the white king is to be placed on the fourth black houfe from the corner of the board, in the firft and lower rank; and the black king is to be placed on the fourth white houfe on the oppofite or adverfary's end of the board. The queens are to be placed next to the kings, on houfes of their own colour. Next to the king and queen, on each hand, place the two bifhops; next to them, the the two knights; and laft of all, on the corners of the board, the two rooks. As to the pawns, they are placed without diftinction, on the fecond rank of the houfe, one before each of the dignified pieces.

Having thus difpofed the men, the onfet is commonly begun by the pawns, which march ftraight forward in their own file, one houfe at a time, except the firft move, when it can advance two houfes, but never moves backwards: the manner of their taking the adverfary's men, is fide-ways, in the next houfe forwards; where having captivated the enemy, they move forward as before. The rook goes forward or crofs-ways through the whole file, and back again. The knight fkips backward and forward to the next houfe, fave one, of a different colour, with a fidling march, or a flope, and thus kills his enemies that fall in his way, or guards his friends that may be expofed on that fide. The bifhop walks always in the fame colour of the field that he is placed in at firft, forward and backward, aflope, or diagonally, as far as he lifts. The queen's walk is more univerfal, as fhe takes all the fteps of the before-mentioned pieces, excepting that of the knight; and as to the king's motion, it is one houfe at a time, and that either forward, backward, floping, or fide-ways.

As to the value of the different pieces, next to the king is the queen, after her the rooks, then the bifhops, and laft of the dignified pieces comes the knight. The difference of the worth of pawns, is not fo great as that of noblemen; only, it muft be obferved, that the king's bifhop's pawn is the beft in the field, and therefore the fkilful gamefter will be careful of him. It ought alfo to be obferved, that whereas any man may be taken, when he falls within the reach of any of the adverfary's pieces, it is otherwife with the king, who, in fuch a cafe, is only to be faluted with the word *check*, warning him of his danger, out of which it is abfolutely neceffary that he move; and, if it fo happen that he cannot move without expofing himfelf to the like inconveniency, it is check-mate, and the game is loft.

CHEST, in commerce, a kind of meafure, containing an uncertain quantity of feveral commodities.

A cheft of fugar, *v. g.* contains from ten to fifteen hundred weight; a cheft of glafs, from two hundred to three hundred feet; of Caftile foap, from two and an half to three hundred weight; of indigo, from one and an half to two hundred weight, five fcore to the hundred.

CHEST, or THORAX, in anatomy. See p. 277.

CHESTER, the capital city of Chefhire, fituated fixteen miles fouth of Liverpool: W. long. 3°, N. lat. 53° 15′. It is a bifhop's fee, and gives the title of earl to the prince of Wales.

New-CHESTER, the capital of a county of the fame name in Penfilvania, in North America, fituated on the river Delawar, fouth of Philadelphia: W. long. 74°, N. lat. 40° 15′. Its harbour is fine and capacious, admitting veffels of any burden.

CHESTERFIELD, a market-town of Derbyfhire, fifteen miles north of Derby, W. long. 1° 25′, N. lat. 53° 20′. It gives the title of earl to a branch of the noble family of Stanhope.

CHEVALER, in the menage, is faid of a horfe when in paffaging upon a walk or trot, his off fore-leg croffes or overlaps the near fore-leg every fecond motion.

CHEVALIER, in a general fenfe, fignifies a knight, or horfeman.

CHEVAUX DE FRISE, in fortification, a large joift, or piece of timber, about a foot in diameter, and ten or twelve in length, into the fides whereof are driven a great number of wooden pins, about fix foot long, armed with iron points, and croffing one another. See FORTIFICATION.

CHEVERON, in heraldry. See CHEVRON.

CHEVIL. See KEVIL.

CHEVIOT, or TIVIOT-HILLS, run from north to fouth through Cumberland, and were formerly the borders or boundaries between England and Scotland, where many a bloody battle has been fought between the two nations, one of which is recorded in the ballad of Chevy-chafe.

CHEVISANCE, in law, denotes an agreement or compofition, as an end or order fet down between a creditor and his debitor, *&c.*

In our ftatutes, this word is moft commonly ufed for an unlawful bargain, or contract.

CHEVRON, or CHEVERON, in heraldry, one of the honourable ordinaries of a fhield, reprefenting two rafters of an houfe, joined together as they ought to ftand; it was anciently the form of the priefteffes head attire: fome fay, it is a fymbol of protection; others, of conftancy; others, that it reprefents knights fpears, *&c.* It contains the fifth part of the field, and is figured as in Plate LV. fig. 3.

A chevron is faid to be abafed, when its point does not approach the head of the chief, nor reach farther than the middle of the coat; mutilated, when it does not touch the extremes of the coat; cloven, when the upper pieces are taken off, fo that the pieces only touch at one of the angles; broken, when one branch is feparated into two pieces; couched, when the point is turned towards one fide of the efcutcheon; divided, when the branches are of feveral metals, or when metal is oppofed to colour; inverted, when the point is turned towards the point of the coat, and its branches towards the chief.

Per CHEVRON, in heraldry, is when the field is divided only by two fingle lines, rifing from the two bafe points, and meeting in the point above, as the chevron does.

CHEVRONED,

CHEVRONED, is when the coat is filled with an equal number of chevrons, of colour and metal.

CHEVRONEL, a diminutive of chevron, and as such only containing half a chevron.

CHEVRONNE, or CHEVRONNY, signifies the dividing of the shield several times chevron-wise.

CHEWING-BALLS, a kind of balls made of asafœtida, liver of antimony, bay-wood, juniper-wood, and pellitory of Spain; which being dried in the sun, and wrapped in a linen-cloth, are tied to the bit of the bridle for the horse to chew: they create an appetite; and it is said, that balls of Venice treacle may be used in the same manner with good success.

CHIAMPA, the south division of Cochin-china, a country of the East-Indies.

CHIAN *earth*, in pharmacy, one of the medicinal earths of the ancients, the name of which is preserved in the catalogues of the materia medica, but of which nothing more than the name has been known for many ages in the shops.

It is a very dense and compact earth, and is sent hither in small flat pieces from the island of Chios, in which it is found in great plenty at this time. It stands recommended to us as an astringent. They tell us, it is the greatest of all cosmetics, and that it gives a whiteness and smoothness to the skin, and prevents wrinkles, beyond any of the other substances that have been celebrated for the same purposes.

CHIAPA, the capital of a province of the same name in Mexico, situated about 300 miles east of Acapulco: W. long. 98°, N. lat. 16° 30′.

CHIARASCO, a fortified town of Peidmont in Italy, situated on the river Tanaro, twenty miles south-east of Turin, and subject to the king of Sardinia: E. long. 7° 45′, N. lat. 44° 40′.

CHIARENZA, a port-town of the north-west coast of the Morea, opposite to the island Zant, in the Mediterranean, and subject to the Turks: E. long. 21° 15′, N. lat 37° 35′.

CHIARO-SCURO, among painters. See CLARO-OBSCURO.

CHICHESTER, the capital city of Sussex, situated fifty-two miles south-west of London, and twelve miles east of Portsmouth: W. long. 50′, and N. lat. 50° 50′. It is a bishop's see, and sends two members to parliament.

New CHICHESTER, a port-town of Pensilvania, situated on the river Delawar, below Chester. See CHESTER.

CHICK, or CHICKEN, in zoology, denotes the young of the gallinaceous order of birds, especially the common hen. See PHASIANUS.

CHICKEN-*pox*. See *Small*-POX, and MEDICINE.

CHICK-*weed*, in botany. See ALSINE.

CHICKLING-*pea*, in botany, a name given to the lathyrus. See LATHYRUS.

CHICUITO, or CUYO, a province of South America, bounded by the province of La Plata on the northeast, and by Chili on the west.

CHIDLEY, or CHIMLEY, a market-town of Devonshire, about eighteen miles north-west of Exeter: W. long. 4°, N. lat. 51°.

CHIEF, a term signifying the head or principal part of a thing or person. Thus we say, the chief of a party, the chief a family, *&c.*

CHIEF, in heraldry, is that which takes up all the upper part of the escutcheon from side to side, and represents a man's head. See Plate LXV. fig. 4.

It is to take up just the third part of the escutcheon, as all other honourable ordinaries do, especially if they are alone on the shield; but if there be several of them, they must be lessened in proportion to their number, and the same holds when they are cantoned, attended and bordered upon by some other figures; then the painter or engraver may be allowed to bring them into a smaller compass, to the end that all that is represented about the ordinaries may appear with some proportion and symmetry. Chiefs are very much varied, for they may be couvert, supported, crenellé, surmounted, abaisé, rempli, dentillé, engreslé, canellé, danché, nebulé, fleurdelezée, fleuronné, vair, echequeté, lozangé, burellé, patté, fretté, gironné, chaperonné, chappé, mantelé, emmanché, chaussé, vestu or revestu. See COUVERT, SUPPORTED, *&c.*

In CHIEF, imports something borne in the chief part or top of the escutcheon.

CHIEF *lord*, the feudal lord, or lord of an honour on whom others depend.

CHIEF-*justice of the king's bench and common pleas.* See JUSTICE.

CHIEFTAIN, denotes the captain, or chief, of any class, family, or body of men: thus, the chieftains, or chiefs, of the highland clans, were the principal noblemen or gentlemen of their respective clans.

CHIERI, a fortified town of Peidmont in Italy, situated eight miles east of Turin: E. long. 7° 45′, N. lat. 44° 50′.

CHILBLAINS, in medicine. See PERNIO.

CHILD-*bed.* } See MIDWIFERY.
CHILD-*birth.* }

CHILDERMAS-*day*, or INNOCENT'*s-day*, an aniversary held by the church, on the 28th of December, in commemoration of the children at Bethlehem, massacred by order of Herod.

CHILI, a province of south America, bounded by Peru on the north, by the province of La Plata on the east, by Patagonia on the south, and by the Pacific ocean on the west; lying between 25° and 45° S. lat. and between 75° and 85° W. long. But some comprehend Patagonia in Chili, extending it to cape Horn, in 57° 30′ S. lat.

CHILIAD, denotes a thousand of any things, ranged in several divisions, each whereof contains that number.

CHILIARCHA, or CHILIARCHUS, in antiquity, a military officer, who had the command of a thousand men.

CHILIASTS, in church-history. See MILLENARIANS.

CHILMINAR, CHELMINAR, or TCHELMINAR, the most beautiful piece of architecture remaining of all antiquity, being the ruins of the famous palace of Persepolis, to which Alexander the Great, in a drunken fit, set fire, at the instigation of Thais the courtezan:

the word comes from the Perfian *tchehle minar*, that is to fay, forty towers.

Don Garcias de Silva Figueroa, Pietro della Valle, Sir John Chardin, and Le Brun, have been very particular in defcribing thefe ruins.

There appear, fay they, the remains of near fourfcore columns, the fragments of which are at leaft fix feet high; but there are only nineteen can be called entire, with another detached from the reft, about an hundred and fifty paces: a rock of hard black marble ferves as a foundation to the edifice: the firft plan of the houfe is afcended to by ninety-five fteps, all cut in the rock; the gate of the palace is about twenty feet wide, with the figure of an elephant on one fide, and that of a rhinoceros on the other, thirty feet high, and both of polifhed marble: near thefe animals there are two columns, and not far from thence the figure of a pegafus. After paffing this gate, are found fragments of magnificent columns in white marble, the fmalleft of which are fifteen cubits high, the largeft eighteen, having forty flutings three full inches wide each; from whence we may judge of their thicknefs and other proportions. Near the gate is feen an infcription on a fquare piece of black marble, containing about twelve lines; the characters are of an extraordinary figure, refembling triangles, or pyramids: befides this, there are other infcriptions, the characters of which refemble the Hebrew, Chaldaic, or Syriac; others the Arabic or Perfian; and others, in fine, the Greek characters. Dr Hyde, who hath explained the Greek infcription, by fupplying fome words that are effaced, obferves, that the infcriptions are engraved very negligently, and perhaps by fome foldiers; or if they are the work of an engraver, he thinks that he was from Palmyra, and confequently that they are in the Phœnician tongue: he adds, that as they are in praife of Alexander, they were probably done in the time of that conqueror.

CHILTERN, a chain of chalky hills, running from eaft to weft through Buckinghamfhire.

CHIMÆRA, in geography, a port town of Turky in Europe, fituated at the entrance of the gulph of Venice, in the province of Epirus, about thirty-two miles north of the city Corfu, near which are the mountains of Chimæra, which divide Epirus from Theffaly: E. long. 20° 40′, and N. lat. 40° 20′.

CHIMAY, the name of a great lake, lying in the province of Acham, between the Eaft-Indies and China.

CHIMERA, a fabulous monfter, which the poets feign to have the head of a lion, the body of a goat, and the tail of a dragon; and add, that this odd beaft was killed by Bellerophon. The foundation of the fable was, that in Lycia there was a burning mountain, or vulcano, of this name: that the top of this mountain was feldom without lions, nor the middle, which had very good grafs, without goats; that ferpents bred at the bottom, which was marfhy; and that Bellerophon rendered the mountain habitable.

By a chimera, among the philofophers, is underftood a mere creature of the imagination, compofed of fuch contradictions and abfurdities as cannot poffibly any where exift but in thought.

CHIMES *of a clock*, a kind of a periodical mufic, produced at equal intervals of time, by means of a particular apparatus added to a clock.

CHIMNEY, in architecture, a particular part of a houfe, where the fire is made, having a tube or funnel to carry away the fmoke. See ARCHITECTURE.

CHINA, including Chinefe Tartary, a large empire, fituated between 95° and 135° E. long. and between 21° and 55° N. lat. being accounted two thoufand miles in length, and one thoufand five hundred in breadth; it is bounded by Ruffian Tartary on the north, by the Pacific ocean on the eaft and fouth, and by Tonquin, Tibet, and the territories of Ruffia on the weft. It is ufually divided into fixteen provinces, which will be defcribed in their alphabetical order. In thefe provinces there are computed to be one hundred and fifty-five capital cities, one thoufand three hundred and twelve of the fecond rank, two thoufand three hundred and fifty feven fortified towns, and upwards of ten millions of families, which may amount to about fifty millions of people.

The principal commodities of this country are filk, tea, China ware, Japan-ware, and gold duft; of all which the maritime ftates of Europe import great quantities, fending them filver in return.

CHINA-*root*, in pharmacy, a medicinal root, brought both from the Eaft and Weft Indies, thence diftinguifhed into oriental and occidental; it is the root of a fpecies of fmilax. See SMILAX.

CHINA-*ware*. See PORCELAIN.

CHINCA, a port-town of Peru, in South America, fituated in an extenfive valley, on a river of the fame name, about fixty miles fouth of Lima: W. long. 76°, and S. lat. 13°.

CHIN COUGH, a convulfive kind of cough, which children are chiefly fubject to. See MEDICINE.

CHINESE, in general, denotes any thing belonging to China. See CHINA.

It is obferved by fome, that the Chinefe language has no analogy with any other language in the world: it only confifts of three hundred and thirty words, which are all monofyllables, at leaft they are pronounced fo fhort that there is no diftinguifhing above one fyllable or found in them; but the fame word, as pronounced with ftronger or weaker tone, has different fignifications; accordingly, when the language is accurately fpoke, it makes a fort of mufic, which has a real melody, that conftitutes the effence and diftinguifhing character of the Chinefe tongue.

As to the Chinefe characters, they are as fingular as the language; the Chinefe have not, like us, any alphabet, containing the elements, or, as it were, the principles of their words: inftead of an alphabet they ufe a kind of hieroglyphics, whereof they have above eighty thoufand.

As the Chinefe pretend to an antiquity both with regard to their nation and arts, far beyond that of any other nation, it will not perhaps be unacceptable to give

give a ſhort view of theſe pretenſions, principally extracted from their own writers. But, when any thing is quoted from the Chineſe hiſtory, it is abſolutely neceſſary to attend, 1. To the times purely fabulous and mythological; 2. To the doubtful and uncertain times; and, 3. To the hiſtorical times, when the Chineſe hiſtory, ſupported by indiſputable monuments, begins to proceed on ſure grounds.

1. Some aſcribe to Tiene-hoang, a book in eight chapters, which contains the origin of letters. They add, that the characters uſed by the Sane hoang were natural, without any determinate form, that they were nothing but gold and precious ſtones.

Lieou-jou, author of Ouai-ki, ſays, that Tiene-hoang gave names to the ten *KANE*, and to the twelve *TCHI*, to determine the place of the year: this is meant of the cyclic characters.

Tiene-hoang ſignifies emperor of heaven. They call him alſo *Tiene ling*, the intelligent heaven; *Tſee jun*, the ſon who nouriſhes and adorns all things; and finally *Tchong-tiene-hoang-kune*, the ſupreme king of the middle heaven, *&c.* This Tiene-hoang ſucceeded Pouane-cou.

The Ouai-ki ſays, that Ti-hoang (emperor of the earth), the ſucceſſor of Tiene-hoang, divided the day and the night, and appointed thirty days to make one moon. The book Tong li, quoted in Lopi, adds further, that this emperor fixed the winter-ſolſtice to the eleventh moon. A proof that the Chineſe year was originally very incorrect, and that the courſe of it was regulated only by that of the ſeaſons, is, that for a long time, to expreſs a year, they ſaid a change of the leaves.

This Ti-hoang, ſay they, was father of Tiene-hoang, and of Gine-hoang who follows.

They give Gine-hoang (ſovereign of men) nine brothers, and pretend, that they divided the government among them. They were nine brothers (ſays Yuene-leoa-ſane) who divided the earth among them, and built cities, which they ſurrounded with walls. It was under this prince (ſays Lopi), that there firſt began to be a diſtinction between the ſovereign and the ſubject; they drank, they eat, and the two ſexes united.

After theſe three emperors which we have juſt now named, they place the period named *Ou-long* (the five Long or dragons) compoſed of five different families. But they do not tell us their names, nor the duration of their reigns. In theſe times (ſays an author) men dwelt in the bottom of caves, or perched upon trees as it were in neſts. This fact contradicts the invention of building cities, and ſurrounding them with walls, which they place under the reign of Gine-hoang; but we will meet with many ſuch contradictions in the ſequel.

They ſay nothing of the third Ki. Of the fourth, named *Ho lo*, and compoſed of three families, they ſay, that the Ho-lo taught men to retire into the hollows of rocks. This is all they ſay of it. Neither do they ſay any thing of the fifth Ki, named *Liene tong*, and compoſed of ſix families; of the ſixth Ki, named *Su ming*, and compoſed of four families.

It is a folly to dwell upon the epocha of theſe ſix Ki; nothing is more abſurd. Lopi cites an author who generouſly gives them 1,100,750 years duration; Lopi ſays himſelf, that the five firſt Ki after Gine hoang make in all 90,000 years.

The ſeventh Ki is named *Sune-fei*, and comprehends twenty-two families. But they ſay nothing under all theſe reigns that has any relation to the arts or ſciences. Only under the twenty-ſecond and laſt, named *Tſee-che-chi*, they ſay, that it was not till then men ceaſed to dwell in caves. Is it not a palpable abſurdity, that after ſo many ages, and under kings of whom they relate ſo many wonders, they had not yet found out the art of building huts to ſhelter them from the winds and rains!

The eighth Ki, named *Yne-ti*, contains thirteen families or dynaſties. Tchine-fang-chi, the firſt of this period, reigned after Tſee-che-chi, and founded the firſt family. They ſay, that at the beginning men covered their bodies with leaves and herbs; ſerpents and beaſts were very numerous; the waters which had overflowed, were not yet returned into their channels; and the miſery of mankind was extreme. Tchine-fang taught men to prepare ſkins, to take off the hair with rollers of wood, and uſe them againſt the winds and froſt which incommoded them very much. He taught them alſo to make a kind of web of their hair, to ſerve them as a covering to their heads againſt the rain. They obeyed him with joy; he called his ſubjects *people clothed with ſkins*; he reigned 350 years. To Tchine-fang-chi ſucceeded Chou-chane-chi, then Hai-kouei-chi, of whom they ſay nothing which has any relation to our ſubject.

The fourth prince, who alſo ſucceeded Hai-kouei-chi, was named *Hoene-tune*; he founded the fourth dynaſty, (for each of theſe princes which we have juſt now mentioned, was the founder of a family or dynaſty.) In the hiſtory of this king, Lopi quotes Lao-chene-tſee, who ſpeaks thus:

"The ancient kings wore their hair diſhevelled, without any ornament upon their heads. They had neither ſceptre nor crown, and they governed their people in peace. Being of a beneficent diſpoſition, they cheriſhed all things, and put no perſon to death. Always giving, and never receiving any thing, their ſubjects, without dreading their power as maſters, revered their virtue in their hearts. Then heaven and earth obſerved a moſt beautiful order, and every thing flouriſhed in a ſurpriſing manner. The birds built their neſts ſo low, that they might be reached with the hand; all the animal creation tamely ſubmitted to the will of man. Then the juſt medium was obſerved, and harmony reigned over all. They did not reckon the year by the days. There was no diſtinction between within and without, between mine and thine. In this manner reigned Hoene-tune. But when mankind had degenerated from this happy ſtate, birds and beaſts, inſects and ſerpents, all together, and as it were in concert, made war againſt them."

To this dynaſty of Hoene-tune, ſucceeded that of Tong-hou-chi, containg ſeven kings which are not named. To this fifth dynaſty ſucceeded the ſixth, whoſe founder was Hoang-tane-chi.

The 7th, the dynaſty of Ki-tong-chi *.

The 8th, the dynaſty of Ki-y-chi *.

The

The 9th, the dynaſty of Ki-kiu-chi *.

The 10th, the dynaſty of Hi-ouei-chi *.

The 11th, the dynaſty of Yeou-tſao-chi.

The 12th, the dynaſty of Soui-gine.

The 13th and laſt, the dynaſty of Yong-tching-chi.

Of theſe ſeven kings, or founders of dynaſties, which remain to be conſidered to complete the number of dynaſties included in this eighth period, nothing is ſaid of thoſe marked * that has any relation to our ſubject.

As to Yeou-tſao-chi, founder of the eleventh dynaſty, whoſe reign, ſay they, laſted more than 300 years, and whoſe family, they add, continued more than 100 generations during the ſpace of 12 or 18,000 years: here is what we find recorded.

Hane-tſee ſays, that, in the firſt ages of the world, animals multiplied very faſt; and that men being but few, they could not ſubdue the beaſts and ſerpents.

Yene-tſee ſays alſo, that the ancients, either perched on trees, or ſtretched in hollow caves, poſſeſſed the univerſe, (Tiene-hia, that is to ſay, China). Theſe good kings (continues he) breathed nothing but charity without any ſhadow of hatred. They gave much, and took nothing. The people did not go to pay their court to them, but all the world ſubmitted to their virtues.

Lopi and Ouai-ki ſay almoſt in the ſame words, that, in the moſt remote antiquity, men ſheltered themſelves in the hollows of rocks, that they dwelt in deſerts, and lived in ſociety with all the other creatures. They had no thought of doing any injury to the beaſts, and the beaſts did not think of hurting them. But in the ſucceeding ages they became too wiſe, which made the animals rebel; armed with claws, teeth, horns, and venom, they aſſaulted man, and man was not able to reſiſt them. Yeou tſao reigned then. He was the firſt who built houſes of wood, in the form of birds neſts; he perſuaded men to retire into them to avoid the wild beaſts. They did not know as yet how to cultivate the earth, they lived on herbs and fruits. They drank the blood of animals, they devoured their fleſh quite raw, they ſwallowed the hair and the feathers. This is what they ſay of Yeou-tſao chi: after him comes Soui gine, founder of the 12th dynaſty.

Soui-gine chi is eſteemed the inventor of fire.

On the ſummit of the mountain Pou-tcheou, ſays an author, are to be ſeen the walls of Juſtice. The ſun and the moon cannot approach them; there is no difference of ſeaſons there, nor viciſſitudes of days and nights. This is the kingdom of light on the confines of Siouang mou. A ſaint (a great man) went to make a tour beyond the bounds of the ſun and moon: he beheld a tree, and upon that tree a bird, who made fire come out of it by picking it. He was ſurpriſed at this; he took a branch of this tree, and from thence ſtruck fire; from whence they called this great perſonage *Soui-gine*.

Other authors ſay alſo, that Soui-gine made fire with a certain kind of wood, and taught men to dreſs their victuals. By this means all diſeaſes, and all diſorders of the ſtomach and bowels were prevented. In this he followed the direction of heaven, and from thence was named *Soui-gine*.

They ſay further, that, in the days of Soui-gine, there was much water upon the earth, and that this prince taught men the art of fiſhing. He muſt, of conſequence, have invented nets or lines, which invention is after this aſcribed to Fou-hi.

One Long ma, or Dragon-horſe, brought him a kind of table, and the tortoiſe letters. Soui-gine is the firſt to whom they apply this event, but the ſame thing will be ſaid in the ſequel of ſeveral others.

Soui-gine was the firſt who gave names to plants and animals; and theſe names (ſay they) were ſo expreſſive, that the nature of every thing was known by its name. He invented weights and meaſures for the regulation of commerce, which had been unknown before him.

Anciently (ſays an author) men married at fifty, and women at thirty years of age: Soui-gine ſhortened this period, and appointed that young men ſhould marry at thirty, and girls at twenty.

Laſtly, the Liki ſays, that it was Soui-gine who firſt taught men urbanity and politeneſs.

It now remains to ſpeak of Yong tching-chi, the founder of the thirteenth and laſt dynaſty of this period.

In his time, they uſed ſlender cords on which they tied various knots, and this ſerved them inſtead of writing. But, after the invention of letters, how could they return again to the uſe of theſe cords, which is ſo limited and imperfect? This evidently implies a contradiction?

We come now to the ninth Ki or period, named *Chene-tong*. This ninth period will bring us down to the times of Fou hi. It comprehends twenty-one kings, whoſe names are as follow:

1. Sſe hoang, or Tſan hie,	12. Hiene-yuene,
2. Pe-hoang-chi,	13. He ſou,
3. Tchong hoang-chi,	14. Kai-tiene,
4. Tai-ting-chi,	15. Tſune liu chi,
5. Kouene liene,	16. Tcho jong,
6. Yene-chi,	17. Hao-yng,
7. Tai chi,	18. Yeou-tſao-chi,
8. Tching hoei-chi,	19. Tchu-ſiang-chi,
9. Li lou, or Hoei-chi,	20. Yne khang-chi,
10. Sohoang chi,	21. Vou hoai-chi.
11. Nuei-touane-chi,	

Liu-pou-ouei ſays plainly, that Sſe-hoang made letters. This Sſe-hoang, is called alſo *Tſang hie*. Some hiſtorians place him under Hoang-ti, whoſe miniſter they make him; while others make him a ſovereign prince, and much anterior to Hoang-ti.

The firſt inventor of letters was Tſang-hie, then the king Vou-hoai made them be engraved on the coin, and Fou-hi uſed them in the public acts for the government of the empire. But obſerve, that theſe three emperors were even before Chini-nong; how can it be ſaid then, that letters were not invented till under Hoang-ti? Such is the reaſoning of Lopi, who was quite confounded with theſe fabulous times.

To this criticiſm it may be anſwered, You have told us, that letters had been invented in the reign of Soui-gine, the 12th king of the eighth period; how then can you pretend to give the honour of this invention to

Tſang-

Tſang-hie, who, according to your own teſtimony, did not flouriſh till the ninth period? However this may be, Sſee-hoan (ſay ſome romancers) knew to form letters the moment he was born. He was endowed with great wiſdom, *&c.* After he had received the Ho-tou, he viſited the ſouth, went upon mount Yang-yu, and ſtopped on the bank of the river Lo. A divine tortoiſe carrying blue letters upon his ſhell, delivered them to him: then Sſee-hoang penetrated all the changes of heaven and earth; above he obſerved the various configurations of the ſtars; below he examined all the marks he had ſeen upon the tortoiſe; he viewed the plumage of birds, he took notice of the mountains, and of the rivers which flow from them, and of all this he compoſed letters. Some very learned Chineſe think, that this was the ancient kind of writing named *Ko-teou-chu*, which continued (ſay they) to the reign of the emperor Suene-ouang, that is, to the year 827 before J. C.

But Cong-yng-ta very well obſerves, that though the external figures of the letters have changed ſeveral times in ſome things, the ſix rules on which Tſang-hie formed them, have never ſuffered any change.

Then (continues Lopi) there was a difference between the ſovereign and the ſubject, relation between the father and the ſon, diſtinction between the precious and the vile; laws appeared, rites and muſic reigned. Puniſhments were inflicted with vigour. Thus Sſee-hoang laid the foundations of good government, he appointed officers for each affair, the ſmalleſt did not eſcape him; and thus heaven and earth arrived at their full perfection.

They ſay nothing of the ſucceſſor of Sſee-hoang which has any relation to our ſubject; but they ſay, that, under the reign of Tchong-hoang-chi, the third king of this period, they ſtill uſed ſlender cords for writing.

From this prince we come at once to Hiene-yuene, the 12th in order of this period, becauſe nothing is ſaid of his predeceſſors.

We find a great many things under the reign of this prince, becauſe he is the ſame with Hoang-ti, or at leaſt they have confounded theſe two princes together.

They aſcribe to Hiene-yuene the invention of cars. He joined two pieces of wood together, the one placed upright, and the other acroſs, to the honour of the Moſt High. It is from this he is called *Hiene-yuene.* The piece of wood placed acroſs is called *hiene*, and that which is placed upright is called *yuene.* Hiene-yuene ſtruck copper money, and made uſe of the balance to determine the weight of things. By this means he ruled the world in peace. *Ho* ſignifies merchandiſe in general. Formerly they wrote ſimply *hoa*, which ſignifies exchange. Theſe merchandiſes (ſay they) conſiſted in metal, *kine*, in precious ſtones, *yu*, in ivory, *tchi*, in ſkins, *pi*, in coined money, *tſuene*, and in ſtuffs, *pou*, &c.

They then denominated money (as is done ſtill) by the name of the reigning family. That of Hiene-yuene was one inch ſeven lines, and weighed twelve *tchu*, [the *tchu* is the 20th part of a *yo*, and a *yo* weighs 1200 little grains of millet]. They then ingraved letters on their money (as is ſtill done at preſent.) It is for this reaſon that *ven-tſee*, letters, ſignifies alſo a piece of money, which is called likewiſe *kini*, and *tſuene*, and *tao.*

Tcho-jong (16th emperor of the 9th period) hearing, at Cane-tcheou, the ſinging of birds, compoſed a muſic of union, whoſe harmony penetrated every where, touched the intelligent ſpirit, and calmed the heart of man, in ſuch a manner, that the external ſenſes were ſound, the humours in equilibrio, and the life very long. He called this muſic *Tſie-ouene*, that is to ſay, temperance, grace, and beauty.

But the deſign, and in ſome ſort the only aim of the ancient muſic of the Chineſe, according to their authors, was the harmony of the virtues, the moderation of the paſſions, elegance of manners, and, in a word, every thing that can contribute to the perfection of a good and wiſe government, *&c.* For they were perſuaded that muſic was capable of working all theſe miracles. It is difficult for us to believe them in this, eſpecially when we conſider the muſic which is at preſent uſed among them. But we appeal to the Greeks, who related as aſtoniſhing effects from this agreeable invention, whilſt the modern Greeks, like moſt part of the Orientals, have no muſic but a wretched and contemptible monotony.

The 17th king of the 9th period is named *Hao-yng.* In his time they cut down the branches of trees to kill beaſts with. Men were few. Nothing but vaſt foreſts were every where to be ſeen, and theſe frightful woods were filled with wild beaſts. How contradictory is this, and how incompatible with the times in which this prince is ſaid to have reigned!

The 18th king of the 9th period is called *Yeou-tſao-chi.* We have ſeen in the preceeding period, a prince of the ſame name. The Ouai-ki places this king at the beginning of the laſt ki, and gives him for ſucceſſor Souigine. At this rate, nine entire periods, or ki, muſt have elapſed before men knew how to build huts, or had the uſe of fire. Lopi follows another method: he has ranged Yeou-tſao-chi and Soui-gine in the preceeding period; and although the king we are now ſpeaking of bears the ſame name, he ſpeaks of him quite differently.

The 19th king of the 9th period is named *Tchu-ſiang-chi.*

They ſay, that he commanded Sſee-kouei to make a kind of guitar with five ſtrings named *ſe*, to remedy the diſorders of the univerſe, and preſerve every thing that had life.

The 20th king of the 9th period is named *Yne-khang-chi.*

In his time, the waters did not flow, the rivers did not purſue their uſual courſe, which occaſioned a great number of diſeaſes.

Yne-khang inſtituted the dances called *Ta-vou* (grand dances), with a view to preſerve health: for, as Lopi ſays, when the body is not in motion, the humours have not a free courſe; matter is amaſſed in ſome part, from whence come diſeaſes, which all proceed from ſome obſtruction.

The Chineſe alſo imagine, that a man's virtues may be known by his manner of touching the lute and drawing the bow, *&c.*

Thus the Chineſe make dances as well as muſic have a reference to good government; and the Liki ſay, that

that we may judge of a reign by the dances which are uſed in it.

The 21ſt and laſt king of the 9th period is named *Vou-hoai-chi*; but they relate nothing of this prince which is worthy of notice.

2. This is all that the fabulous times contain. If theſe times cannot enable us to fix the real epocha of various inventions, (as the Chineſe are ſo full of contradictions about the time of theſe different diſcoveries), we ſee at leaſt from them, that the origin of arts has been much the ſame among them as among other nations. We are now come down to Fou-hi, who is conſidered by the Chineſe hiſtorians as the founder of their monarchy. What they ſay of this prince and his ſucceſſors, has ſome more ſolidity in it than what we have hitherto ſeen.

FOU-HI.

The Ouai-ki, quoted in the Chineſe annals, thus deſcribes the manners of mankind in theſe days. "In the beginning, men differed nothing from other animals in their way of life. As they wandered up and down in the woods, and women were in common, it happened that children never knew their fathers, but only their mothers. They abandoned themſelves to luſt without ſhame, and had not the leaſt idea of the laws of decency. They thought of nothing but ſleeping and ſnoring, and then getting up and yawning. When hunger preſſed them, they ſought for ſomething to eat; and when they were glutted, they threw the reſt away. They eat the very feathers and hair of animals, and drank their blood. They clothed themſelves with ſkins quite hairy. The emperor Fou-hi began by teaching them to make lines for catching fiſh, and ſnares for taking birds. It was for this, that this prince was named *Fou hi-chi*. He taught them further to feed domeſtic animals, and to fatten them for ſlaughter; for which they gave him the ſirname of *Poa-hi-chi*."

It ſeems evident, that the ancient Chineſe had at firſt no other habitation than caves, the hollows of rocks, and natural dens. They were then infected with a kind of inſect or reptile called *iang*; and when they met, they aſked one another, Are you troubled with *iangs?* To this day they make uſe of this expreſſion, in aſking after any perſon's health; *Couei-iang?* What diſeaſe have you? How do you do? *Vou-iang*, I am without *iang*; that is to ſay, I am hearty, in perfect health, without any ailment.

It would be ſuperfluous to relate here, what the Chineſe ſay, in their annals, of the invention of characters, and of *coua*, after what hath been ſaid by F. Couplet and ſo many others on that ſubject. We ſhall only add, that the treatiſe *Hit-ſee* bears, that, at the beginning nations were governed by means of certain knots which they made on ſlender cords: that afterwards the ſaint introduced writing in their place, to aſſiſt the mandarins in performing all their offices, and the people in examining their conduct; and that it was by the ſymbol *Kouai*, that he conducted himſelf in the execution of his work.

Lopi, whom we have ſo often quoted already, ſays, that Fou-hi extracted from the ſymbol of ſix lines every thing that concerned good government. For example, *Li* gave him the hint of making lines for hunting and fiſhing, and theſe lines were a new occaſion of inventing ſtuffs for garments. Lopi adds, that it is a miſtake to imagine, that, in the times of Fou-hi, they ſtill uſed cords tied and knotted, and that books were not introduced till under Hoang-ti.

Fou-hi taught men to rear the ſix domeſtic animals, not only for food, but alſo for victims, in the ſacrifices which they offered to *Chine*, and to *Ki*. They pretend that Fou-hi regulated the rites *Kiao-chene*.

Fou-hi alſo inſtituted marriage: before this the intercourſe of the ſexes was indiſcriminate; he ſettled the ceremonies with which marriages were to be contracted, in order to render this great foundation of ſociety reſpectable. He commanded the women to wear a different dreſs from that of the men, and prohibited a man's marrying a woman of the ſame name, whether a relation or not, a law which is actually ſtill in force.

Fou-hi appointed ſeveral miniſters and officers to aſſiſt him in the government of the empire.

One of theſe officers made the letters, another drew up the calendar, a third built the houſes, a fourth practiſed medicine, a fifth cultivated the ground, a ſixth was the maſter of the woods and waters.

They pretend that Fou-hi applied himſelf very much to aſtronomy. The Tcheou-pi-ſouane ſays, that he divided the heavens into degrees. Lopi takes notice, that properly the heavens have no degrees, but that this term is uſed with relation to the path of the ſun in the courſe of a year.

The period of ſixty years is reckoned due to Fou-hi. The Tſiene-piene ſays plainly, that this prince made a calendar to fix the year, and that he is the author of Kia-tſe. The Sane-fene ſays the ſame thing; and the Hane-li-tchi ſays, that Fou-hi made the firſt calendar by the Kia-tſe; but the Chi-pene aſcribes this to Hoang-ti. This is one of theſe contradictions ſo common in the Chineſe hiſtorians.

The ſame Fou-hi, they ſay, made arms, and ordained puniſhments. Theſe arms were of wood, thoſe of Chin-nong were of ſtone, and Tchi-yeou made ſome of metal.

Fou-hi drained off the waters, and ſurrounded the cities with walls. In the mean time, as Chin-nong is eſteemed the firſt who made walls of ſtone, we muſt ſuppoſe that thoſe raiſed by Fou-hi were only of earth or brick.

Fou-hi gave rules to muſic. Thoſe who aſcribe this fine art to Hoang-ti are deceived (or *vice verſa.*) After Fou-hi had invented fiſhing, he made a ſong for the fiſhers. It was from his example that Chin nong made one for the labourers.

Fou-hi took of the wood of Tong; he made it hollow; and of it made a *kine* (a lyre, or what you pleaſe to tranſlate it) ſeven feet two inches long; the ſtrings were of ſilk, to the number of 27; he commanded this inſtrument to be named *Li*. Others ſay it had but 25 ſtrings,

ſtrings, others 10, and others only 5; (which of them ſhall we believe?) Beſides, others make this inſtrument only three feet ſix inches ſix lines in length.

Fou-hi made this inſtrument, ſay ſome, to ward off inchantments, and baniſh impurity of heart.

He took of the wood of *ſang*, and made alſo a guitar of 36, or rather of 50 ſtrings. This inſtrument ſerved to adorn the perſon with virtues, and to regulate the heart, &c. Laſtly, he made a third inſtrument of baked earth; after which, ſay they, ceremonies and muſic were in high eſteem.

The money which Fou-hi introduced, was of copper, round within to imitate heaven, and ſquare without to reſemble the earth.

He himſelf made trial of many medicinal plants (This is moſt commonly ſaid of Chin nong: but it is pretended, that Chin-nong finiſhed what Fou-hi had begun.)

This is all we read of Fou-hi. Several contradictions will be remarked in moſt of theſe traditions, eſpecially when we come to ſee in the ſequel, that almoſt all theſe inventions are aſcribed to the ſucceſſors of Fou-hi. From hence may be judged what regard is due to the beginnings of the Chineſe hiſtory.

We have ſtill ſome reigns to examine, before we have done with the fabulous and uncertain times.

They ſay of Koung-koung, that he employed iron in making hangers and hatchets.

They aſcribe to Niu-oua (who is the Eve of the Chineſe) ſeveral inſtruments of muſic. The inſtruments *ſeng* and *hoang* ſerved her, ſay they, to communicate with the eight winds. By means of *kouene*, or double flutes, ſhe united all ſounds into one, and made concord between the ſun, moon, and ſtars. This is called *perfect harmony*. Niu-oua had a guitar (*ſe*) of five ſtrings; ſhe made another of 50 ſtrings, whoſe ſound was ſo affecting, that it could not be borne; wherefore ſhe reduced theſe 50 ſtrings to 25, to diminiſh its force.

The emperor Chin-nong is very famous among the Chineſe, by the great diſcoveries which, they ſay, he made in medicine, agriculture, and even in the military art, ſince they believe, that, in the times of *Han*, they had a book of this prince on the military art.

A fondneſs for the marvellous has made ſome ſay, that, at three years of age, he knew every thing that concerned agriculture. The very name *Chin-nong*, in the Chineſe language, ſignifies, *the ſpirit of huſbandry*. Chin-nong took very hard wood, of which he made the coulter of the plough, and ſofter wood of which he made the handle. He taught men to cultivate the earth. They aſcribe to him the invention of wine. He ſowed the five kinds of grains on the ſouth of Mount Ki, and taught the people to make them their food.

Chin-nong commanded that they ſhould be diligent in gathering the fruits which the earth produced. He taught every thing relative to hemp, to the mulberry tree, and the art of making cloth and ſtuffs of ſilk. They owe alſo to Chin-nong the potters and the founders art; others, however, aſcribe pottery to Hoang-ti, and the art of melting metals to Tchi-yeou

Chin-nong invented fairs in the middle of the day. This was the origin of commerce and mutual exchange. He made uſe of money to facilitate trade. He inſtituted feſtivals.

Chin-nong diſtinguiſhed plants, determined their various properties, and applied them ſkilfully in the cure of diſeaſes. They ſay, that, in one day, he made trial of 70 kinds of poiſons, ſpoke of 400 diſeaſes, and taught 365 remedies. This makes the ſubject of a book, intitled, *Pouenetſao*, which they aſcribe to him, and which contains four chapters. Others alledge, and with reaſon, that this book is not ancient. They ſay, with as little truth, that Chin-nong made books ingraved on ſquare plates.

Chin-nong commanded Tſiou-ho-ki to commit to writing every thing relative to the colour of ſick perſons, and what concerned the pulſe, to teach how to examine its motions if they were regular and harmonious, and, for this end, how to feel it from time to time, and acquaint the patient.

Chin-nong compoſed ballads or ſongs on the fertility of the country. He made a very beautiful lyre, and a guitar adorned with precious ſtones, to form the grand harmony, to bridle concupiſcence, to elevate virtue to the intelligent ſpirit, and bring men back to the celeſtial verity.

Chin-nong aſcended a car drawn by five dragons. He was the firſt that meaſured the figure of the earth, and determined the four ſeas. He found 900,000 lys is weſt, and 850,000 is north and ſouth. He divided all this vaſt ſpace into kingdoms.

Among the ſucceſſors of Chin-nong they place Hoang-ti, and the rebel Tchi-yeou, whom they make the inventor of arms of iron, and ſeveral kinds of puniſhments. Tchi-yeou had the power of raiſing miſts and darkneſs extremely thick. Hoang-ti knew not how to attack and overcome him. He accompliſhed it, however, by forming a car, on which he placed a figure whoſe arm of itſelf always turned to the ſouth, in order to point out the four regions. Hoang-ti uſed the lance and buckler.

Tchi-yeou ordered ſabres, lances, and croſs-bows to be made. They aſcribe to Hoang-ti the *kia-tſe*, or cycle of 60 years; or at leaſt Ta-nao made it by his direction.

The Mandarin Tſang-kiai was charged to compoſe hiſtory. Yong-tcheng made a ſphere which repreſented the celeſtial orbs, and diſcovered the polar ſtar.

Li-cheou regulated numbers, and invented an inſtrument for computation, like to, or the ſame with that which is ſtill in uſe in China and India; and of which Martini, in his Decades, and la Loubere, in his voyage to Siam, have given us the deſign and deſcription.

Ling-lune, a native of Yuene-yu, in the weſt of Tahia, (that is, Khoraſſan), took reeds in the valley of Hiai-ki; he cut two of an equal length, and blew into them: this gave occaſion to the invention of bells. He adjuſted twelve of theſe reeds to imitate the ſong of ſong-hoang, the royal bird, (one of the fabulous birds of the Chineſe). He divided theſe reeds into twelve *lu*; ſix ſerved to imitate the ſong of the male, and ſix that of the female. Finally, this man brought muſic to perfection, and explained the order and arrangement of different ſounds. By means of theſe lu-lu, he governed the

the Khi of the Yne and of Yang, he determined the change of the four ſeaſons, and gave calculations for aſtronomy, geometry, and arithmetic.

Yong yuene, by order of Hoang-ti, made twelve bells of copper, which correſponded to the moons, and ſerved to adjuſt the five tones, and fix the ſeaſons, &c. fables.

Hoang ti invented a kind of diadem or tiara, called *Miene*. He ordered a blue and yellow robe to be made for himſelf, in imitation of the colours of heaven and earth. Having viewed the bird *hoei*, and conſidered the variety of its colours, as well as thoſe of the flowers, he made garments be dyed of different colours, to make a diſtinction between the great and ſmall, the rich and poor.

Nin-fong and Tche-tſiang invented mortars for pounding rice; kettles or caldrons: they invented the art of building bridges, and of making ſhoes; they made coffins for the dead; and men reaped great advantages from all theſe inventions. Hoei invented the bow, Y-meou arrows; Khy-pe invented the drum, which made a noiſe like thunder, trumpets and horns, which imitated the voice of the dragon.

Kong-kou and Hoa-hu, by order of the Emperor Hoang ti, hollowed a tree of which they made a ſhip; of the branches of the ſame tree they made oars; and by this means they were able to penetrate into places which ſeemed inacceſſible, and where men had never been.

For the tranſportation of merchandiſe by land, they alſo invented chariots under this reign, and trained oxen and horſes to draw them.

Hoang-ti alſo turned his thoughts to buildings, and gave models of them. He built a temple, called *Ho-kong*, in which he ſacrificed to *Chang-ti*, or to the Supreme Being.

With a view to facilitate commerce, Hoang-ti ſtruck money, called *kine-tao, knife of metal*, becauſe it had the ſhape of the blade of a knife.

Hoang-ti having obſerved that men died before the time fixed by nature, of diſeaſes which carried them off, he commanded Yu-fou, Ki-pe, and Lei-kong, three famous phyſicians of theſe times, to aſſiſt him to determine what remedies were proper for each diſeaſe.

Si-ling-chi, the chief conſort of that emperor, contributed on her part to the good of the ſtate, and taught the people the art of rearing ſilk-worms, of ſpinning their cods, and making ſtuffs of them.

The Ouai-ki takes notice, that Hoang-ti commanded China to be meaſured, and divided into provinces or tcheou. Each *tcheou* was compoſed of ten *che*, each *che* was compoſed of ten *tou*, and each *tou* contained ten *ye*, or ten cities. Theſe ten *ye*, or cities, had each five *ly*, or ſtreets, &c.

The empire of Hoang-ti, which, according to this hiſtorian, ſeems to have been conſiderable, extended on the eaſt to the ſea, on the weſt to Khong tong. It was bounded on the ſouth by Kiang, and on the north by the country of Hoene-jo

They ſay nothing that has any relation to the arts under the three princes who follow Hoang-ti; that is to ſay, under the reigns of Chao-hao, who reigned 84 years; of Tchouene-hio, who reigned 78 years; and of Cao ſine, who reigned 70 years. They obſerve only, that Chao-hao made them beat the watches with a drum: this ſuppoſes that they had then ſome inſtrument for marking the hours. The Se-ki adds, that this emperor levelled the highways, in order to render the mountains acceſſible, and that he cleared the channels of rivers. He made alſo a new kind of muſic, called *Ta-yuene*, to unite men and genii, and reconcile high and low.

3. After having overcome the fatigue of ſo many fabulous traditions, we now come to the hiſtorical times. But before we enter upon them, it will not be improper to make ſome reflections which are abſolutely neceſſary to ſhew how little regard is due to this ſort of traditions. Theſe reflections are thought to be ſo much the more important, as they will help to undeceive a great many people of the miſtake they are in about the Chineſe antiquities.

The Chineſe monarchy begun by three princes, diſtinguiſhed by the title of *Sane-hoang*, that is to ſay the *three Auguſti*. Theſe three Auguſti, according to the moſt generally received opinion, are *Fou-hi*, *Chine-nong*, and *Hoang-ti*. The five emperors, ſucceſſors of the Sane-hoang, are diſtinguiſhed by the title of *Ou-ti*, that is to ſay, *the five emperors*. The five emperors are, *Chao-hao*, *Tchouene-hio*, *Tico*, *Yao*, and *Chune*. This diviſion has been followed by Cong-ngane-coue, the great-grandſon of Confucius, in the eighth generation, and one of the moſt celebrated writers of the dynaſty of Hane. It has been adopted alſo by Hoang-fou-mi, and by moſt part of the beſt writers. The proofs of this opinion are taken partly from the book Tcheou-li, an ancient record, or ſtate of the empire, which many aſcribe to the famous Tcheou-cong, miniſter and brother of Vou-vang, who was the founder of the imperial dynaſty of Tcheou, eleven hundred and ſome odd years before the Chriſtian æra; partly from the commentaries of Tſo-kieou-mine on the Tchune-tſieou of Confucius's maſter. In theſe works, mention is made of the books, Sane-fene, and Ou-tiene, which, they ſay, are the hiſtories of the three Hoang, and of the five Ti: now, the two firſt chapters of Chou-king, which contain an extract of the hiſtories of Yao and of Chune, bore the title of *Tiene-yao* and *Tiene-Chune*; from whence it was concluded, that Yao and Chune were two of the five Ti; conſequently Fou-hi, Ching-nong, and Hoang-ti, were what are called the three Hoang; and Chao-hao, Tchouene-hio, Tico, Yao, and Chune, were the five Ti.

Theſe may perhaps be thought but feeble proofs to ſupport an hiſtorical fact of this kind; but thoſe who are of a contrary opinion, bring nothing to induce us to believe them, rather than Cong-ngane-coue and Hoang-fou mi.

Hou-chouang-hou, in a preface before the Tſiene-piene of Kine gine-chane confeſſes, that we find in the Tcheou-li, the exiſtence of the book of three Hoang, and that of five Ti: but he adds, that we do not find there the names of theſe eight monarchs; that, under the Tſin, they ſpoke of Tiene hoang, of Ti-hoang, and of Gine hoang; that Cong-ngane-coue, in his preface to Chou-

Chou-king, gives Fou hi, Chine nong, Hoang-ti, for the three Hoang, and that he takes Chao hao, Tchouene-hio, Tio, Yao, and Chune for the five Ti; but that we know not on what foundation he does this, since Confucius, in the Kia-yu, distinguishes by the title of *Ti*, all the kings after Fou hi. The same thing is proved by some passages of Tso-chi and of Liu-pou-ouei; from whence they conclude, that Fou-hi, Chine-nong, and Hoang ti are not the three Hoang, and that there are no other Hoang but heaven, earth, and man.

Tchine-huene retrenches Hoang-ti from the number of the Sane-hoang, and puts in his place Niu-oua, whom he ranges between Fou-hi and Chine nong. Others strike out Niu-oua, and put Tcho-yong in the place of Hoang-ti. Niu-oua was the sister of Fou hi, and Fou-hi, they say, reigned 115 years. At what age must this princess have mounted the throne, for they make her succeed her brother?

The famous Se ma-tsiene, to whom the Chinese, from their high esteem of him, have given the name of *Tai-sse-cong*, or *father of history*, will have Hoang-ti, Tchouene-hio, Cao-sine, Yao, and Chune to be the five Ti; and he gave these princes for their predecessors Soui-gine chi, Fou-hi, and Chine-nong, who, according to him, were the three Hoang. This opinion, since his time, has been embraced by several other writers, who depended upon his authority more than upon proofs which he could not produce.

Confucius says in his Kia yu, that the princes who had governed the empire began at Fou hi to take the name of *Ti* or Emperor. The same philosopher says further, in the treatise Hi-tsee, or commentary upon the Y-king, that anciently Fou hi governed China, that Chine nong succeeded him, that after them Hoang-ti, Yao, and Chune were seated on the throne. From so decisive a testimony, Hou-ou-sang, and several others with him, have not doubted, that these five princes named by Confucius were the Ou-ti, or five emperors. As to the Sane-hoang, they admitted Tiene hoang chi, Ti-hoang chi, Gine-hoang chi, as three chiefs of the people who had governed the empire before Fou-hi.

As it is from Tao-sse, that the several authors we have now quoted, have borrowed their idea of this chimerical division of the eight first Chinese emperors, into three Hoang and five Ti, it is necessary to relate what these religious think themselves. They have opinions peculiar to themselves about these first ages of the monarchy. They believe, that at the first there were three Augusti, Sane-hoang; then five emperors, Ou ti; next three kings, Sane-vang; and lastly, five Pa, Ou-pa; that is to say, five chiefs of Regulos.

This order so regularly observed of three and then five, which is repeated twice, shews plainly, that all this has no foundation in truth, but that it is a system invented at pleasure. Wherefore Tou-chong-chu, who lived under the Hane, explained this in an allegorical manner. The three Hoang were, according to him, the three powers, (heaven, earth, and man); The five Ti were the five duties (the duties of king and subject, of father and children, of husband and wife, of elder and younger brothers, of friends); the three Vang were the three lights, (sun, moon, and stars); finally, the five Pa were the five mountains, four of which are situated at the four cardinal points of the empire, and the fifth at the centre. Thus Tong-tchong-chu allegorized this this pretended succession of kings. But Lopi, who relates this explanation, adds, it was not his own. This is a point of criticism of little importance to us; let them, if they please, ascribe it to some other than Tong-tchong-chu; we have still ground to say, that it came from some writer who lived in an age not far from that of Tong-tchong-chu. This is enough for our present purpose, since we see from hence the little regard they then paid to this division, which they considered as chimerical. It would be in vain to attempt to reconcile all these contradictions. All these imaginary reigns are in the manner of the Tao-sse, who have darkened the origin of the Chinese monarchy by their fables and mythology. The ten Ki or periods are of their inventing; they gave them between two and three millions of years duration. But before these ten periods, they place three dynasties, viz. the dynasty of Thiene-hoang-chi, that of Ti-hoang-chi, and finally, that of Gine-hoang-chi. If we attend to the signification of these names, they must be interpreted thus: the *Sovereign of heaven*, the *Sovereign of earth*, the *Sovereign of men*. We see from hence, that the allegorical explanation of Tong-tchong-chu, which made the three Hoang signify the three powers, that is, heaven, earth, and man, is not without probability.

These three Hoang succeeded to Pouane-cou, otherwise Hoene-tune, the chaos, the origin of the world, which several of the Tao-sse take for the first man, or the first king who governed China.

The dynasty of Thiene-hoang-chi had thirteen kings, who reigned, say they, 18,000 years; then came the dynasty of Ti-hoang-chi, whose kings, to the number of eleven, make up a like duration of 18,000 years. Finally, to Ti-hoang-chi succeeded the Gine-hoang-chi, whose dynasty, composed of nine kings, furnishes a space of 45,600 years. These three sums added, give us precisely 81,600 years. But if we add to these three dynasties, those which are comprehended in each of the ten Ki, and which amount, according to some calculations, to more than 230; we shall find that the pretensions of the Chinese very much exceed those of the Chaldeans and Egyptians. For if we believe the calculations of various authors, from Pouane-cou to the death of Confucius, which happened in the year 479 before J. C. there is elapsed 276,000 years, or 2,276,000, or 2.759,860, or even 3,276,000; or, finally, which is a great deal more, 96,961,740 years: for we find all these different calculations.

It is visible enough, that these extravagant numbers can be nothing else but astronomical periods, contrived to give the conjunction of the planets in certain constellations, or calculations which have some relation to the ideas of the Tao sse, concerning the perpetual destructions and reproductions of worlds. In fact, some have endeavoured to make these numbers agree with the period of Tchao-cang-tsie, a famous philosopher in the days of Song, who had undertaken to determine the period of the duration of the world; for the system of the de-

ſtruction and reproduction of worlds was very current, not only in the ſect of Ju or of the learned, but alſo among the Bonzes, Ho-chang or the religious of Fo, and among the Tao-ſſe or followers of Lao-Kiune, that is to ſay, among the three great ſects, who have the moſt influence in the empire. Tchao-cang-tſie eſtabliſhed then a great period of 129,000 years, called *Yuene*, compoſed of twelve equal parts, called *hoei*, or *conjunctions*, which were each of 10,800 years. In the firſt conjunction, ſaid he, heaven was formed by little and little, by the motion which the Tai-ki, or the Supreme Being, impreſſed upon matter which was formerly at perfect reſt. During the ſecond conjunction, the earth was produced in the ſame manner. At the middle of the third conjunction, man and all other beings began to ſpring up, in the manner that plants and trees are produced in the iſlands, which afterwards preſerve their ſeveral kinds by their ſeeds. At the middle of the eleventh conjunction, all things ſhall be deſtroyed, and the world ſhall fall back again into its primitive chaos, from whence it ſhall not ariſe till after the twelfth conjunction is expired.

It is not difficult at preſent to conceive, that the Tao-ſſe had invented that prodigious number of reigns before Fou-hi, for no other reaſon, but to fill up that interval, which, according to them, had elapſed from the production of man, to the beginning of the Chineſe monarchy, that is to ſay, to the reign of Fou-hi. The ſame calculator determined the half of Yuene, or of his great period of 129,000 years, at the reign of Yao.

Theſe Tao-ſſe, as was ſaid already, laid down theſe ten ages or ten Ki as an indiſputable principle; each Ki comprehended ſeveral dynaſties, whoſe duration they determined as they thought fit, and as their calculation required: but if they were at liberty to increaſe or diminiſh the duration of the ten Ki, it was not the ſame as to their number, which was in ſome ſort a fundamental principle of their ſect, from which they were not allowed to depart.

Some miſſionaries, to whom this doctrine of Tao-ſſe was not unknown, imagined, that they diſcerned in theſe ten Ki, the ten generations before Noah; and as the writers cited by Lopi, and by Cong-ing-ta, ſay, that of theſe ten Ki, ſix were before Fou-he, and four after him; theſe ſame miſſionaries have imagined, that Fou-hi was Enoch. It muſt be owned, in the mean time, that Tchine-huene and ſeveral others do not obſerve the ſame order; that they place Chine-nong in the ninth Ki, Hoang-ti in the tenth, *&c.* By this computation Hoang-ti would be Noah, and Fou-hi Methuſelah, which contradicts their hypotheſis.

The opinion which conſiders the ten Ki of the Chineſe as the ten generations which preceded Noah, is very ingenious, and not improbable. Towards the end of the reign of Tcheou, about 300 years before the Chriſtian æra, ſome Jews travelled into China, who might have made the writings of Moſes known there, and, of conſequence, the ten generations which preceded the deluge: beſides, this knowledge was common to the Chaldeans, who might have penetrated into China before the Jews.

CHINEY, a city of the Auſtrian Netherlands, on the confines of the biſhopric of Liege, about twelve miles ſouth-eaſt of Namur: E. long. 5°, N. lat. 50° 20′.

CHINON, a town of France in the province of the Orleanois, about twenty three miles ſouth-weſt of Tours; E. long. 20′, and N. lat. 47° 15′.

CHIO, Chios, Xio, or Scio, an Aſiatic iſland, lying near the coaſt of Ionia, in Natolia or Leſſer Aſia, about one hundred miles weſt of Smyrna. It is called by the Turks Sakiſaduci, and is about one hundred miles in circumference; being chiefly inhabited by Chriſtians of the Greek church, who are ſaid to have three hundred churches in the iſland.

Chio is alſo the capital of the above iſland, ſituated on the eaſt coaſt: E. long. 27°, and N. lat. 38°.

CHIONANTHUS, or snow-drop-tree, in botany, a genus of the diandria-monogynia claſs. The calix divided into four oval ſegments; and the drupa contains but one ſeed. There are two ſpecies, *viz.* the virginica and zeylonica, both natives of the Indies.

CHIOZZO, or Chioggio, a town on an iſland of the ſame name, in the gulph of Venice, by which there is a paſſage into the Lagunes, ſituated about twelve miles ſouth of the city of Venice.

CHIPPENHAM, a borough-town in Wiltſhire, about twenty-two miles north-weſt of Saliſbury: W. long. 2° 12′, and N. lat. 51° 25′. It ſends two members to parliament.

CHIPPING, or Much-Wiccomb, a borough-town of Buckinghamſhire, about ten miles ſouth of Aileſbury: W. long. 42′, and N. lat. 51° 35′. It ſends two members to parliament.

CHIROGRAPHY, a writing under one's own hand.

CHIROMANCY, a ſpecies of divination, drawn from the different lines and lineaments of a perſon's hand; by which means, it is pretended, the inclinations may be diſcovered.

CHIRONIA, in botany, a genus of the pentandria monogynia claſs. The corolla is rotated; the piſtillum declines; the ſtaminæ are inſerted into the tube of the corolla; the antheræ are ſpiral; and the pericarpium is bilocular. There are eight ſpecies, none of them natives of Britain.

CHIRONOMY, in antiquity, the art of repreſenting any paſt tranſaction by the geſtures of the body, more eſpecially by the motions of the hands: this made a part of liberal education; it had the approbation of Socrates, and was ranked by Plato among the political virtues.

CHIROTONY, among eccleſiaſtical writers, denotes the impoſition of hands uſed in conferring prieſtly orders.

However, it is proper to remark, that chirotony originally was a method of electing magiſtrates, by holding up the hands.

CHIRVAN, a province of Perſia, lying on the weſtern coaſt of the Caſpian ſea.

CHIRURGERY. See Surgery.

CHISLEY-LAND, in agriculture, a ſoil of a middle nature between ſandy and clayey land, with a large admixture of pebbles.

CHISSEL, an inftrument much ufed in carpentry, mafonry, joinery, fculpture, *&c.* and diftinguifhed according to the breadth of the blade into half-inch chiffels, quarter-inch chiffels, *&c.* They have alfo different names according to the different ufes to which they are applied; as, 1. The former, ufed by carpenters, *&c.* juft after the work is fcribed: it is ftruck with a mallet. 2. The paring-chiffel, which is ufed in paring off the irregularities made by the former: this is preffed with the workman's fhoulder. 3. The fkew-former cleanfes acute angles with the point of its narrow edge. 4. The mortice chiffel, ufed in cutting deep fquare holes in wood, for mortices: it is narrow, but thick and ftrong, to endure hard blows. 5. Socket-chiffels, having their fhank made with a hollow focket at top, to receive a ftrong wooden fprig fitted into it with a fhoulder. 6. Ripping chiffel, having a blunt edge, with no bafil, ufed in tearing two pieces of woop afunder. And, 7. the gouge. See GOUGE.

CHITAU, in the materia medica, a kind of lignum-aloes, of a reddifh colour. See LIGNUM-ALOES.

CHIVALRY, in law, is a tenure of fervice, whereby the tenant is bound to perform fome noble or military office to his lord; and is either regal, when held only of the king; or common, fuch as may be held of a common perfon as well as the king: the former is properly called ferjeanty, and the latter efcuage.

A ftatute of Charles II. abolifhes all tenures by chivalry, in capite, *&c.* and ordains that all tenures fhall be conftrued to be free and common foccage.

CHIVES, in botany. See ANTHERÆ.

CHIUSI, a city of Italy, in the dutchy of Tufcany, fituated on the confines of the pope's territories, about thirty-five miles fouth-eaft of Sienna: E. long. 13°, and N. lat. 33°.

CHLAMYS, in antiquity, a military habit worn by the ancients over the tunica. It belonged to the patricians, and was the fame in the time of war that the toga was in the time of peace. This fort of gown was called picta, from the rich embroidery with figures in Phrygian-work; and purpurea, becaufe the ground-work was purple. The chlamydes of the emperors were all purple, adorned with a golden or embroidered border.

CHLORIS, in ornithology, the trivial name of a fpecies of Loxia. See LOXIA.

CHLOROSIS, in medicine, a difeafe commonly called the green-ficknefs, incident to young girls. See MEDICINE.

CHOCOLATE, in commerce, a kind of pafte, or cake, prepared of certain ingredients, the bafis of which is the cacao-nut.

The Indians, in their firft making of chocolate, ufed to roaft the cacao in earthen pots; and having afterwards cleared it of the hulks, and bruifed it between two ftones, they made it into cakes with their hands. The Spaniards improved this method: when the cacao is properly roafted, and well cleaned, they pound it in a mortar, to reduce it into a coarfe mafs which they afterwards grind on a ftone, till it be of the utmoft finenefs: the pafte being fufficiently ground, is put quite hot into tin moulds, in which it congeals in a very little time. The form of thefe moulds is arbitrary; the cylindrical ones, holding two or three pounds, are the moft proper, becaufe the bigger the cakes are, the longer they will keep. Obferve, that thefe cakes are very liable to take any good or bad fcent, and therefore they muft be carefully wrapt up in paper, and kept in a dry place. Complaints are made, that the Spaniards mix with the cacao nuts too great a quantity of cloves and cinnamon, befides other drugs without number, as mufk, ambergrife, *&c.* The grocers of Paris ufe few or none of thefe ingredients; they only chufe the beft nuts, which are called Caracca, from the place from whence they are brought, and with thefe they mix a very fmall quantity of cinnamon, the frefheft vanilla, and the fineft fugar, but very feldom any cloves. Among us in England, the chocolate is made of the fimple cacao, excepting that fometimes fugar, and fometimes vanilla is added.

Chocolate ready made, and cacao pafte, are prohibited to be imported from any part beyond the feas. If made and fold in Great Britain, it pays inland-duty 1 s. 6 d. per lb. avoirdupoife: it muft be inclofed in papers containing one pound each, and produced at the excife-office, to be ftamped. Upon three days notice given to the officer of excife, private families may make chocolate for their own ufe, provided no lefs than half an hundred weight of nuts be made at one time.

CHOENIX, a dry meafure, containing a forty-eighth part of a medimnus, or fix bufhels. Hence the celebrated proverb of Pythagoras, *Super chœnice ne fedeas.*

CHOIR, that part of the church or cathedral where choirifters fing divine fervice: it is feparated from the chancel, where the communion is celebrated; and alfo from the nave of the church, where the people are placed: the patron is faid to be obliged to repair the choir of the church.

CHOLEDOCHUS, in anatomy. See Vol. i. p. 265.

CHOLER. See BILE.

CHOLERA *morbus*, in medicine. See MEDICINE.

CHONDRILLA, in botany, a genus of the fyngenefia polygamia æqualis clafs. The calix is caliculated; the receptacle is naked; the pappus is fimple, and furnifhed with a ftipes; and the flofcules are numerous. There is but one fpecies, *viz.* the jancæa, a native of Germany.

CHONDROPTERYGII, in ichthyology, a term formerly applied to the order of fifhes, now called amphibia nantes by Linnæus. See AMPHIBIA.

CHOPIN, or CHOPINE, a liquid meafure, ufed both in Scotland and France, and equal to half their pint. See PINT, and MEASURE.

CHORASSAN, a province of Perfia, on the north-eaft, adjoining to Ufbec Tartary; this was the ancient Bactria, and the native country of the late Kouli Kan.

CHORD, in geometry, a right line drawn from one part of an arch of a circle to the other. Hence,

CHORD *of an arch* is a right line joining the extremes of that arch. See TRIGONOMETRY.

CHORDS, or CORDS, in music, are strings, by the vibration of which the sensation of sound is excited, and by the divisions of which the several degrees of tune are determined.

CHORD is also used in music for the note or tone to be touched or sounded: in this sense the fifth is said to consist of five chords or sounds.

CHORDAPSUS, in medicine, a disease of the intestines, when to the touch they feel like stretched cords: it is the same with the iliac passion.

CHORDEE, in medicine and surgery, a symptom attending a gonorrhœa, consisting in a violent pain under the frenum, and along the duct of the urethra, during the erection of the penis, which is incurvated downwards. These erections are frequent and involuntary. See MEDICINE.

CHOREUS, in ancient poetry. See TROCHEE.

CHORGES, or GORGES, a town of Dauphiny, in France, about six miles east of Gap: E. long. 6°, and N. lat. 44° 36′.

CHORIAMBUS, in ancient poetry, a foot consisting of four syllables, whereof the first and last are long, and the two middle ones are short; or, which is the same thing, it is made up of a trochæus and iambus: such is the word nōbĭlĭtās.

CHORION, in anatomy, the exterior membrane which invests the fœtus in the uterus.

CHOROBATA, or CHOROBATES, a kind of water-level among the ancients, of the figure of the letter T, according to Vitruvius's description.

CHOROGRAPHY, the art of making a map of some country or province.

CHORUS, in dramatic poetry, one or more persons present on the stage during the representation, and supposed to be by standers without any share in the action.

Tragedy in its origin was no more than a single chorus, who trod the stage alone, and without any actors, singing dithyrambics or hymns in honour of Bacchus. Thespis, to relieve the chorus, added an actor, who rehearsed the adventures of some of their heroes; and Æschylus, finding a single person too dry an entertainment, added a second, at the same time reducing the singing of the chorus, to make more room for the recitation. But when once tragedy began to be formed, the recitative, which at first was intended only as an accessory part to give the chorus a breathing time, became a principal part of the tragedy. At length, however, the chorus became inserted and incorporated into the action: sometimes it was to speak, and then their chief, whom they called corryphæus, spoke in behalf of the rest: the singing was performed by the whole company; so that when the coryphæus struck into a song, the chorus immediately joined him.

The chorus sometimes also joined the actors in the course of the representation, with their plaints and lamentations on account of any unhappy accidents that befel them: but the proper function, and that for which it seemed chiefly retained, was to shew the intervals of the acts: while the actors were behind the scenes, the chorus engaged the spectators; their songs usually turned on what was exhibited, and were not to contain any thing but what was suited to the subject, and had a natural connection with it; so that the chorus concurred with the actors for advancing the action. In the modern tragedies the chorus is laid aside, and the fiddles supply its place. Mr Dacier looks on this retrenchment as of ill consequence, and thinks it robs tragedy of a great part of its lustre; he therefore judges it necessary to re-establish it, not only on account of the regularity of the piece, but also to correct, by prudent and virtuous reflections, any extravagancies that might fall from the mouths of the actors, when under any violent passion.

Mr Dacier observed also, that there was a chorus, or grex, in the ancient comedy; but this is suppressed in the new comedy, because it was used to reprove vices by attacking particular persons; as the chorus of the tragedy was laid aside to give the greater probability to those kind of intrigues which require secrecy.

CHORUS, in music, is when, at certain periods of a song, the whole company are to join the singer in repeating certain couplets, or verses.

CHOTZIM, a frontier-town of Moldavia, on the confines of Poland, situated on the river Niester, and subject to the Turks: E. long. 27°, and N. lat. 48°.

CHOUG, a town of Syria, upon the road from Aleppo to Sayde, called by some travellers Shoggle.

CHOUGH, in ornithology. See CORVUS.

CHREMNITZ, the principal of the mine-towns in Upper Hungary, situated about sixty-eight miles north-east of Presburg, and subject to the house of Austria: E. long. 19°, and N. lat. 48° 45′.

CHREMPS, in ichthyology. See SPARUS.

CHRISM, oil consecrated by the bishop, and used in the Romish and Greek churches in the administration of baptism, confirmation, ordination, and extreme unction.

Order of CHRIST, a military order, founded by Dionysius I. king of Portugal, to animate his nobles against the Moors.

The arms of this order are gules, a patriarchal cross, charged with another cross argent: they had their residence at first at Castromarin, afterwards they removed to the city of Thomar, as being nearer to the Moors of Andalusia and Estremadura.

CHRIST is also the name of a military order in Livonia, instituted in 1205, by Albert bishop of Riga. The end of this institution was to defend the new Christians, who were converted every day in Livonia, but were persecuted by the heathens. They wore on their cloaks a sword with a cross over it, whence they were also denominated brothers of the sword.

CHRIST-BURGH, a town of Poland, near the lake Draussen, and about three Polish miles from Marienburgh.

CHRIST-CHURCH, a borough town of Hampshire, thirty miles south-west of Wincester, near the sea-coast: W. long. 2°, N. lat. 50° 40′. It sends two members to parliament.

CHRIST-*thorn*, in botany. See RHAMNUS.

Most

Moſt CHRISTIAN *king*, one of the titles of the king of France.

The French antiquaries trace the origin of this appellation up to Gregory the Great, who, writing a letter to Charles Martlet, occaſionally gave him that title, which his ſucceſſors have ſince retained.

CHRISTIAN *religion*, that inſtituted by Jeſus Chriſt. See RELIGION.

CHRISTIANS, thoſe who profeſs to believe the Chriſtian religion. See RELIGION.

CHRISTIANS *of St John*, a ſect of Chriſtians very numerous in Balſara and the neighbouring towns: they formerly inhabited along the river Jordan, where St John baptized, and it was from thence they had their name. They hold an anniverſary feaſt of five days, during which they all go to the biſhop, who baptizes them with the baptiſm of St John. Their baptiſm is alſo performed on rivers, and that only on Sundays; they have no notion of the third perſon in the Trinity, nor have they any canonical book, but abundance full of charms, *&c.* Their biſhoprics deſcend by inheritance, as our eſtates do, though they have the ceremony of an election.

CHRISTIANS *of St Thomas*, a ſort of Chriſtians in a peninſula of India, on this ſide of the gulf: they inhabit chiefly at Cranganor, and the neighbouring country: theſe admit of no images, and receive only the croſs, to which they pay a great veneration: they affirm, that the ſouls of the ſaints do not ſee God till after the day of judgment: they acknowledge but three ſacraments, *viz.* baptiſm, orders, and the euchariſt: they make no uſe of holy oils in the adminiſtration of baptiſm, but after the ceremony anoint the infant with an unction compoſed of oil and walnuts, without any benediction. In the euchariſt, they conſecrate with little cakes made of oil and ſalt, and inſtead of wine make uſe of water in which raiſins have been infuſed.

CHRISTIANA, a town of Norway, in the province of Aggerhuys, ſituated on a bay of the ſea, a hundred miles north of Gottenburgh: E. long. 10° 15′, N. lat. 59° 30′.

CHRISTIANOPLE, a port-town of Sweden, ſituated on the Baltic ſea, in the territory of Bleking, and province South Gothland, about thirteen miles north-eaſt of Carleſcroon: E. long. 15° 40′, and N. lat. 57°.

CHRISTIANSBURGH, a Daniſh factory upon the gold-coaſt of Africa, near Acra.

CHRISTIANSTADT, a town of Sweden, ſituated on the river Helles, in the territory of Bleking, and province of South Gothland, forty-five miles weſt of Carleſcroon: E. long. 14° 40′, N. lat 56° 30′.

CHRISTMAS, a feſtival of the Chriſtian church, obſerved on the 25th of December, in memory of the nativity of Jeſus Chriſt.

CHRISTOPHER-*herb*, in botany. See CHRISTOPHORIANA.

CHRISTOPHERS, or *St* CHRISTOPHERS, one of the Caribbee iſlands, to which Columbus gave his Chriſtian name: W. long. 62°, N. lat. 71° 30′.

It is about twenty miles long, and ſeven broad; and has a high moun- H R
ſome rivulets run down.
cotton, ginger, and indigo. middle, from whence
and lies about ſixty miles weſt o e is chiefly ſugar,

CHRISTOPHORIANA, in botany. British colony,

CHROASTACES, in natural hiſtory, a ge
cid gems, comprehending all thoſe of variable A.
as viewed in different lights; of which kinds are
opal and the aſteria, or oculus cati. See OPAL, and ASTERIA.

CHROMA, in muſic, a note or character of time, uſually termed a quaver.

Chroma is alſo a graceful way of ſinging, or playing with quavers and trilloes.

CHROMATIC, in the ancient muſic, the ſecond of the three kinds into which the conſonant intervals were ſubdivided into their concinnous parts. The other two kinds are enharmonic and diatonic.

CHROMATIC, in painting, a term uſed to ſignify the colouring, which makes the third part in the art of painting.

CHROMIS, in ichthyology. See SPARUS.

CHRONIC, or CHRONICAL, among phyſicians, an appellation given to diſeaſes that continue a long time, in contradiſtinction to thoſe that ſoon terminate, and are called *acute*. See MEDICINE.

CHRONICLE, in matters of literature, a ſpecies or kind of hiſtory, diſpoſed according to the order of time, and agreeing in moſt reſpects with annals. See ANNALS.

Books of CHRONICLES, in the canon of ſcripture, two ſacred books, called by the Greeks *paralipomena*, that is, remains, additions, or ſupplements, as containing many circumſtances omitted in the other hiſtorical books.

CHRONOGRAM, a ſpecies of falſe wit, conſiſting in this, that a certain date or epocha is expreſſed by numeral letters of one or more verſes: ſuch is that which makes the motto of a medal ſtruck by Guſtavus Adolphus, in 1632.

ChrIſtVs DVX, ergo trIVMphVs.

CHRONOLOGY, the ſcience or doctrine of time, in ſo far as it regards hiſtory, whether civil or eccleſiaſtical.

The buſineſs of chronology, is to aſcertain and adjuſt the various epochas, æras, and other periods mentioned in hiſtory; ſo that the revolutions of empires and kingdoms, and other remarkable events, may be truly ſtated. For the principles of chronology, ſee ASTRONOMY, *Of the diviſion of time.*

CHRONOMETER, in general, denotes any inſtrument or machine, uſed in meaſuring time; ſuch are dials, clocks, watches, *&c.* See CLOCK, DIAL, *&c.*

CHRONOSCOPE, denotes much the ſame with chronometer. See the preceding article.

CHROSTASIMA, in natural hiſtory, a genus of pellucid gems, comprehending all thoſe which appear of one ſimple and permanent colour in all lights: ſuch are the diamond, carbuncle, ruby, garnet, amethyſt, ſapphire, beryl, emerald, and the topaz. See DIAMOND, CARBUNCLE, *&c.*

C H R see Falco.

, a ftate of reft and

CHRYSAETUS, in ornibutterflies, moths, and fe-

CHRYSALIS, in natcts, muft pafs through before feeming infenfibilwinged or moft perfect ftate. See veral other kiтory.

they arriнEMOIDES, in botany. See Osteo-Natум.

CHRSANTHEMUM, in botany, a genus of plants belonging to the fyngenefia polygamia fuperflua clafs. The receptacle is naked, it has no pappus; the calix is hemifpherical and imbricated; and the fcales on the margin are membranaceous. There are nineteen fpecies, two of which are natives of Britain, *viz.* the fegetum, or corn mary-gold; and the leucanthemum, or ox-eye daify.

CHRYSOBALANUS, in botany, a genus of the icofandria monogynia clafs. The corolla confifts of five petals; the calix has five teeth; and the drupa contains a nut with five furrows. There is but one fpecies, *viz.* the icaco, a native of America.

CHRYSOBERYL, a kind of beryl with a tincture of yellow. See Beryl.

CHRYSOCOLLA, in natural hiftory, a fpecies of green ochres. See Ochra.

CHRYSOCOMA, in botany, a genus of plants belonging to the fyngenefia polygamia æqualis clafs. The receptacle is naked; the pappus is fimple; the calix is imbricated and hemifpherical; and the ftylus is hardly longer than the flofcules. There are nine fpecies, none of which are natives of Britain.

CRYSOGONUM, or Moth-mullein, in botany, a genus of plants belonging to the fyngenefia polygamia neceffaria clafs. The receptacle is paleaceous; the pappus is monophyllous, and three-teethed; the calix confifts of five leaves; and the feeds are caliculated, and involved in four leaves. There is but one fpecies, a native of Virginia.

CHRYSOLITE, in natural hiftory, a gem which the ancients knew under the name of the topaz; and the true chryfolite of the ancients, which had its name from its fine gold-yellow colour, is now univerfally called topaz by modern jewellers. See Topaz.

Chrysolite-*pafte*, a kind of glafs made in imitation of natural chryfolite, by mixing two ounces of prepared cryftal, with ten ounces of red-lead, adding twelve grains of crocus martis made with vinegar; and then baking the whole for twenty-four hours, or longer, in a well luted cucurbit.

CHRYSOMELA, in zoology, a genus of infects, belonging to the order of coleoptera. The antennæ are fhaped like bracelets, and thicker on the outfide; and neither the breaft nor the elytra are marginated. There are no lefs than 127 fpecies, principally diftinguifhed by differences in their colour.

CHRYSOPHYLLUM, in botany, a genus of the pentandria monogynia clafs. The corolla is bell-fhaped, and divided into ten fegments, which alternately fpread wider; and the berry contains ten feeds. There are but two fpecies, both natives of America.

CHRYSOPRASUS, or Chrysoprasius, the tenth of the precious ftones, mentioned in the Revelations, as forming the foundation of the heavenly Jerufalem.

The chryfoprafius is a fpecies of prafius, of a pale but pure green colour, with an admixture of yellow.

CHRYSOSPLENIUM, in botany, a genus of the decandria digynia clafs. The calix is divided into four or five coloured fegments; it has no corolla; and the capfule has two beaks, and one cell containing many feeds. The fpecies are two, *viz.* the alternifolium, or alternate leaved golden faxifrage; and the oppofitifolium, or common golden faxifrage; both natives of Britain.

CHRYSTAL, or Crystal. See Crystal.

CHUB, or Chubb, in ichthyology. See Cyprinus.

CHURCH, has different fignifications, according to the different fubjects to which it is applied. 1. It is underftood of the collective body of Chriftians, or all thofe over the face of the whole earth who profefs to believe in Chrift, and acknowledge him to be the Saviour of mankind. This is what the ancient writers call the catholic or univerfal church. Sometimes the word church is confidered in a more extenfive fenfe, and divided into feveral branches; as the church militant, is the affembly of the faithful on earth; the church triumphant, that of the faithful already in glory; to which the Papifts add the church patient, which, according to their doctrines, is that of the faithful in purgatory.

2. Church is applied to any particular congregation of Chriftians, who affociate together and concur in the participation of all the inftitutions of Jefus Chrift, with their proper paftors and minifters. Thus we read of the church of Antioch, the church of Alexandria, the church of Theffalonica, and the like.

3. Church denotes a particular fect of Chriftians diftinguifhed by particular doctrines and ceremonies. In this fenfe, we fpeak of the Romifh church, the Greek church, the reformed church, the church of England, *&c.*

The Latin or weftern church, comprehends all the churches of Italy, France, Spain, Africa, the north, and all other countries whither the Romans carried their language. G. Britain, part of the Netherlands, of Germany, and of the North, have been feparated from hence ever fince the time of Henry VIII. and conftitute what we call the reformed church, and what the Romanifts call the weftern fchifm.

The Greek or eaftern church, comprehends the churches of all the countries anciently fubject to the Greek or eaftern empire, and through which their language was carried; that is, all the fpace extended from Greece to Mefopotamia and Perfia, and thence into Egypt. This church has been divided from the Roman, ever fince the time of the emperor Phocas.

The Gallican church, denotes the church of France, under the government and direction of their refpective bifhops and paftors. This church has always enjoyed certain franchifes and immunities, not as grants from popes, but as derived to her from her firft original, and which fhe has taken care never to relinquifh. Thefe liberties depend upon two maxims; the firft, that the pope

pope has no authority or right to command or order any thing either in general or in particular, in which the temporalities and civil rights of the kingdom are concerned; the second, that notwithstanding the pope's supremacy is owned in cases purely spiritual, yet, in France, his power is limited and regulated by the decrees and canons of ancient councils received in that realm.

4. The word church is used to signify the body of ecclesiastics, or the clergy, in contradistinction to the laity. See CLERGY.

5. Church is used for the place where a particular congregration or society of Christians assemble for the celebration of divine service. In this sense, churches are variously denominated, according to the rank, degree, discipline, &c. as metropolitan church, patriarchal church, cathedral church, parochial church, collegiate church, &c. See METROPOLIS, PATRIARCH, &c.

CHURCH-*reeves*, the same with church-wardens.

CHURCH-STRETTON, a market-town of Shropshire, about twelve miles south of Shrewsbury: W. long. 2° 50′, N. lat. 52° 35′.

CHURCH-*wardens*, formerly called church-reeves, are officers chosen yearly, in Easter week, by the minister and parishoners of every parish, to look after the church, church-yard, church-revenues, &c. also to observe the behaviour of the parishoners in relation to such misdemeanors as appertain to the censure or jurisdiction of the ecclesiastical court.

They are to be chosen by the joint consent of the minister and his parishoners; and by custom, the minister may chuse one, and the parishoners another; or, if there be a custom for it, the parishoners may elect both, though it is against the canon. They were sworn into their office by the archdeacon; and if he refuses to swear a church-warden, a mandamus may issue out to compel him: for as the church-wardens have a trust reposed in them by the parish, as temporal officers, the parishoners are the proper judges of their abilities to serve, and not the archdeacon who swears them.

The church wardens are a corporation to sue, and be sued, for the goods of the church: they are to take care of the repairs of the church; and if they erect or add any thing new to the same, they must have the consent of the parishoners, or vestry; and if in the church, the license of the ordinary: they have, with consent of the minister, the placing of the parishoners in the seats of the body of the church, appointing gallery keepers, &c. reserving to the ordinary a power to correct the same. In London, the church-wardens have this authority in themselves: there also they are bound to fix fire-cocks, keep engines, &c. in their parishes, under the penalty of 10l.

Besides their ordinary power, the church-wardens have the care of the benefice during its vacancy: they are to join with the overseers of the poor in making rates for their relief, setting up trades for employing them, placing out poor apprentices, settling poor persons, &c. It is their duty to collect the charity-money upon briefs read in churches; they are to sign the certificates of those persons who receive the sacrament, to qualify them to bear offices, &c.

CHURCHING *of women after child-birth*, an office in the liturgy, containing a thanksgiving to be used by women after being delivered from the great pain and peril of child-birth.

CHURN-OWL, in ornithology. See CAPRIMULGUS.

CHURN-WORM, in zoology. See GRYLLOTALPA.

CHUSAN, or CHEUXAN, an island on the eastern coast of China, near the province of Chekiam: E. long. 124°, N. lat. 30° 40′.

CHUSISTAN, a province in the south-west part of Persia, bounded by the gulph of Persia on the south, and by the province of Eyraca-Agem on the north.

CHUTON, CHUTTON, a market-town of Somersetshire, about seven miles north-east of Wells: W. long. 2° 36′, N. lat. 51° 25′.

CHYLE, in the animal œconomy, a milky fluid, secreted from the aliments by means of digestion.

The principles of the chyle seem to be sulphureous, mucilaginous, saline, and aqueous. It is a kind of natural emulsion, both with regard to the colour, the ingredients, and the manner of preparation. There is this difference between the artificial and natural emulsion, that the latter is far more pure, and is prepared with much greater apparatus, not by the sudden expression of part of the liquid, but by a gentle and successive percolation. The chyle is made sooner or later, according to the difference of the temperaments, strength, aliments and customs: therefore how many hours chylification requires, cannot be certainly determined. When the chyle enters the villous oscula of the lacteals, it is not a fluid extracted merely from the aliment and drink, but a mixture of fluids; that is, the saliva and thinner mucus of the mouth, and the two fluids of the œsophagus, one proceeding from the villous membrane of the tube itself, the other from its glands. To these may be added the glutinous fluid of the stomach, the pancreatic juice, the fluid of peyer's glands, which are very numerous in the small intestines. Hence the reason appears, why men may live upon bread and water, why the oriental nations use rice in the room of all kinds of pulse, and why acids, spirituous liquors, saline things, and many vegetable juices, herbs, roots, acrid and aromatic substances, are the least fit to generate chyle.

CHYLIFICATION, the formation of the chyle, or the act whereby the food is changed into chyle.

Chylification commences by comminuting the aliment in the mouth, mixing it with saliva, and chewing it with the teeth; by these means the food is reduced into a kind of pulp, which, being received into the stomach, mixes with the juices thereof; and thus diluted, begins to ferment or putrify, and, assuming a very different form from what it had before, grows either acid or rancid. Here it meets with a juice separated from the blood by the glands of that part, whose excretory ducts open into the cavity of the stomach:

ftomach: by the commixture of thefe liquors, whether of faliva or the juice of the ftomach, a proper menftruum is compofed, by which the parts of the aliment are ftill more and more divided by its infinuating into their pores, and acquire ftill a greater likenefs to the animal fluids. The ftomach, by means of its mufcular fibres, contracting itfelf, does gradually dicharge its contents by the pylorus into the duodenum; in which gut, after a fmall femicircular defcent, it meets with the pancreatic juice and bile; both which joining it, renders fome part of the aliment more fluid, by ftill difuniting the groffer part from the more pure, and here the chylifaction is made perfect. The bile which abounds with lixivial falts, and apt to entangle with the groffer parts of the concocted aliment, ftimulates the guts, and cleanfes their cavities of the mucous matter feparated from the blood by the glands of the guts, and lodged in their cavities; which not only moiftens the infide of the guts, but defends the mouth of the lacteal veffels from being injured by alien bodies which often pafs that way.

The contents of the inteftines move ftill on, by means of the periftaltic motion of the guts; whilft thofe thinner parts, fitted to the pores of the lacteal veffels, are abforbed by them: the thicker move ftill more flowly on, and by the many ftops they continually meet with by the connivant valves, all the chyle or thin parts are at length entirely abforbed; the remains being merely excrementitious, are only fit to be protruded by ftool.

In the paffage through the fmall inteftines, the finer part of the mafs, which we call the chyle (as has been already obferved) enters the orifices of the lacteal veffels of the firft kind, wherewith the whole mefentery is intermixed, which either alone, or together with the meferaic veins. difcharge themfelves into the glands, at the bafis of the mefentery.

Then the chyle is taken up by the lacteals of the fecond kind, and is conveyed into glands between the two tendons of the diaphragm, called Pecquet's refervatory; whence it is carried to the heart by the thoracic duct, and the fubclavian vein: and here it firft mixes with the blood, and in time becomes affimilated thereto.

CHYLOSIS, among phyficians, the act of reducing the aliment in the ftomach to chyle.

CHYME, or CHYMUS, in the common fignification of the word, denotes every kind of humour which is incraffated by concoction, under which notion it comprehends all the humours fit or unfit for preferving and nourifhing the body, whether good or bad. It frequently imports the fineft part of the chyle, when feparated from the fæces, and contained in the lacteal and thoracic duct.

CHYMISTRY, or CHEMISTRY. See CHEMISTRY.

CHYMOLOGI, an appellation given to fuch naturalifts as have employed their time in inveftigating the properties of plants from their tafte and fmell.

CHYMOSIS, in medicine, the act of making or preparing chyme. See CHYME.

CHYMOSIS is alfo a diftortion of the eye-lids, arifing from an inflammation; alfo an inflammation of the cornea tunica in the eye.

CIALIS, the name of the capital of a kingdom of that name in independant Tartary, fituated on the road from Samarcand to China.

CIBDELOPLACIA, in natural hiftory, a genus of fpars debafed by a very large admixture of earth: they are opaque, formed of thin crufts, covering vegetables and other bodies, by way of incruftations.

Of this genus we have the following fpecies: 1. A greyifh-white one, with a rough furface. 2. A whitifh brown one: both thefe are friable. 3. A hard, pale-brown kind, which is the oftecolla of the fhops. 4. The whitifh-grey kind, with a fmooth furface: this is the unicornu foffile and ceratites of authors. 5. The whitifh-brown coralloide kind.

CIBDELOSTRACIA, in natural hiftory, terrene fpars, deftitute of all brightnefs and tranfparence, formed into thin plates, and ufually found coating over the fides of fiffures, and other cavities of ftone, with congeries of them of great extent, and of plain or botroyide furfaces.

Of thefe there are ufually reckoned feven kinds: the firft is the hard, brownifh-white cibdeloftracium, found in Germany: the fecond is the hard, whitifh cibdeloftracium, with thin crufts, and a fmoother furface, found alfo in the Harts-foreft in Germany: the third is the hard, pale-brown cibdeloftracium, with numerous very thin crufts, found in fubterranean caverns in many parts of England as well as Germany: the fourth is the white, light, and friable cibdeloftracium, found alfo in Germany, but very rarely in any part of England: the fifth is the light, hard, pale-brown cibdeloftracium, with a fmooth furface, found in almoft all parts of the world: the fixth is the whitifh, friable, cruftaceous cibdeloftracium, with a rougher furface, frequent in Germany and England; and the feventh is the brownifh-white, friable cibdeloftracium, with a dufty furface, found in feveral parts of Ireland, as well as Germany.

CICADIA, in zoology, a genus of infects belonging to the order of hemiptera. The beak is inflected; the antennæ are fetaceous; the four wings are membranaceous and deflected; and the feet, in moft of the fpecies, are of the jumping kind. The fpecies are fifty-one. The larvæ of feveral of this genus evacuate great quantities of a frothy matter upon the branches and leaves of plants, in the midft of which they conftantly refide.

CICATRICULA, among natural hiftorians, denotes a fmall whitifh fpeck in the yolk of an egg, fuppofed to be the firft rudiments of the future chick.

CICATRIX, in furgery, a little feam or elevation of callous flefh rifing on the fkin, and remaining there after the healing of a wound or ulcer. It is commonly called a fcar. See SURGERY.

CICATRIZANTS, in pharmacy, medicines which affift nature to form a cicatrix. Such are arminian bole, powder of tutty, dificcativum rubrum, &c.

Cicatrizants are otherwife called efcharotics, epulotics, incarnatives, agglutinants, &c.

CICELY. See MYRRHIS.

CICER, or CHICK-PEA, in botany, a genus of the diadelphia decandria clafs. The calix is divided into five fegments, of the fame length with the corolla, the four uppermoft fegments lying upon the vexillum; and the legumen or pod is turgid, rhomboidal, and contains two feeds. There is but one fpecies, *viz.* the arietinum, a native of Spain.

CICERBITA, in botany. See SONCHUS.

CICHORIUM, or SUCCORY, in botany, a genus of the fyngenefia polygamia æqualis clafs. The receptacle is paleaceous; the calix is caliculated; and the pappus has five teeth on its margin. The fpecies are three, only one of which, *viz.* the intybus, or wild cichory, is a native of Britain. The leaves and root are detergent, aperient, and attenuating.

CICINDELIA, in zoology, a genus of infects belonging to the order of coleoptera. The antennæ are fetaceous; the jaws are prominent, and furnifhed with teeth; the eyes are a little prominent; and the breaft is roundifh and marginated. There are fourteen fpecies.

CICONIA, in ornithology. See ARDEA.

CICUTA, in botany, a genus of the pentandria digynia clafs. The fruit is furrowed and ovated. The fpecies are three, only one of which, *viz.* the virofa, or long-leaved water-hemlock, is a native of Britain.

CICUTA is alfo a fynonime of the conium. See CONIUM.

CICUTARIA, in botany, a fynonime of the æthufa, phellandrium, *&c.*

CIDARIS, in antiquity, the mitre ufed by the Jewifh high-priefts. The Rabbins fay, that the bonnet ufed by priefts in general was made of a piece of linen-cloth fixteen yards long, which covered their heads like a helmet or a turbant: and they allow no other difference between the high-prieft's bonnet, and that of other priefts, than this, that one is flatter and more in the form of a turbant; whereas that worn by ordinary priefts, rofe fomething more in a point.

CIDARIS, in conchyliology, the trivial name of a fpecies of echinus. See ECHINUS.

CIFALU, or CEFALEDI, a port-town of Sicily, thirty-fix miles eaft of Palermo: E. long. 13° 32′, N. lat. 38° 30′.

CILIA, the EYE-LASHES, in anatomy. See Vol. I. p. 291.

CILIARE, or LIGAMENTUM CILIARE, in anatomy. See Vol. I. p. 290.

CILIARIS, in anatomy. See Vol. I. p. 291.

CILIATED *leaf*, among botanical writers, one furrounded all the way with parallel filaments, fomewhat like the hairs of the eye-lids.

CILICIUM, in Hebrew antiquity, a fort of habit made of coarfe ftuff, formerly in ufe among the Jews in times of mourning and diftrefs. It is the fame with what the Septuagint and Hebrew verfions call fack-cloth.

CILLEY, the capital of a territory of the fame name in Stiria, and the circle of Auftria in Germany: E. lon. 15° 35′, N. lat. 46° 35′.

CIMA, or SIMA, in architecture, the fame with cymatium or ogee. See OGEE.

CIMEX, or BUG, in zoology, a genus of infects belonging to the order of hemiptera. Linnæus enumerates no lefs than 121 fpecies. The lectularius, or common houfe-bug, is a well known infect. The methods of expelling them are various; as, oil of turpentine, the fmoke of corn-mint, of narrow-leaved wild-crefs, of herb-robert, of the reddifh agaric, of muftard, of Guiney pepper, of peats or turf, *&c.* But cleanlinefs is the only remedy againft vermin of every kind.

CIMOLIA *terra*, in natural hiftory, a fpecies of white marle, which is ponderous and friable, and makes a confiderable effervefcence with aqua fortis.

CINALOA, a province of Mexico, in North America, lying on the Pacific Ocean, oppofite to the fouth end of California.

CINAN, a city of China, the metropolis of the province of Zantung, fituated in 37° N. lat. and 30′ eaft of Pekin.

CINCHONA, in botany, a genus of the pentandria monogynia clafs. The corolla is bell-fhaped; and the capfule is below the flower, and opens at the bafe. There is but one fpecies, *viz.* the officinalis, a native of Peru. The Peruvian bark, which is the bark of this tree, is brought to us in pieces of different fizes, fometimes rolled up into fhort thick quills, and fometimes flat: the outfide is brownifh, and generally covered in part with a whitifh mofs; the infide is of a yellowifh, reddifh, or rufty iron colour. It has a lightly aromatic fmell, fomewhat mufty, yet not difagreeable; a bitterifh, aftringent tafte, which dwells long upon the tongue, accompanied with a degree of aromatic warmth. The fmall, thin, flat pieces are by fome accounted the beft; by others, the quill fort, with the roughest coat, efpecially if of a bright cinnamon colour on the infide; though the large flat pieces, whether rough or fmooth, of a lighter or darker colour, are often of equal goodnefs. The beft bark is that which is ftrongeft in fmell and tafte: this likewife proves friable betwixt the teeth, and does not feparate into fibres; it breaks, not fhivery, but clofe and fmooth.

The virtues of this bark, as a febrifuge, were difcovered by the Indians about the year 1500: Europe did not become acquainted with it till 1649: nor was it received into general practice till feveral years after this; fome ill confequences enfuing from its imprudent ufe, having brought it for a time into difrepute. At prefent, it is looked upon as the moft effectual remedy in intermittent fevers of almoft every kind, and fafe in all ages and conftitutions; provided it be judicioufly and feafonably adminiftered, and due regard be had to the circumftances of the difeafe. The modern practice, previous to the ufe of this medicine, ufually gives an emetic at the beginning of a paroxyfm: in fome cafes a cathartic, and in plethoric habits venæfection, are premifed: thefe render the bark not only more fafe, but likewife more certain and fpeedy in its operation: where thefe evacuations are neglected, or not fufficiently plentiful, the difeafe, if of long ftanding,

ftanding, fcarce yields to the *cortex*; or if it appears at length fubdued, yet the patient does not recover his ftrength, and foon fuffers a relapfe. The ufe of the bark is begun at the end of a paroxyfm, and repeated, in the quantity of half a dram (more or lefs, according to the circumftances of the patient) every third or fourth hour during the intermiffion: where the fever is of the bilious kind, and accompanied with great heat, a little nitre is joined: in all cafes, moderate exercife generally promotes its effect. At firft, it ufually loofens the belly, and fometimes operates as if a cathartic had been taken; and by this means fupplies the omiffion of evacuations before its exhibition: if the purging continues, the medicine does not anfwer the purpofes intended by it: in fuch cafe, a little opium is added, which effectually fuppreffes the flux: if after this the patient continues too coftive, recourfe is had to glyfters. The loofenefs, however, ought not to be ftopt too foon: on the contrary, where the bark does not itfelf produce this effect, it is neceffary, as Dr Mead informs us, to join to it a little rhubarb, fo as to occafion for a time two ftools a day; by this means the difeafe is more effectually cured, and lefs fubject to be followed by a dropfy, or ill habit of body; after a dram or two of rhubarb have been taken, it is to be difcontinued, and the bark exhibited by itfelf. After the fever has been removed, the medicine is continued for fome time longer, to prevent a relapfe; and evacuations, unlefs abfolutely neceffary, abftained from. The difeafe is neverthelefs feldom completely cured before fome very confiderable evacuation, either by ftool, urine, or perfpiration, enfues: if this does not fucceed fpontaneoufly, cathartics, diuretics, or diaphoretics, are given in conjunction with the bark; otherwife the patient continues weak, and without appetite, till either the difeafe returns, or changes into one of a different kind.

In fymptomatic agues, hectic and purulent fevers, cacochymic habits, and where the hypochondres are fwelled and diftended, this medicine is improper, and for the moft part prejudicial. Its manifeft aftringency forbids its ufe in obftructions of the abdominal vifcera, or fuppreffion of any critical evacuation; until the obftruction is firft removed, or the evacuation had its due courfe.

In acute, inflammatory, or malignant fevers, the bark does not feem to have any good effect. Neverthelefs, in the decline of long nervous fevers, or after a remiffion, when from bad habit, old age, fatigue, or the like, the patient is extremely weak, and the pulfe low, the *cortex* proves a medicine of excellent fervice; provided that there is no extravafation, that the veffels remain entire, and pus is not already formed.

Peruvian bark has likewife been found eminently ferviceable in gangrenes and mortifications, proceeding either from an internal or external caufe. In all the cafes of this kind, where it proved fuccefsful, it occafioned a kind fuppuration, which degenerated when the ufe of the medicine was difcontinued, and again turned kindly upon refuming it. Some have been hence induced to try the *cortex* in variolous cafes, where either the puftules did not rightly fuppurate, or petechiæ fhewed a difpofition to a gangrene; and here likewife it anfwered expectation: the empty veficles filled with matter, watery fanies changed into thick white pus, the petechiæ became gradually of a pale colour, and at length difappeared, and the pox began to turn fooner than was expected.

The bark has been applied likewife, and not without fuccefs, to the cure of periodic head-achs, hyfteric and hypochondriac fits, and other diforders, which have regular intermiffions. By its aftringency and aromatic quality, it ftrengthens the whole nervous fyftem, and proves ufeful in weaknefs of the ftomach, and fundry chronical diforders, proceeding from too great laxity of the fibres. In obftinate uterine fluxes, and old gleets, bark joined with chalybeates has notable effects.

The virtues of Peruvian bark refide chiefly in a refinous fubftance, and hence are extracted in perfection by rectified fpirit. By ftrong coction in water, the refin is melted out, and mingled with the water; which whilft hot appears tranfparent, but in cooling grows turbid, and depofites great part of the refin to the bottom. Water elevates in diftillation the aromatic part of the bark; pure fpirit brings over nothing. Hence an aqueous extract proves not only lefs in quantity, but likewife inferior in quality to one made with rectified fpirit. Proof-fpirit extracts the virtues of this drug in tolerable perfection, in the cold; heat enables it to take up more than it can retain when cold. Spirit of fal ammoniac, prepared with fixt alkaline falts, gains very little from the *cortex*, either with or without heat: the fpirit prepared with quicklime, and the dulcified fpirit, in a few hours become ftrongly impregnated with its fmell and tafte.

The officinal preparations of bark are an extract refin, fpirituous tincture, tincture in volatile fpirit, and compound tincture. It is an ingredient alfo in the ftomachic tincture.

The fubftances ufually joined with bark in prefcription feem calculated either to promote its efficacy, or merely for reducing it into the intended form; without much regard to its agreeablenefs, and the conveniency of taking it: this is neverthelefs a point of great confequence, as its tafte, and the quantity which is neceffary, make the patient too frequently loath it, before enough has been taken to produce the defired effect. If defigned to be given in the folid form of a bolus, electuary, *&c.* it fhould be made up, not, as is cuftomary, with fyrups, but with mucilages: with the former, it fticks about the mouth and fauces, whence its tafte remains for a confiderable time; with the latter, it paffes freely, fcarce leaving any tafte in the mouth. Aromatics do not prevent the tafte of the bark from difcovering itfelf; extract of liquorice very effectually conceals it. The extract of logwood alfo, joined to that of bark, and a proper quantity of mucilage, form a very elegant and agreeable compofition.

CINCLUS, in ornithology. See TRINGA.

CINCTURE,

CINCTURE, or CEINTURE, in architecture, a ring, lift, or orlo at the top and bottom of the shaft of a column, separating the shaft at one end from the base, and at the other from the capital. See ARCHITECTURE.

CINERARIA, in ornithology. See MOTACILLA.

CINNABAR, in natural history, is either native or factitious. The native cinnabar is an ore of quick-silver, moderately compact, very heavy, and of an elegant, striated red colour. In this ore the quick-silver is blended in different proportions with sulphur. It is so rich an ore, as to be no other than mercury impregnated with a small quantity of sulphur, just enough to reduce it to that state, being commonly more than six parts of mercury to one of sulphur; and even the poorest cinnabar yields one half mercury: it is of a very bright, glittering appearance, when fresh broken, and is usually found lodged in a bluish, indurated clay, though sometimes in a greenish talcy stone.

For the method of separating mercury from cinnabar, see MERCURY.

Factitious CINNABAR, a mixture of mercury and sulphur sublimed, and thus reduced into a fine red glebe. The best is of a high colour, and full of fibres, like needles.

The receipt for making it, according to the late college-dispensatory, is as follows. Take of purified quick-silver, twenty-five ounces; of sulphur, seven ounces; melt the sulphur, and stir the quick-silver into it while fluid; if it take fire, let it be immediately extinguished, by covering it with another vessel. When cold, let it be rubbed into a fine powder. Let this powder be put into a subliming vessel, and setting it over a gentle fire, raise it by degrees till the whole is sublimed into a red, striated, heavy mass, which perfectly resembles native cinnabar. This, as well as the native cinnabar, is excellent in epilepsies, and in all complaints of the head and nerves. But the factitious is rather to be preferred, as it doth not excite nauseas, vomitings, and other disorders which arise from vitriolic and perhaps arsenical particles blended by nature among some of the masses of the native mineral.

Cinnabar is likewise used by painters as a colour, and is rendered more beautiful, by grinding it with gum-water and a little saffron.

CINNAMON-TREE, in botany. See LAURUS.

CINNAMON-WATER is made by distilling the bark first infused in spirit of wine, brandy, or white-wine.

Clove-CINNAMON is the bark of a tree growing in Brazil, which is often substituted for real cloves.

White CINNAMON, called also Winter's bark, is the bark of a tree frequent in the islands of St Domingo, Guadalupe, *&c.* of a sharp biting taste like pepper. Some use it instead of nutmeg; and in medicine it is esteemed a stomachic and antiscorbutic.

CINOLOA, or CINALOA, the capital of the province of Cinaloa, in North America, about thirty miles east of the bay of California: W. long. 113°, and N. lat. 25°. See CINALOA.

CINQUEFOIL, *quinquefolium*, in botany. See POTENTILLA.

CINQUE-PORTS, an appellation given to five port-towns, situated on the coast of Kent and Sussex, over-against France, and famous in English history.

The cinque-ports are Hastings, Dover, Hithe, Romney, and Sandwich; which have had large privileges granted them, on account of their former great importance, being then not only the keys of the kingdom, but considerable for their maritime strength: thus, we are told, that they were obliged to provide eighty ships at their own charge for forty days, as often as the king should have occasion in his wars.

CINQUE-PORT is also a particular kind of fishing-net much used in standing water, so called on account of the five entrances into it.

CINTRA, a cape and mountain of Portugal, in the province of Estremadura, usually called the rock of Lisbon, situated on the north side of the entrance of the river Tagus: W. long. 10° 15′, N. lat. 39°.

CINYRA, or CINNOR, in Jewish antiquity, generally translated cithara, lyra, *&c.* a musical instrument used before the flood, and invented by Jubah the son of Lamech.

CION, or CYON, among gardeners, denotes a young sprig, or sprout of a tree.

CIPHER, or CYPHER, one of the Arabic characters, or figures, used in computation, formed thus, 0. See ARITHMETIC.

CIPHER is also a kind of enigmatic character, composed of several letters interwoven, which are generally the initial letters of the persons names for whom the ciphers are intended.

CIPHER denotes likewise certain secret characters disguised and varied, used in writing letters that contain some secret, not to be understood but by those between whom the cipher is agreed on.

CIPPUS, in antiquity, a low column, with an inscription, erected on the high roads, or other places, to shew the way to travellers, to serve as a boundary, to mark the grave of a deceased person, *&c.*

CIRCÆA, or ENCHANTERS NIGHTSHADE, in botany, a genus of the diandria monogynia class. The corolla consists of two petals; the corolla has likewise two leaves; and the capsule contains but one seed. The species are three, two of which are natives of Britain, *viz.* the lutitiana, or enchanters-nightshade; and the alpina, or mountain enchanters-nightshade.

CIRCASSIA, a country situated between 40° and 50° E. long. and between 45° and 50° N. lat.

It is bounded by Russia on the north, by Astracan and the Caspian sea on the east, by Georgia and Dagestan on the south, and by the river Don and the Palus Meotis on the west.

The Circassian Tartars form a kind of republic, but sometimes put themselves under the protection of Persia, and sometimes of Russia, or the Turks. They live mostly in tents, removing from place to place for the benefit of pasturage; and are chiefly remarkable for the beauty of their children, the seraglios of Turky and

and Persia being usually supplied with boys and young virgins from this and the neighbouring country of Georgia.

CIRCENSIAN GAMES, a general term under which was comprehended all combats exhibited in the Roman circus, in imitation of the Olympic games in Greece. Most of the feasts of the Romans were accompanied with Circensian games; and the magistrates, and other officers of the republic, frequently presented the people with them, in order to procure their favour. The grand games were held five days, commencing on the 15th of September. There were six kinds of games exhibited: the first was wrestling, and fighting with swords, with staves, and with pikes; the second was racing; the third, leaping; the fourth, quoits, arrows, and cestus; all which were on foot; the fifth was horse-coursing: the sixth courses of chariots.

CIRCIA, in ornithology, a species of anas, called in english the summer-teal, and all over of a dusky yellowish brown, with black feet.

CIRCINALIS, in botany, a name used by some for adiantum, maiden-hair. See ADIANTUM.

CIRCLE, in geometry, a plane figure comprehendred by a single curve line, called its circumference, to which right lines drawn from a point in the middle, called the centre, are equal to each other. To find the area of a circle, see PRACTICAL GEOMETRY.

CIRCLES *of the sphere*. See GEOGRAPHY and ASTRONOMY.

CIRCLES *of latitude*. See GEOGRAPHY.

CIRCLES *of longitude*. See GEOGRAPHY.

Horary CIRCLES, in dialling, are the lines which shew the hours on dials, though these be not drawn circular, but nearly streight. See DIALLING.

Horary CIRCLE, on the globe. See GEOGRAPHY.

Polar CIRCLE. See GEOGRAPHY.

CIRCLE, in logic, or *logical* CIRCLE, is when the same terms are proved *in orbem* by the same terms; and the parts of the syllogism alternately by each other, both directly and indirectly.

CIRCLES *of the empire*, such provinces and principalities of the German empire as have a right to be present at diets. Maximilian I. divided the empire into six, and some years after into ten circles. This last division was confirmed by Charles V. The circles, as they stand in the Imperial Matricola, are as follows, Austria, Burgundy, the Lower Rhine, Bavaria, Upper Saxony, Franconia, Swabia, Upper Rhine, Westphalia, and the Lower Saxony.

CIRCOLO MEZZO, in the Italian music, denotes a diminution of four quavers or semiquavers, which represent a semicircle, proceeding by conjoint degrees.

CIRCUIT, in law, signifies a longer course of proceedings than is needful to recover the thing sued for.

CIRCUIT, also signifies the journey, or progress, which the judgestake twice every year, through the several counties of England and Wales, to hold courts and administerjustice, where recourse cannot be had to the king's courts at Westminster: hence England is divided into six circuits, *viz.* the Home circuit, Norfolk circuit, Midland circuit, Oxford circuit, Western circuit, and Northern circuit.

In Wales there are but two circuits, North and South Wales: two judges are assigned by the king's commission to every circuit.

CIRCUIT *court*, in Scots law, the judges of the supreme criminal court, or court of justiciary, are divided into three separate courts, consisting of two judges each; and the kingdom into as many districts. In certain boroughs of every district, each of these courts by rotation are obliged to hold two courts in the year, in spring and autumn; which are called circuit courts. See SCOTS LAW, *Of the supreme judges and courts of Scotland*.

CIRCULAR, in a general sense, any thing that is described or moved in a round, as the circumference of a circle, or surface of a globe.

CIRCULAR NUMBERS, called also spherical ones, according to some, are such whose powers terminate in the roots themselves.

Thus, for instance, 5 and 6, all whose powers do end in 5 and 6, as the square of 5 is 25, the square of 6 is 36, *&c.*

CIRCULAR SAILING is the method of sailing by the arch of a great circle. See NAVIGATION.

CIRCULATION, the act of moving round, or in a circle: thus we say, the circulation of the blood, *&c.*

CIRCULATION *of the blood*, the natural motion of the blood in a living animal, whereby that fluid is alternately carried from the heart into all parts of the body, by the arteries, from whence it is brought back to the heart again by the veins.

This motion is chiefly caused by the the dilatation and contraction of this organ, and is the principle on which life depends; for when it ceases in any part, it dies; when it is diminished, the operations are weak; and, when it ceases totally, life is extinguished.

All the veins discharge themselves into the ventricles of the heart; from hence all the arteries arise: the blood expelled out of the right ventricle must be carried, through the pulmonary artery, into the lungs; from which it must be returned, by the pulmonary veins, to the left ventricle; from the left ventricle the blood, thus imported, is, by the constriction of that part, again expelled into the aorta, and by it distributed all over the rest of the body, and thence is returned again to the right ventricle by the cava, which completes the circulation.

This circulation becomes actually visible, with the assistance of a microscope, especially in fish, frogs, *&c.* wherein the inosculation, or union of the extremities of the arteries with those of the veins, together with the globules of the blood flowing from the one into the other, may be plainly seen.

The auricles of the heart being large hollow muscles, furnished with a double series of strong fibres, proceeding with a contrary direction to the opposite tendons, the one adhering to the right ventricle, the other to the sinus venosus; as also with innumerable

veins and arteries; by the contractile force of these auricles, the blood will be vigorously expressed and driven into the right ventricle, which, upon this contraction, is rendered flaccid, empty, and disposed to admit it.

Now, if the right ventricle, thus full of blood, by the contraction of its fibres, press the blood towards the aperture again, the venous blood at the same time pouring in, will drive it back again into the cavity, and mix it more intimately, till, rising up against the parietes, it raise the valvulæ tricuspides, which are so connected to the fleshy columns extended on the opposite side, as that, when laid quite down, they cannot close the parietes of the right ventricle; these it thrusts towards the right auricle, till being there joined, they stop the passage very closely, and prevent any return.

By the same means, the same blood rises into the three semilunar valves, placed in the extremity of the other mouth, and lying open to the pulmonary artery; these it shuts close against the sides of the artery, and leaves a passage into the artery alone: the blood carried by this artery into the lungs, and distributed by its branches through the whole substance thereof, is first admitted into the extremities of the pulmonary vein, called arteria venosa; whence passing into four large vessels, which unite together, it is brought to the left sinus venosus, or trunk of the pulmonary vein, by the force of whose musculous structure it is driven into the left ventricle, which, on this occasion, is relaxed, and by that means prepared to receive it.

Hence, as before, it is driven into the left ventricle, which is relaxed by the same means; and by the valvulæ mitrales opening, admit it into the left ventricle, and hinder its flux into the pulmonary vein: from hence it is forced into the aorta, at whose orifice there are three semilunar valves, which also prevent a reflux, by closing the same.

The motion of the blood in living animals is attended with the following phenomena: 1. Both the venous sinuses are filled, and grow turgid at the same time. 2. Both auricles grow flaccid at the same time, and both are filled at the same time with blood, impelled by the contractile force of its correspondent muscular venous sinus. 3. Each ventricle contracts and empties itself of blood at the same time; and the two great arteries are filled and dilated at the same time. 4. As soon as the blood, by this contraction, is expelled, both ventricles being empty, the heart grows larger and broader. 5. Upon which the muscular fibres of both venous sinuses contract, and express the blood contained in them into the ventricle of the heart. 6. In the mean time the venous sinuses are again filled as before, and the auricles, *&c.* return into their former habitude. 7. This alteration continues till the animal begins to languish under the approach of death, at which time the auricles and venous sinuses make several palpitations, for one contraction of the ventricle.

In a fœtus, the apparatus for the circulation of the blood is somewhat different from that in adults. The septum, which separates the two auricles of the heart, is pierced through with an aperture, called the foramen ovale, and the trunk of the pulmonary artery, a little after it has left the heart, sends out a tube into the descending aorta, called the communicating canal. The fœtus being born, the foramen ovale closes by degrees, and the canal of communication dries up, and becomes a simple ligament.

As to the velocity of the circulating blood, and the time wherein the circulation is completed, several computations have been made. By Dr Keil's account, the blood is driven out of the heart into the aorta with a velocity which would carry it twenty-five feet in a minute: but this velocity is continually abated in the progress of the blood, in the numerous sections or branches of the arteries, so that before it arrive at the extremities of the body, its motion is greatly diminished. The space of time wherein the whole mass of blood ordinarily circulates, is variously determined. Some state it thus: Supposing the heart to make two thousand pulses in an hour, and that at every pulse there is expelled an ounce of blood; as the whole mass of blood is not ordinarily computed to exceed twenty-four pounds, it must be circulated seven or eight times over in the space of an hour.

The circulation of the blood was first discovered in England, in the year 1728, by Dr Harvey.

CIRCULATION *of the sap of vegetables*. See Vol. I. p. 45.

CIRCULATION, in chemistry, is an operation whereby the same vapour, raised by fire, falls back, to be returned and distilled several times.

CIRCULATION *of money*. See COMMERCE, and MONEY.

CIRCULUS, in chemistry, an iron instrument in form of a ring, which being heated red hot, and applied to the necks of retorts and other glass vessels, till they grow hot, a few drops of cold water thrown upon them, or a cold blast, will make the necks fly regularly and evenly off.

Another method of doing this, is to tie a thread, first dipt in oil of turpentine, round the place where you would have it break; and then setting fire to the thread, and afterwards sprinkling the place with cold water, the glass will crack exactly where the thread was tied.

CIRCUMAJENTES MUSCULI, or OBLIQUI MUSCULI, in anatomy. See Vol. I. p. 290.

CIRCUMAMBIENT, an appellation given to a thing that surrounds another on all sides; chiefly used in speaking of the air.

CIRCUMCISION, the act of cutting off the prepuce; a ceremony in the Jewish and Mahommetan religions, wherein they cut off the foreskin of their males, who are to profess the one or the other law.

Among the Jews, the time for performing this rite was the eighth day, that is, six full days after the child was born: the law of Moses ordained nothing with respect to the person by whom, the instrument with which, or the manner how, the ceremony was to be performed; the instrument was generally a knife of stone. The child is usually circumcised at home, where the father, or godfather, holds him in his arms, while the operator takes

takes hold of the prepuce with one hand, and with the other cuts it off; a third person holds a porringer, with sand in it, to catch the blood; then the operator applies his mouth to the part, and having sucked the blood, spits it into a bowl of wine, and throws a styptic powder upon the wound. This ceremony was usually accompanied with great rejoicings and feasting, and it was at this time that the child was named in presence of the company. The Jews invented several superstitious customs at this ceremony, such as placing three stools, one for the circumcisor, the second for the person who holds the child, and the third for Elijah, who, they say, assists invisibly at the ceremony, *&c.*

The Jews distinguished their proselytes into two sorts, according as they became circumcised, or not: those who submitted to this rite were looked upon as children of Abraham, and obliged to keep the laws of Moses; the uncircumcised were only bound to observe the precepts of Noah, and were called noachidæ.

This ceremony, however, was not confined to the Jews: Herodotus and Philo Judæus observe, that it obtained also among the Egyptians and Ethiopians. Herodotus says, that the custom was very ancient among each people, so that there was no determining which of them borrowed it from the other. The same historian relates, that the inhabitants of Colchis also used circumcision; whence he concludes, that they were originally Egyptians.

The Turks never circumcise till the seventh or eighth year, as having no notion of its being necessary to salvation. The Persians circumcise their boys at thirteen, and their girls from nine to fifteen. Those of Madagascar cut the flesh at three several times; and the most zealous of the relations present, catches hold of the preputium, and swallows it.

Circumcision is practised on women by cutting off the foreskin of the clitoris, which bears a near resemblance and analogy to the preputium of the male penis. We are told that the Egyptian captive women were circumcised; and also the subjects of Prester John.

Circumcision is also the name of a feast, celebrated on the first of January, in commemoration of the circumcision of our Saviour.

CIRCUMDUCTION, in Scots law. When parties in a suit are allowed a proof of addigeamus after the time limited by the judge for taking that proof is elapsed, either party may apply for circumduction of the time of proving; the effect of which is, that no proof can afterwards be brought, and the course must be determined as it stood when circumduction was obtained. See Scots Law, title *Pobation.*

CIRCUMFERENCE, in a general sense, denotes the line or lines bounding a plane figure. However, it is generally used in a more limited sense, for the curve line which bounds a circle, and otherwise called a periphery; the boundary of a right-lined figure being expressed by the term perimeter.

CIRCUMFERENTOR, an instrument used by surveyors, for taking angles. See Practical Geometry.

CIRCUMFLEX, in grammar, one of the accents. See Accent.

CIRCUMGYRATION, denotes the whirling motion of any body round a center: such is that of the planets round the sun.

CIRCUMLOCUTION, a paraphrastical method of expressing one's thoughts, or saying that in many words which might have been said in few.

CIRCUMPOLAR *stars*, an appellation given to those stars, which by reason of their vicinity to the pole move round it without setting.

CIRCUMSCRIBED, in geometry, is said of a figure which is drawn round another figure, so that all its sides or planes touch the inscribed figure.

CIRCUMSCRIPTION, in natural philosophy, the termination, bounds, or limits of any natural body.

CIRCUMSTANCE, a particularity which, though not essential to any action, yet doth some way effect it.

CIRCUMSTANTIBUS, in law, a term used for supplying and making up the number of jurors (in case any impanelled appear not, or appearing are challenged by any party) by adding to them so many of the persons present as will make up the number, in case they are properly qualified.

CIRCUMVALLATION, or *line of* Circumvallation, in the art of war, is a trench bordered with a parapet, thrown up quite round the besieger's camp, by way of security against any army that may attempt to relieve the place, as well as to prevent desertion.

CIRCUMVOLUTION, in architecture, denotes the torus of the spiral line of the ionic volute.

CIRCUS, in antiquity, a great building of a round or oval figure, erected by the ancients, to exhibit shews to the people.

The Roman circus was a large oblong edifice, arched at one end, encompassed with porticoes, and furnished with two rows of seats, placed ascending over each other. In the middle was a kind of foot-bank, or eminence, with obelisks, statues, and posts at each end. This served them for the courses of their bigæ and quadrigæ.

Those that have measured the circus say, that it was 2187 feet long, and 960 broad; so that it was the greatest building in Rome: some say it would contain 150,000 people, others 260,000, or 300,000.

Circus, in zoology, See Falco.

CIRENCESTER, a borough-town of Gloucestershire, situated on the river Churn, fifteen miles south-east of Gloucester: W. long. 2°, noth lat. 51° 42′ It sends two members to parliament.

CIRLUS, in ornithology. See Emberiza.

CIRRI, among botanists, fine strings or thread-like filaments, by which some plants fasten themselves to walls, trees, *&c.* such are those of ivy.

Cirri, in ichthyology, certain oblong and soft appendages, not unlike little worms, hanging from the under jaws or mouths of some fishes: these cirri, commonly translated *beards*, afford marks to distinguish the different species of the fishes on which they are found.

CIRSIUM, in botany. See Serratula.

CIRSOCELE,

CIRSOCELE, a ſpecies of hernia. See MEDICINE and SURGERY.

CISALPINE, any thing on this ſide the Alps. Thus the Romans divided Gaul into ciſalpine and tranſalpine.

CISLEU, in Hebrew chronology, the ninth month of their eccleſiaſtical, and the third of the civil year, anſwering nearly to our November.

CISMAR, a town of lower Saxony, in Germany, at a little diſtance from the Baltic ſea.

CISSAMPELOS, in botany, a genus of the diœcia monadelphia claſs. The calix of the male has four leaves; the corolla is wanting; the nectarium is rotated; and the ſtamina are four connected together. The calix of the female conſiſts of one ligulated roundiſh-leaf; it has no corolla; the ſtyli are three; and the fruit is a berry containing one ſeed. There are three ſpecies, all natives of America

CISSOID, in geometry, a curve of the ſecond order, firſt invented by Diocles, whence it is called the ciſſoid of Diocles. See FLUXIONS.

CISSUS, in botany, a genus of the tetrandria monogynia claſs. The berry contains but one ſeed, and is ſurrounded by the corolla and calix, which are both divided into four ſegments. The ſpecies are five, all natives of the Indies.

CISTERCIANS, in church-hiſtory, a religious order founded in the eleventh century by St Robert, a benedictine. They became ſo powerful, that they governed almoſt all Europe, both in ſpirituals and temporals. Cardinal de Vitri deſcribing their obſervances, ſays, they neither wore ſkins nor ſhirts; nor ever eat fleſh, except in ſickneſs; and abſtained from fiſh, eggs, milk, and cheeſe: they lay upon ſtraw-beds, in their tunics and cowls: they roſe at midnight to prayers: they ſpent the day in labour, reading and prayer: and in all their exerciſes obſerved a continual ſilence. The habit of the Ciſtercian monks is a white robe, in the nature of a caſſock, with a black ſcapulary and hood, and is girt with a wooden girdle. The nuns wear a white tunic, and a black ſcapulary and girdle.

CISTERN, denotes a ſubterraneous reſervoir of rain-water; or a veſſel ſerving as a receptacle for rain or other water, for the neceſſary uſes of a family.

There are likewiſe lead-ciſterns, jar-ciſterns, *&c.* See PLUMBERY and JAR.

Authors mention a ciſtern of Conſtantinople, the vaults of which are ſupported by two rows of pillars, 212 in each row, each pillar being two feet in diameter. They are planted circularly, and in radii tending to that of the center.

CISTUS, in botany, a genus of the polyandria monogynia claſs. The corolla conſiſts of five petals, and the calix of five leaves, two of them being leſs than the other two. The ſpecies are 37, and only five of them natives of Britain, *viz.* the guttulus, or annual ciſtus; the helianthemum, or dwarf ciſtus, or ſun-flower; the ſurreianus, or narrow-leaved ciſtus; the polii-folius, or mountain dwarf ciſtus; and the hirſutus, or hoary dwarf ciſtus.

CITADEL, a place fortified with four, five, or ſix baſtions, built on a convenient ground near a city, that it may command it in caſe of a rebellion.

CITATION, in eccleſiaſtical courts, is the ſame with ſummons in civil courts. See SUMMONS.

CITATION is alſo a quotation of ſome law, authority, or paſſage of a book.

CITHARA, in antiquity, a muſical inſtrument, the preciſe ſtructure of which is not known; ſome think it reſembled the Greek delta Δ; and others, the ſhape of a half moon. At firſt it had only three ſtrings, but the number was at different times increaſed to eight, to nine, and laſtly to twenty-four. It was uſed in entertainments and private houſes, and played upon with a plectrum or quill, like the lyre.

CITHAREXYLON, in botany, a genus of the didynamia angioſpermia claſs. The calix is bell-ſhaped, and has five teeth; the corolla is tunnel ſhaped; and the berry contains two ſeeds. There are two ſpecies, both natives of America.

CITHARISTA, or CITHAROEDUS, one who played on the cithara.

CITILLE, in zoology, the trivial name of a ſpecies of mus. See MUS.

CITIZEN, a native or inhabitant of a city, veſted with the freedom and liberties of it.

A citizen of Rome was diſtinguiſhed from a ſtranger, becauſe he belonged to no certain commonwealth ſubject to the Romans. A citizen is either by birth or election; and ſons may derive the right from their fathers. To make a good Roman citizen, it was neceſſary to be an inhabitant of Rome, to be inrolled in one of the tribes, and to be capable of dignities. Thoſe to whom were granted the rights and privileges of Roman citizens, were only honorary citizens. It was not lawful to ſcourge a citizen of Rome.

CITRINELLA, in ornithology. See EMBERIZA.

CITRINUS, in natural hiſtory, a kind of ſprig cryſtal, of a fine yellow colour, which being ſet in rings is often miſtaken for a topaz.

CITRON TREE, in botany. See CITRUS.

CITRULLUS, in botany. See CUCURBITA.

CITRUS, in botany, a genus of the polyadelphia icoſandria claſs. The calix is divided into five ſegments; the petals are five, and oblong; and the fruit is a berry, conſiſting of nine cells. The ſpecies are three, *viz.* the medica, or lemon-tree, a native of Aſia; the aurantium, or orange-tree, a native of the Indies; and the trifoliata, a native of Japan.

CITTADELLA, the capital of the iſland of Minorca, about twenty-three miles weſt of Port-mahon: E. long. 3° 30′, N. lat. 40°.

CITTADELLAPIEVE, a town of Italy, in the territories of the pope, near the lake of Peruſa.

CIVENCHEU, a city of China, the ſecond metropolis of the province of Fokien, in 25° N. lat. and 2° 9′ eaſt of Pekin.

CIVES, the Engliſh name of a ſpecies of onion, growing in tufts, and ſeldom exceeding ſix inches in height: they never produce any bulbs, and are much uſed in ſallads in ſpring.

CIVET, a ſoft unctuous matter produced in the manner

of

of musk, in bags growing from the lower part of the belly of a civet-cat. See CASTOR.

CIVET-CAT, the English name of the animal which produces the civet. See CASTOR.

CIVIC CROWN, was a crown given by the ancient Romans to any soldier who had saved the life of a citizen in any engagement.

CIVIDAD *de las Palmas*, the capital of all the Canary islands, situated in the island of Canary.

CIVIDAD-REAL, a city of Spain, in the province of New Castile: it is the capital of La Mancha, situated on the river Guadiana, sixty miles south of Toledo: W. long. 4° 20′, N. lat. 39°.

CIVIL, in a general sense, something that regards the policy, public good, or peace of the citizens, or subjects of the state; in which sense we say, civil government, civil law, civil right, civil war, *&c.*

CIVIL, in a legal sense, is also applied to the ordinary procedure in an action, relating to some pecuniary matter or interest, in which sense it is opposed to criminal.

CIVIL DEATH, any thing that cuts off a man from civil society, as a condemnation to the gallies, perpetual banishment, condemnation to death, outlawry, and excommunication.

CIVIL LAW, is properly the peculiar law of each state, country, or city: but what we usually mean by the civil law, is a body of laws composed out of the best Roman and Grecian laws, compiled from the laws of nature and nations, and, for the most part, received and observed throughout all the Roman dominions for above 1200 years. See LAW.

CIVIL WAR, a war between people of the same state, or the citizens of the same city.

CIVIL YEAR is the legal year, or annual account of time, which every government appoints to be used within its own dominions, and is so called in contradistinction to the natural year, which is measured exactly by the revolution of the heavenly bodies.

CIVILIAN, in general, denotes something belonging to the civil law; but more especially the doctors and professors thereof are called civilians.

CIVITA-CASTELLANA, a city of Italy, in St Peter's patrimony, situated near the river Tiber, twenty-five miles north of Rome: E. long. 13°, N. lat. 42° 15′.

CIVITA VECCHIA, a port-town and fortress of Italy, in St Peter's patrimony, situated on a bay of the Mediterranean, thirty miles north-west of Rome: E. long. 12° 30′, N. lat. 42°.

It is the station of the galleys belonging to the pope, who has lately declared it a free port.

CLACK, among country-men. To clack wool, is to cut off the sheep's mark, which makes the weight less, and yields less custom to the king.

CLACKMANNAN, the capital of Clackmannanshire, in Scotland, situated on the northern shore of the Forth, about twenty five miles north-west of Edinburgh: W. long. 3° 40′, N. lat. 56° 15′.

The county of Clackmannan is joined with that of Kinross, which each in their turn chuse a member to represent them in parliament.

CLAGENFURT, or CLAGENFORT, the capital of Carinthia, in the circle of Austria in Germany, 120 miles south-west of Vienna: E. long. 14°, N. lat. 47°.

CLAIM, in law, a challenge of interest in any thing that is in possession of another.

CLAKIS, in ornithology, a synonime of the anas bernicla. See ANAS.

CLAMP *in a ship*, denotes a piece of timber applied to a mast or yard, to prevent the wood from bursting; and also a thick plank lying fore and aft under the beams of the first orlop, or second deck, and is the same that the rising timbers are to the deck.

CLAMP is likewise the term for a pile of unburnt bricks built up for burning. These clamps are built much after the same manner as arches are built in kilns, *viz.* with a vacuity betwixt each brick's breadth for the fire to ascend by; but with this difference, that instead of arching, they truss over, or over-span; that is, the end of one brick is laid about half way over the end of another, and so till both sides meet within half a brick's length, and then a binding brick at the top finishes the arch

CLAMP-NAILS, such nails as are used to fasten on clamps in the building or repairing of ships.

CLAMPING, in joinery, is the fitting a piece of board with the grain, to another piece of board cross the grain. Thus the ends of tables are commonly clamped, to prevent their warping.

CLANDESTINA, in botany. See LATHRÆA.

CLANDESTINE, any thing done without the knowledge of the parties concerned, or without the proper solemnities. Thus a marriage is said to be clandestine, when performed without the publication of bans, the consent of parents, *&c.*

CLANGULA, in ornithology. See ANAS.

CLAP, in medicine, the first stage of the venereal disease, more usually called a gonorrhœa. See MEDICINE.

CLARAMONT-POWDER, a kind of earth, called *Terra de Baira*, from the place where it is found: it is famous at Venice, for its efficacy in stopping hæmorrhages of all kinds, and in curing malignant fevers.

Precept of CLARE CONSTAT, in Scots law, the warrant of a superior for entering and infefting the heir of his former vassal, without the interposition of an inquest. See SCOTS LAW, title, *Succession in heritable Rights*.

CLARE, a market-town of Suffolk, thirteen miles south of Bury: E. long. 35′, N. lat. 52° 15′. It gives the title of earl to the duke of Newcastle.

CLARE is also the capital of a county of the same name in the province of Connaught, in Ireland, situated about seventeen miles north-west of Limerick: W. long. 9°, N. lat. 52° 40′.

CLARENCIEUX, the second king at arms, so called from the duke of Clarence, to whom he first belonged; for Lionel third son to Edward III. having by his

wife

wife the honour of Clare, in the county of Thomond, was afterwards declared duke of Clarence; which dukedom afterwards efcheating to Edward IV. he made this earl a king at arms. His office is to marfhal and difpofe of the funerals of all the lower nobility, as baronets, knights, efquires, on the fouth fide of the Trent; whence he is fometimes called Surroy, or South-roy, in contradiftinction to Norroy.

CLARENDON. The conftitutions of Clarendon, are certain ecclefiaftical laws drawn up at Clarendon, near Salifbury. They were fixteen in number, all tending to reftrain the power of the clergy, and readily affented to by all the bifhops and barons, the archbifhop Becket excepted, who oppofed them at firft, but was afterwards prevailed upon to fign them. The pope Alexander III. declared againft and annulled moft of them.

CLARENZA, the capital of a duchy of the fame name in the Morea: it is a fea-port town, fituated on the Mediterranean, twenty-fix miles fouth of Petras: E. long. 21° 40′, N. lat. 37° 40′.

CLARET, a name given by the French to fuch of their red wines as are not of a deep or high colour. See WINE.

CLARICHORD, or MANICHORD, a mufical inftrument in form of a fpinnet.

It has forty-nine or fifty ftops, and feventy ftrings, which bear on five bridges, the firft whereof is the higheft, the reft diminifhing in proportion. Some of the ftrings are in unifon, their number being greater than that of the ftops. There are feveral little mortoifes for paffing the jacks, armed with brafs-hooks, which ftop and raife the chords inftead of the feather ufed in virginals and fpinnets: but what diftinguifhes it moft is, that the chords are covered with pieces of cloth, which render the found fweeter, and deaden it fo, that it cannot be heard at any confiderable diftance: whence it comes to be particularly in ufe among the nuns, who learn to play, and are unwilling to difturb the filence of the dormitory.

CLARIFICATION, in chemiftry, the act of clearing and fining any fluid from all heterogeneous matter or feculencies. See CHEMISTRY.

CLARION, a kind of trumpet, whofe tube is narrower, and its tone acuter and fhriller than that of the common trumpet. It is faid that the clarion, now ufed among the Moors and Portuguefe, who borrrowed it from the Moors, ferved anciently for a treble to feveral tumpets, which founded tenor and bafs.

CLARION, in heraldry, a bearing as reprefented in Plate LXV. fig. 5. he bears ruby, three clarions topaz, being the arms of the earl of Bath, by the name of Granville: Guillim is of opinion, that thefe three clarions are a kind of old-fafhioned trumpets; but others fay, that they rather refemble the rudder of a fhip; others, a reft for a lance.

CLARO-OBSCURO, or CLAIR-OBSCURE, in painting, the art of diftributing to advantage the lights and fhadows of a piece, both with regard to the eafing of the eye, and the effect of the whole piece.

CLARO-OBSCURO, or CHIARO-SCURO, is alfo ufed to fignify a defign confifting only of two colours, moft ufually black and white, but fometimes black and yellow; or it is a defign wafhed only with one colour, the fhadows being of a dufky brown colour, and the lights heightened up with white.

The word is alfo applied to two prints of two colours, taken off at twice, whereof there are volumes in the cabinets of the curious in prints.

CLARY, in botany. See SALVIA.

CLARY-WATER, a fpirit drawn from an infufion of the herb clary in fpirit of wine, being a very pleafant and excellent cordial.

CLASMIUM, in natural hiftory, conftitutes a diftinct genus of gypfums by itfelf, being more foft, dull, and opake, than other kinds: it neither gives fire with fteel, nor ferments with aqua fortis; but calcines readily in the fire, and affords a very valuable plafter.

CLASS, an appellation given to the moft general fubdivifions of any thing: thus, animal is fubdivided into the claffes quadrupeds, birds, fifhes, &c. which are again fubdivided into feriefes or orders; and thefe laft into genera. See NATURAL HISTORY, and BOTANY.

CLASS is alfo ufed in fchools, in a fynonymous fenfe with form, for a number of boys all learning the fame thing.

CLASSIC, or CLASSICAL, an epithet chiefly applied to authors read in the claffes at fchools.

This term feems to owe its origin to Tullius Servius, who, in order to make an eftimate of every perfon's eftate, divided the Roman people into fix bands, which he called claffes. The eftate of the firft clafs was not to be under 200 l. and thefe by way of eminence were called *claffici*, claffics: hence authors of the firft rank came to be called claffics, all the reft being faid to be *infra claffem*: thus Ariftotle is a claffic author in philofophy; Aquinus, in fchool-divinity, &c.

CLATHRUS, in botany, a genus of the cryptogamia fungi clafs. This fungus is roundifh, and full of cancelli. The fpecies are four, none of them natives of Britain.

CLATTE, in heraldry, an appellation given to irregular lines, not reducible to thofe commonly ufed. See LINE.

CLAVARIA, in botany, a genus of the cryptogamia fungi clafs. It is fmooth and oblong. The fpecies are eight, feven of which are natives of Britain, *viz.* the piftillaris, or fimple clavaria; the ophiogloffoides, or black clavaria; the digitata, or fingered clavaria; the hypoxylon, or flat clavaria; the coralloides, or yellow clavaria; the faftigiata, or ftinking clavaria; and the mufcoides, or pointed clavaria.

CLAVES INSULÆ, a term ufed in the ifle of Man; where all weighty and ambiguous caufes are referred to a jury of twelve, who are called *claves infulæ*, the keys of the ifland.

CLAVICLES, in anatomy. See Vol. I. p. 175.

CLAVIS properly fignifies a key, and is fometimes ufed in Englifh to denote an explanation of fome obfcure paffages in any book or writing.

CLAUSE, in grammar, denotes a member of a period, or ſentence.

Clause ſignifies alſo an article, or particular ſtipulation in a contract, a charge or condition in a teſtament, *&c.*

CLAUSENBURG, a large city of Tranſilvania, ſituated on the river Samos, about fifty-five miles north-weſt of Hermanſtat: E. long. 20° 50′, N. lat. 47° 10′.

CLAVUS, in antiquity, an ornament upon the robes of the Roman ſenators and knights, which was more or leſs broad, according to the dignity of the perſon: hence the diſtinction of tunica auguſti-clavia and laticlavia.

Clavus, in medicine and ſurgery, is uſed in ſeveral ſignifications: 1. Clavus hyſtericus, is a ſhooting pain in the head, between the pericranium and cranium, which affects ſuch as have the green-ſickneſs. 2. Clavus oculorum, according to Celſus, is a callous tubercle on the white of the eye, taking its denomination from its figure. 3. Clavus imports indurated tubercles of the uterus. 4. Clavus imports a chirurgical inſtrument of gold, mentioned by Amatus Luſitanus, deſigned to be introduced into an exulcerated palate, for the better articulation of the voice. 5. Clavus is a callus or corn on the foot.

CLAW, among zoologiſts, denotes the ſharp-pointed nails with which the feet of certain quadrupeds and birds are furniſhed.

Crab's Claws, in pharmacy, See Crab's claws.

CLAY, in natural hiſtory, a genus of earths, the characters of which are theſe: they are firmly coherent, weighty, and compact; ſtiff, viſcid, and ductile to a great degree, while moiſt; ſmooth to the touch, not eaſily breaking between the fingers, nor readily diffuſible in water, and when mixed not readily ſubſiding from it.

CLAYTONIA, in botany, a genus of the pentandria monogynia claſs. The calix conſiſts of two valves; the corolla has five petals; the ſtigma is trifid; and the capſule has three valves, and contains three ſeeds. The ſpecies are two, none of them natives of Britain.

Cape CLEAR, a promontory in a little iſland on the ſouth-weſt coaſt of Ireland.

CLEAVERS, in botany. See Gallium.

CLEBURY, a market-town of Shropſhire, about 25 miles ſouth-eaſt of Shrewſbury: W. long. 2° 30′, and N. lat. 52° 27′.

CLECHE, in heraldry, a kind of croſs, charged with another croſs of the ſame figure, but of the colour of the field. See Plate LXV. fig. 6.

CLEDGE, among miners, denotes the upper ſtratum of fuller's earth.

CLEF, or Cliff, in muſic, a mark ſet at the beginning of the lines of a ſong, which ſhews the tone or key in which the piece is to begin; or it is a letter marked on any line, which explains the reſt.

CLEIDOMASTOIDEUS, in anatomy. See Vol. I. p. 215.

CLEMA, in antiquity, a twig of the vine, which ſerved as the badge of a centurion's office.

CLEMATIS, in botany, a genus of the polyandria polygynia claſs. It has no calix; the petals are four; and the ſeeds are caudated. There are twelve ſpecies, none of them natives of Britain.

CLEOME, in botany, a genus of plants belonging to the tetradynamia ſiliquoſa claſs. It has three nectariferous glands, one at each ſinus of the calix, excepting the loweſt; the ſiliqua or pod has two valves and one cell. There are fifteen ſpecies, none of them natives of Britain.

CLEPSYDRA, a water-clock, or inſtrument to meaſure time by the fall of a certain quantity of water.

CLERGY, a general name given to the body of eccleſiaſtics of the Chriſtian church, in contradiſtinction to the laity.

The diſtinction of Chriſtians into clergy and laity, was derived from the Jewiſh church, and adopted into the Chriſtian by the apoſtles themſelves: whenever any number of converts were made, as ſoon as they were capable of being formed into a congregation or church, a biſhop or preſbyter, with a deacon, were ordained to miniſter to them. Of the biſhops, prieſts, and deacons, the clergy originally conſiſted; but in the third century, many inferior orders were appointed, as ſubſervient to the office of deacon, ſuch as ſubdeacons, acolythiſts, readers, *&c.*

Benefit of Clergy, is an ancient privilege, whereby one in orders claimed to be delivered to his ordinary, to purge himſelf of felony: this purgation was to be by his own oath, affirming his innocency, and the oath of twelve compurgators, as to their belief of it, before a jury of twelve clerks: if the clerk failed in his purgation, he was deprived of his character, whereby he became a mere layman; or he was to be kept in priſon till a pardon was obtained: but if he purged himſelf, he was ſet at liberty.

CLERK, a word originally uſed to denote a learned man, or man of letters; whence the term became appropriated to church-men, who were from thence called clerks, or clergymen; the nobility and gentry being uſually bred up to the exerciſe of arms, and none left but the eccleſiaſtics to cultivate the ſciences.

Clerk is alſo applied to ſuch as by their courſe of life, exerciſe their pens in any court or office, of which there are various kinds: thus,

Clerk *of the bails*, an officer in the court of king's bench, whoſe buſineſs it is to file all bail-pieces taken in that court, where he always attends.

Clerk *of the check*, an officer belonging the king's court, ſo called, becauſe he has the check and controulment of the yeomen that belong to the king, queen, or prince. He likewiſe, by himſelf or deputy, ſets the watch in the court. There is alſo an officer in the navy of the ſame name, belonging to the king's yards.

Clerk *of the crown*, an officer, in the king's bench, who frames, reads, and records all indictments againſt offenders, there arraigned or indicted of any public crime. He is likewiſe termed clerk of the crown-office, in which capacity he exhibits informations by order of the court, for divers offences.

Clerk *of the crown*, in chancery, an officer whose business it is constantly to attend the lord-chancellor, in person or by deputy, to write and prepare for the great seal special matters of state by commission, both ordinary and extraordinary, *viz.* commissions of lieutenancy, of justices of assize, oyer and terminer, goal-delivery, and of the peace; all general pardons, granted either at the king's coronation, or in parliament: the writs of parliament, with the names of the knights, citizens, and burgesses, are also returned into his office. He also makes out special pardons, and writs of execution on bonds of statute-staple forfeited.

Clerk *of the deliveries*, an officer of the tower, whose function is to take indentures for all stores and ammunition issued from thence.

Clerk *of the errors*, in the court of common pleas, an officer who transcribes and certifies into the king's bench, the tenor of the record of the action on which the writ of error, made out by the cursitor, is brought there to be determined. In the king's bench, the clerk of the errors transcribes and certifies the records of causes, by bill, in that court, into the exchequer. And the business of the clerk of the errors in the exchequer, is to transcribe the records certified thither out of the king's bench, and to prepare them for judgment in the exchequer-chamber.

Clerk *of the essoins*, in the court of common pleas, keeps the essoin-roll, or enters essoins; he also provides parchment, cuts it into rolls, marks the number on them, delivers out all the rolls to every officer, and receives them again when written. See Essoin.

Clerk *of the estreats*, an officer in the exchequer, who every term receives the estreats out of the lord-treasurer's remembrancer's office, and writes them out, to be levied for the crown.

Clerk *of the green cloth*. See Green-cloth.

Clerk *of the hamper*, or *hanaper*, an officer in chancery, whose business is to receive all money due to the king for the seals of charters, letters patent, commissions, and writs; also the fees due to the officers for enrolling and examining them.

Clerk-*comptroller of the king's household*, an officer of the king's court, authorised to allow or disallow the charges of pursuivants, messengers of the green cloth, &c. to inspect and controul all defects of any of the inferior officers; and to sit in the counting-house with the lord-steward and other officers of the household, for regulating such matters.

Clerk *of the king's silver*, an officer of the common pleas, to whom every fine is brought, after it has passed the office of the custos brevium; and who enters the effect of writs of covenant, into a book kept for that purpose, according to which all the fines of that term are recorded in the rolls of the court.

Clerk *of the market*, an officer of the king's house, to whom is given the charge of the king's measures and weights, the standards of those that ought to be used all over England.

Clerk *of the nichils*, or *nihils*, an officer of the exchequer, who makes a roll of all such sums as are nichilled by the sheriffs upon their estreats of green wax, and delivers them in to the remembrancer of the treasury, to have execution done upon them for the king. See Nihil.

Clerk *of the outlawries*, an officer of the common pleas, and deputy to the attorney-general, for making out all writs of capias utlagatum, after outlawry, to which there must be the king's attorney's name.

Clerk *of the paper-office*, an officer belonging to the king's bench, whose business is to make up the paper-books of special pleadings in that court.

Clerk *of the peace*, an officer belonging to the sessions of the peace, whose business is to read indictments, inrol the proceedings, and draw the process: he likewise certifies into the king's bench, transcripts of indictments, outlawries, attainders and convictions had before the justices of peace, within the time limited by statute, under a certain penalty. This office is in the gift of the custos rotulorum, and may be executed by deputy.

Clerk *of the pells*, an officer that belongs to the exchequer, whose business is to enter every teller's bill into a parchment roll called *pellis receptorum*, and to make another roll of payments called *pellis exituum*.

Clerk *of the petty bag*, an officer of the court of chancery, whereof there are three, the master of the rolls being the chief: their business is to record the return of all inquisitions out of every shire, to make out patents of customers, gaugers, comptrollers, &c. liberates upon extents of statutes-staple, *conge d'elires* for bishops, summons of the nobility, clergy, and burgesses to parliament, and commissions directed to knights and others, of every shire, for assessing subsidies and taxes.

Clerk *of the pipe*, an officer of the exchequer, who having the accounts of all debts due to the king delivered out of the remembrancer's office, charges them in a great roll folded up like a pipe. He writes out warrants to sheriffs, to levy the said debts on the goods and chattels of the debtors: and if they have no good, then he draws them down, to the treasurer's remembrancer, to write estreats against their lands.

Clerk *of the pleas*, an officer of the exchequer, in whose office all the officers of the court, having special privilege, ought to sue, or be sued, in any action. In this office also actions at law may be prosecuted by other persons, but the plaintiff ought to be tenant or debtor to the king, or some way accountable to him. The under-clerks are attorneys in all suits.

Clerks *of the privy-seal*, four officers that attend the lord privy-seal, for writing and making out all things that are sent by warrant from the signet to the privy-seal, and to be passed the great-seal; and likewise to make out privy-seals, upon special occasions of his majesty's affairs, as for loan of money, or the like.

Clerk *of the rolls*, an officer of the chancery, whose business is to make searches after, and copies of deeds, officers, &c.

Clerk *of the signet*, an officer continually attending upon his majesty's principal secretary, who has the custody of the privy-signet, as well for sealing the king's

king's private letters, as thofe grants which pafs the king's hand by bill figned. There are four of thefe officers, who have their diet at the fecretary's table.

CLERK, or WRITER, *to the fignet*, in Scots law. See SCOTS LAW, title 3.

Six CLERKS, officers in chancery, next in degree below the twelve mafters, whofe bufinefs is to inrol commiffions, pardons, patents, warrants, *&c.* which pafs the great feal: they were anciently clerici, and forfeited their places if they married. Thefe are alfo attorneys for parties in fuits depending in the court of chancery.

CLERK *of the treafury*, an officer belonging to the court of common pleas, who has the charge of keeping the records of the court, makes out all records of *nifi prius*, and likewife all exemplifications of records being in the treafury. He has the fees due for all fearches; and has under him an under-keeper, who always keeps one key of the treafury door.

CLERK *of the warrants*, an officer of the common pleas, whofe bufinefs is to enter all warrants of attorney for plaintiffs and defendants in fuit; and to inroll deeds of bargain and fale, that are acknowledged in court, or before a judge. His office is likewife to eftreat into the exchequer all iffues, fines, eftreats, and amercements, which grow due to the crown in that court.

CLERMONT, a city and bifhop's fee of France, in the territory of Auvergne, and province of Lyonois, about feventy-five miles weft of Lyons: E. long. 3° 20′ and N. lat. 45° 42′.

CLERODENDRUM, in botany, a genus of the didynamia-angiofpermia clafs. The calix is bell fhaped, and divided into five fegments; the tube of the corolla is filiform; the limbus is divided into five equal parts; the ftamina are very long; and the berry contains but one feed. The fpecies are two, both natives of the Indies.

CLEROMANCY, a fort of divination performed by throwing lots, which were generally black and white beans, little clods of earth, or pebbles; alfo dice, or fuch like things, diftinguifhed by certain characters. They caft the lots into a veffel, and having made fupplication to the gods to direct them, drew them out, and, according to the characters, conjectured what fhould happen to them.

CLETHRA, in botany, a genus of the decandria monogynia clafs. The calix is divided into five fegments; the petals are five; the ftigma is trifid; and the capfule has three cells and three valves. There is but on fpecies, *viz.* the alnifolia, a native of Carolina.

CLEVES, or CLEF, the capital of the dutchy of Cleve, in the circle of Weftphalia, in Germany, fituated near the weftern fhore of the river Rhine: E. long. 5° 36′, and N. lat. 51° 40′. It is fubject to the king of Pruffia.

CLEVELAND, a diftrict in the north-riding of Yorkfhire, from which the noble family of Fitzroy takes the title of duke.

CLIENT, among the Romans, a citizen who put himfelf under the protection of fome great man, who, in refpect of that relation, was called patron.

This patron affifted his client with his protection, intereft, and goods; and the client gave his vote for his patron, when he fought any office for himfelf or his friends. Clients owed refpect to their patrons, as thefe owed them their protection.

The right of patronage was appointed by Romulus, to unite the rich and poor together in fuch a manner, as that one might live without contempt, and the other without envy; but the condition of a client, in courfe of time, became little elfe but a moderate flavery.

CLIENT is now ufed for a party in a lawfuit, who has turned over his caufe into the hands of a counfellor or follicitor.

CLIFFORTIA, in botany, a genus of the diœcia polyandria clafs. The calix of the male confifts of three leaves; it has no corolla; and the ftamina are about thirty. The calix of the female confifts likewife of three leaves; and the corolla is wanting; the ftyli are two; and the capfule is bilocular, and contains one feed. The fpecies are four, all natives of Æthiopia.

CLIMACTERIC, among phyficians, a critical year in a perfon's life, in which he is fuppofed to ftand in great danger of death.

According to fome, every feventh year is a climacteric; but others allow only thofe years produced by multiplying 7 by the odd number 3, 5, 7, and 9, to be climacterical. Thefe years, they fay, bring with them fome remarkable change with refpect to health, life, or fortune; the grand climacteric is the fixty-third year; but fome, making two, add to this the eighty-firft: the other remarkable climacterics are the feventh, twenty-firft, thirty-fifth, forty ninth, and fifty fixth.

CLIMATE, in geography, a fpace upon the furface of the terreftrial globe, contained between two parallels, and fo far diftant from each other, that the longeft day in one differs half an hour from the longeft day in the other parallel. See GEOGRAPHY.

CLIMAX, or GRADATION, in rhetoric, a figure wherein the word or expreffion which ends the firft member of a period begins the fecond, and fo on; fo that every member will make a diftinct fentence, taking its rife from the next foregoing, till the argument and period be beautifully finifhed; as in the following gradation of Dr Tillotfon. "After we have practifed good actions a while, they become eafy; and when they are eafy, we begin to take pleafure in them; and when they pleafe us, we do them frequently; and by frequency of acts, a thing grows into a habit; and confirmed habit is a fecond kind of nature; and fo far as any thing is natural, fo far it is neceffary; and we can hardly do otherwife; nay, we do it many times, when we do not think of it."

CLINCH, in the fea-language, that part of a cable which is bended about the ring of the anchor, and then feized, or made faft.

CLINCHING, in the fea-language, a kind of flight caulking ufed at fea, in a profpect of foul weather, about the pofts: it confifts in driving a little oakum into their feams, to prevent the water's coming in at them.

CLINIC,

CLINIC, a term applied by the ancient church-hiſtorians, to thoſe who received baptiſm on their death-bed.

CLINIC *medicine*, was particularly uſed for the method of viſiting and treating ſick perſons in bed, for the more exact diſcovery of all the ſymptoms of their diſeaſe.

CLINOIDES, in anatomy. See Vol. I. p. 158.

CLINOPODIUM, in botany, a genus of the didynamia gymnoſpermia claſs. The involucrum is hoary. The ſpecies are three, only one of which is a native of Britain, *viz.* the vulgare, or great wild baſil.

CLIO, in zoology, a genus of inſects belonging to the order of vermes molluſca; the body is oblong, and fitted for ſwimming; and it has two membranaceous wings placed oppoſite to each other. The ſpecies are three, principally diſtinguiſhed by the ſhape of their vagina, and are all natives of the ocean.

CLIPEUS, in natural hiſtory, a name given to the flat depreſſed centroniæ, from their reſembling a ſhield. See CENTRONIA.

CLITORIA, in botany, a genus of the diadelphia decandria claſs. The vexillum is large, open, plaited, and covers the alæ. The ſpecies are five, all natives of the Indies.

CLITORIS, in anatomy. See Vol. I. p. 276.

CLOACA, in Roman antiquity, the common ſewer, by which the filth of the city of Rome was carried away.

CLOCK, a kind of movement, or machine, ſerving to meaſure time.

The invention of clocks is attributed to Pacificus, archdeacon of Verona, who lived in the time of Lotharius: others aſcribe it to Boetius, about the year 510: be that as it will, it is certain, that the art of making clocks, ſuch as are now in uſe, was either firſt invented, or at leaſt retrieved in Germany, about 230 years ago; and the invention of pendulum clocks, ſo late as the laſt age, is diſputed between Huygens and Galileo. For the principles of *Clock* and *Watch Work*, ſee WATCH.

CLOGHER, a city and biſhop's ſee of Ireland, in the county of Tyrone, and province of Ulſter, ſituated twelve miles weſt of Armagh: W. long. 7° 30′, and N. lat. 54° 16′.

CLOISTER, an habitation ſurrounded with walls, and inhabited by religious.

In a more general ſenſe, it is uſed for a monaſtery of religious of either ſex. In the firſt ſenſe, it is the principal part of a regular monaſtery, being a ſquare ſurrounded with walls or buildings. It is commonly placed between the church, the chapter-houſe, and refectory, underneath the dormitory.

CLOSE, in heraldry. When any bird is drawn in a coat of arms with its wings cloſe down about it, (*i. e.* not diſplayed), and in a ſtanding poſture, they blazon it by this word *cloſe*; but if it be flying, they call it *volant*. See VOLANT.

CLOT-*bird*. See FRINGILLA.

CLOTH, in commerce, a manufacture made of wool, wove in the loom.

Cloths are of divers qualities, fine or courſe. The goodneſs of cloth, according to ſome, conſiſts in the following particulars. 1. That the wool be of a good quality, and well dreſſed. 2. It muſt be equally ſpun, carefully obſerving that the thread of the warp be finer and better twiſted than that of the woof. 3. The cloth muſt be well wrought, and beaten on the loom, ſo as to be every where equally compact. 4. The wool muſt not be finer at one end of the piece than in the reſt. 5. The liſts muſt be ſufficiently ſtrong, of the ſame length with the ſtuff, and muſt conſiſt of good wool, hair, or oſtrich-feathers; or, what is ſtill better, of Daniſh dog's hair. 6. The cloth muſt be free from knots, and other imperfections. 7. It muſt be well ſcoured with fuller's earth, well fulled with the beſt white ſoap, and afterwards waſhed in clear water. 8. The hair or nap muſt be well drawn out with the teazel, without being too much opened. 9. It muſt be ſhorn cloſe without making it thread-bare. 10. It muſt be well dried. 11. It muſt not be tenter-ſtretched, to force it to its juſt dimenſions. 12. It muſt be preſſed cold, not hot preſſed, the latter being very injurious to woolen cloth.

Manufacturing of white cloths which are intended for dying.

The beſt wool for the manufacturing of cloths are thoſe England and Spain, eſpecially thoſe of Lincolnſhire and Segovia. To uſe thoſe wools to the beſt advantage, they muſt be ſcoured, by putting them into a liquor ſomewhat more than lukewarm, compoſed of three parts fair water, and one of urine. After the wool has continued long enough in the liquor to ſoak, and diſſolve the greaſe, it is drained and well waſhed in running water. When it feels dry, and has no ſmell but the natural one of the ſheep, it is ſaid to be duly ſcoured.

After this it is hung to dry in the ſhade, the heat of the ſun making it harſh and inflexible: when dry, it is beat with rods upon hurdles of wood, or on cords, to cleanſe it from duſt, and the groſſer filth; the more it is thus beat and cleanſed, the ſofter it becomes, and the better for ſpinning. After beating, it muſt be well picked, to free it from the reſt of the filth that had eſcaped the rods.

It is now in a proper condition to be oiled, and carded on large iron cards, placed ſlopewiſe. Olive oil is eſteemed the beſt for this purpoſe: one fifth of which ſhould be uſed for the wool intended for the woof, and a ninth for that deſigned for the warp. After the wool has been well oiled, it is given to the ſpinners, who firſt card it on the knee with ſmall fine cards, and then ſpin it on the wheel, obſerving to make the thread of the warp ſmaller by one third than that of the woof, and much compacter twiſted.

The thread thus ſpun, reeled, and made into ſkeins, that deſigned for the woof is wound on little tubes, pieces of paper, or ruſhes, ſo diſpoſed, as that they may be eaſily put in the eye of the ſhuttle. That for the warp is wound on a kind of large wooden bobbins, to diſpoſe it for warping. When warped, it is ſtiffened with ſize, the beſt of which is that made of ſhreds of

of parchment, and when dry, is given to the weavers, who mount it on the loom.

The warp thus mounted, the weavers, who are two to each loom, one on each ſide, tread alternately on the treddle, firſt on the right ſtep, and then on the left, which raiſes and lowers the threads of the warp equally; between which they throw tranſverſely the ſhuttle from the one to the other: and every time that the ſhuttle is thus thrown, and a thread of the woof inſerted within the warp, they ſtrike it conjunctly with the ſame frame, wherein is faſtened the comb or reed, between whoſe teeth the threads of the warp are paſſed, repeating the ſtroke as often as is neceſſary.

The weavers having continued their work till the whole warp is filled with the woof, the cloth is finiſhed; it is then taken off the loom by unrolling it from the beam whereon it had been rolled in proportion as it was wove; and now given to be cleanſed of the knots, ends of threads, ſtraws, and other filth, which is done with iron nippers.

In this condition it is carried to the fullery, to be ſcoured with urine, or a kind of potter's clay, well ſteeped in water, put along with the cloth in the trough wherein it is fulled. The cloth being again cleared from the earth or urine, is returned to the former hands to have the leſſer filth, ſmall ſtraws, *&c.* taken off as before: then it is returned to the fuller to be beat and fulled with hot water, wherein a ſuitable quantity of ſoap has been diſſolved; after fulling, it is taken out to be ſmoothed, or pulled by the liſts lengthwiſe, to take out the wrinkles, crevices, *&c.*

The ſmoothing is repeated every two hours, till the fulling be finiſhed, and the cloth brought to its proper breadth: after which it is waſhed in clear water, to purge it of the ſoap, and given wet to the carders to raiſe the hair or nap on the right ſide with the thiſtle or weed. After this preparation the clothworker takes the cloth, and gives it its firſt cut or ſhearing: then the carders reſume it, and after wetting, give it as many more courſes with the teazle, as the quality of the ſtuff requires, always obſerving to begin againſt the grain of the hair, and to end with it; as alſo to begin with a ſmoother thiſtle, proceeding ſtill with one ſharper and ſharper, as far as the ſixth degree.

After theſe operations, the cloth being dried, is returned to the cloth worker, who ſheers it a ſecond time, and returns it to the carders, who repeat their operation as before, till the nap be well ranged on the ſurface of the cloth, from one end of the piece to the other.

The cloth thus wove, ſcoured, napped, and ſhorn, is ſent to the dyer; when dyed, it is waſhed in fair water, and the worker takes it again wet as it is, lays the nap with a bruſh on the table, and hangs it on the tenters, where it is ſtretched both in length and breadth ſufficiently to ſmooth it, ſet it ſquare, and bring it to its proper dimenſions, without ſtraining it too much; obſerving to bruſh it afreſh, the way of the nap, while a little moiſt, on the tenters.

When quite dry, the cloth is taken off the tenters, and bruſhed again on the table, to finiſh the laying of the nap; after which it is folded, and laid cold under a preſs, to make it perfectly ſmooth and even, and give it a gloſs.

Laſtly, the cloth being taken out of the preſs, and the papers, *&c.* for gloſſing it removed, it is in a condition for ſale or uſe. With regard to the manufacture of mixt cloths, or thoſe wherein the wools are firſt dyed, and then mixt, ſpun and wove of the colours intended, the proceſs, except what relates to the colour, is moſtly the ſame with that juſt repreſented.

CLOUD, a collection of vapours ſuſpended in the atmoſphere. See PNEUMATICS.

CLOVE-TREE, in botany. See CARYOPHYLLUS.

CLOVE, a term uſed in weights of wool. Seven pounds make a clove.

In Eſſex, eight pounds of cheeſe and butter go to the clove.

CLOVE-JULY-FLOWER. See CARYOPHYLLUS.

CLOVER-GRASS, in botany. See TRIFOLIUM.

CLOYNE, a city and biſhop's ſee of Ireland, in the county of Cork, and province of Munſter, about fifteen miles eaſt of Cork: W. long. 8°, and N. lat. 51° 40′.

CLUPEA, or herring, in ichthyology, a genus belonging to the order of abdominales. The upper jaw is furniſhed with a ſerrated myſtache; the branchioſtege membrane has eight rays; a ſcaly ſerrated line runs along the belly from the head to the tail; and the belly-fins have frequently nine rays. There are 11 ſpecies, *viz.*

1. The harengus, or common herring, has no ſpots, and the under jaw is longer than the upper one. A herring dies immediately after it is taken out of the water, whence the proverb ariſes, *As dead as a herring*. The fleſh is every where in great eſteem, being fat, ſoft, and delicate, eſpecially if it is dreſt as ſoon as caught; for then it is incomparably better than on the next day. There are vaſt quantities of theſe fiſh taken, ſalted, ſmoak-dried, and conſumed all over Europe. They make a progreſs every year from the ſeas near the north of Scotland, into the Britiſh channel, coming in purſuit of worms and ſmall fiſh, which at that time abound there. There is alſo plenty near Norway and Denmark, from whence they proceed annually as far as the coaſt of Normandy.

The herring-fiſhery is begun both by the Engliſh and Dutch towards the latter end of June; and the Dutch alone employ no leſs than one thouſand ſhips therein, called buſſes, from forty-five to ſixty ton each. The beſt time for catching herrings is from the latter end of September, to the latter end of October; and the nets they make uſe of, are about twenty five yards long, and five deep. They ſometimes faſten ſo many of theſe nets together, as will take in a mile in compaſs. They judge where the herrings lie by the hovering and motion of the ſea-birds, which continually purſue them, in expectation of prey. The fiſhermen row very gently along, letting the nets fall into the ſea,

ſea, and taking their courſes as near as they can againſt the tide; that ſo, when they draw their nets, they may have the aſſiſtance of the tide. As ſoon as any boat has got its load, it makes to the ſhore, and delivers its load to thoſe that waſh and gut them.

Herrings are put into a tub with ſalt or brine, where they lie for twenty-four hours, and are then taken out and put into wicker baſkets and waſhed. After this, they are ſpitted on ſharp wooden ſpits, and hung up in a chimney, built for that purpoſe, at ſuch diſtances, that the ſmoke may have free acceſs to them all. Theſe places will hold ten or twelve thouſand at a time; and they kindle billets on the floor in order to dry them. This done, they ſhut the doors, having before ſtopped up all the air-holes. This they repeat every quarter of an hour, inſomuch that a ſingle laſt of herrings requires five hundred billets to dry them. A laſt is ten barrels, and each barrel contains about one thouſand herrings. When they are ſmoke-dried in this manner, they are called red herrings. Salt herrings, and pickled herrings, are cured after a different manner; the laſt of which were formerly beſt done by the Dutch; but now the Scotch and Engliſh are become their rivals in that trade. Herrings always ſwim in ſhoals, delighting to be near the ſhore. They ſpawn but once a year, that is about the beginning of November; a little before which, like moſt other fiſh, they are in higheſt ſeaſon.

There are likewiſe herrings on the coaſt of North America, but they are not ſo plenty as in Europe; and they never go farther ſouth than the rivers of Carolina. There are none near Spain, Portugal, in the Mediterranean, nor on the coaſt of Africa.

2. The ſprattus has 13 rays in the back-fin. It is a native of the European ſeas, and has a great reſemblance to the herring, only it is of a leſs ſize.

3. The aloſa, has a forked ſnout, and black ſpots on the ſides. It is found in the European ſeas.

4. The encraſicolus, or anchovy, has its upper jaw longer than the under one, and is found in the European ſeas. It is about three inches long, and is frequently uſed as a pickle.

5. The atherinoides has a ſhining line on each ſide, and ſmall belly-fins. It is a native of Surinam.

6. The thriſſa has 28 rays in the fin at the anus. It is found in the Indian ocean.

7. The ſima has yellow fins, thoſe of the belly being very ſmall. The mouth is flat; the upper jaw is very ſhort; the body is of a ſhining ſilver colour; and the fins are yellow. It is a native of Aſia.

8. The ſternicla has no belly-fins, and the body is broad. It is a native of Surinam.

9. The myſtus is ſhaped like a ſword, and the fins at the anus are united. It is found in the Indian ocean.

10. The tropica has a wedge-like tail, and a white, broad, compreſſed body; and the tail is wedge-ſhaped. It is found at Aſcenſion iſland.

11. The ſinenſis is very like the common herring, but broader. It has no teeth, and is a native of China.

CLUSIA, in botany, a genus of the polygamia monœcia claſs. The calix of the male conſiſts of ſix leaves; the corolla has five petals; and the ſtamina are numerous. The calix and corolla of the female are the ſame as thoſe of the male; the nectarium includes the germen and united antheræ; and the capſule has five cells, five valves, and a ſtuffed pulp. The ſpecies are four, all natives of America.

CLUTIA, in botany, a genus of the diœcia gynandria claſs. The calix and corolla, both of the male and female, conſiſt of five leaves; the ſtyli are three; and the capſule has three cells and one ſeed.

CLYDE, a river in Scotland, which, ariſing in Annandale, runs north-weſt by Lanerk, Hamilton, and Glaſgow, and falls into the Frith of Clyde, over-againſt the iſle of Bute.

CLYMENUM, in botany. See LATHYRUS.

CLYPEOLA, in botany, a genus of the tetradynamia ſiliculoſa claſs. The pod is emarginated, roundiſh, entire, compreſſed, and deciduous. The ſpecies are two, none of them natives of Britain.

CLYPEUS, or CLYPEUM, a ſhield or buckler. See SHIELD.

CLYSSUS, an extract prepared, not from one, but ſeveral bodies mixt together: and, among the moderns, the term is applied to ſeveral extracts procured from the ſame body, and then mixed together. Thus, if from wormwood we draw the water, ſpirit, oil, ſalt, and tincture, and according to the rules of art re-unite theſe into a maſs compounded of them all, and containing the joint virtues of all, we have a clyſſus of wormwood.

CLYSTER, is a liquid remedy, to be injected chiefly at the anus into the larger inteſtines. It is uſually adminiſtered by the bladder of a hog, ſheep, or ox, perforated at each end, and having at one of the apertures an ivory pipe faſtened with pack-thread. But the French, and ſometimes the Dutch, uſe a pewter ſyringe, by which the liquor may be drawn in with more eaſe and expedition than in the bladder, and likewiſe more forcibly expelled into the large inteſtines. This remedy ſhould never be adminiſtered either too hot or too cold, but tepid; for either of the former will be injurious to the bowels.

Clyſters are prepared of different ingredients, according to the different intentions propoſed.

Clyſters are ſometimes uſed to nouriſh and ſupport a patient who can ſwallow little or no aliment, by reaſon of ſome impediment in the organs of deglutition. In which caſe they may be made of broth, milk, ale, and decoctions of barley and oats with wine. The Engliſh introduced a new kind of clyſter, made of the ſmoke of tobacco, which has been uſed by ſeveral other nations, and appears to be of conſiderable efficacy when other clyſters prove ineffectual, and particularly in the iliac paſſion, in the *hernia incarcerata*, and for the recovery of drowned perſons.

CNEORUM, in botany, a genus of the triandria monogynia claſs. The calix has three teeth; and the corolla has three equal petals. There is but one ſpecies, *viz.* the tricoccum, a native of Spain.

CNICUS,

CNICUS, or Saffron flower, in botany, a genus of the syngenesia polygamia æqualis class. The calix is ovated, and imbricated with spinous branches; and the corollæ are equal. The species are seven, none of them natives of Britain.

COA, in botany. See Hippocratea.

COACH, a commodious vehicle for travelling, so well known as to need no description. Their invention was owing to the French about the reign of Francis I.

COAGULATION, in a general sense, imports a certain change in the state of any liquor, by means of which, instead of retaining its fluidity, it becomes more or less consistent, according to the degree of coagulation.

COAGULUM, is the same with what in English we call runnet, or rather the curd formed thereby.

COAL, or Pit-coal, in natural history. See Lithanthrax.

Cannel-Coal, in natural history. See Ampelites.

Small-Coal, a sort of charcoal prepared from the spray and brush-wood stripped off from the branches of coppice-wood, sometimes bound in bavins for that purpose, and sometimes charred without binding, and then it is called coming it together.

COALITION, the re-union of the parts of a body before separated.

COAT, or Coat of Arms, in heraldry, a habit worn by the ancient knights over their arms both in war and tournaments, and still borne by heralds at arms. It was a kind of fur-coat, reaching as low as the navel, open at the sides with short sleeves, sometimes furred with ermine and hair, upon which were applied the armories of the knights embroidered in gold and silver, and enamelled with beaten tin-coloured black, green, red, and blue; whence the rule never to apply colour on colour, nor metal on metal. The coats of arms were frequently open, and diversified with bands and fillets of several colours, alternately placed, as we still see cloths scarleted, watered, &c. Hence they were called devises, as being divided and composed of several pieces sewed together; whence the words *fasse*, *pale*, *chevron*, *bend*, *cross*, *saltier*, *lozenge*, &c. which have since become honourable pieces, or ordinaries of the shield. See Cross, Bend, Chevron, &c.

Coats of arms and banners were never allowed to be worn by any but knights and ancient nobles.

Coat, in anatomy. See Part VI.

Coat *of* Mail. See Mail.

COATI, in zoology, a synonime of a species of viverra and ursus. See Viverra and Ursus.

COBALT, in chemistry, a genus of fossils, of the order of the asphurelata: it is a dense, compact, and ponderous mineral, very bright and shining, and much resembling some of the antimonial ores. See Antimony, and Chemistry, p. 139, 140, 141.

It is sometimes found of a deep blueish-black, very heavy and hard, and of a granulated structure, looking like a piece of pure iron where fresh broken: at other times it is found more compact, not granulated, but resembling a mass of melted lead on the surface. These are the more ordinary appearances of cobalt, besides which there are other accidental varieties of it, being sometimes found of a florid red, or a red debased by mixtures of grey, black, or yellow; and in this state, it either forms an uniform mass, or a beautifully striated and ridged one.

From this mineral are produced the several kinds of arsenic, zaffre, and smalt. See Chemistry, p. 145.

COBELLA, in zoology, the trivial name of a species of coluber. See Coluber.

COBITIS, the loache, in ichthyology, a genus of fishes belonging to the order of abdominales. The eyes are in the upper part of the head. The branchiostege membrane has from four to five rays; and the body is nearly of an equal thickness throughout. The species are five, *viz.* the anablops, with two cirri, a depressed head, and prominent eyes. It is found on the coasts of Surinam. 2. The barbatula, with six cirri, and a compressed smooth head. 3. The tænia, with six cirri, and a prickle below the eye. The above two are found in the fresh-waters of Europe. 4. The fossilis, with eight cirri, and a prickle above the eye. It is a native of Europe. 5. The heteroclita, has no cirri; and the back-fin and that at the anus are full of white spots. It is a native Carolina.

COBLENTZ, a large city of Germany, in the archbishopric of Triers, and circle of the Lower Rhine, situated at the confluence of the Rhine and Moselle, fifty two miles north-east of Triers, and thirty-six south of Cologne: E. long. 7° 15′, N. lat. 50° 30′.

COBLON, a port-town of the hither India, situated on Coromandel-coast, twelve miles south of Fort St George: E. long. 80°, N. lat. 12. 50′.

COBWEB, in physiology, the fine net-work which spiders spin out of their own bowels, in order to catch their prey. See Aranea.

COCCEIRA in botany. See Theobroma.

COCCIFEROUS plants, the same with bacciferous. See Bacciferous.

COCCINELLA, in zoology, a genus of insects, of the coleoptera order. The antennæ are fulclavated, and truncated; the polypi are shaped like a hart; the body is of a hemispherical figure; the breast and elytra are marginated; and the belly is plain. The species are forty-nine, mostly distinguishable by the number and colour of the spots on their wings, and the plants upon which they live.—The coccinella cacti, a native of the warmer parts of America, is the famous cochineal animal, so highly valued in every part of the world for the incomparable beauty of its red colour, which it equally communicates to wool, silk, linen, and cotton. It is bred on a plant known in Oaxaca in New Spain, and all those parts where it abounds, by the name of nopal, or nopalleca, the Indian fig-tree, which, except in the difference of the foliage, resembles the tunos, so common in the kingdom of Andalusia; the leaf of the tuna being broad, flat and prickly, and that of the nopal, oblong, with several eminences;

eminences; and inſtead of ſpines has a fine ſmooth membrane, of a permanent and lively green.

The method of planting the nopal is by making rows of holes about half a yard deep, and about two yards diſtant from one another. In each of theſe holes is placed one or two leaves of the nopal, in a flat poſition, and then covered with earth. This leaf ſoon after ſhoots up into a ſingle ſtem, which during its growth divides into ſeveral branches, and theſe ſucceſſively produce freſh leaves, the largeſt being neareſt to the ſtem, which is full of knots, as are alſo the branches, and from theſe the leaves have their origin. The uſual height of this plant is about three yards, which it ſeldom exceeds. The ſeaſon when the nopal diſplays all its beauty and vigour, is like that of other plants, from the ſpring to the autumn, which at Oaxaca and other parts of North America is at the ſame time as in Spain. Its bloſſom is ſmall, of a bright red, and in the ſhape of a bud; from the centre of which proceeds the tuna, a name given to its fruit; and as this increaſes the bloſſom fades, till at length it falls. When the tuna, or fig, is ripe, the outward ſkin becomes white; but the pulp is ſo fully impregnated with a deep red, that it tinges the urine of thoſe who eat it of a blood colour, a circumſtance attended with no ſmall uneaſineſs to thoſe who are unacquainted with this particular. Few fruits, however, are either more wholeſome or pleaſant.

The ground where the nopal is intended to be planted, muſt be carefully cleanſed from all kinds of weeds, as they drain the ſoil of thoſe juices which the nopal requires. Alſo after the cochineal is taken from the plant, which is never done till the inſects are arrived at perfection, all the ſuperfluous leaves are plucked off, that they may be ſucceeded by others the following year. For it muſt be obſerved, that the cochineal which are bred on young plants thrive much better, and are of a finer quality, than thoſe produced on ſuch as have ſtood ſome years.

The cochineal was formerly imagined to be a fruit or ſeed of ſome particular plant; an error which probably aroſe from an ignorance of the manner in which it is propagated; but at preſent every one is convinced of its being an inſect, agreeably to its name, ſignifying a woodlouſe, which generally breeds in damp places, eſpecially in gardens. Theſe inſects, by rolling themſelves up, form a little ball ſomething leſs than a pea, and in ſome places are known by the name of Baquilas de San Anton, *i. e.* St Anthony's little cows: and ſuch is the figure of the cochineal, except that it has not the faculty of rolling itſelf up; and its magnitude, when at its full growth, does not exceed that of a tick, common in dogs and other animals.

Theſe inſects breed and are nouriſhed on the nopals, where their eggs are placed among the leaves; the juice of the plant, which is their ſole nouriſhment, becomes converted into their ſubſtance; when, inſtead of being thin and wateriſh, and, to all outward appearance, of little or no uſe, is rendered a moſt beautiful crimſon colour. The plant is in May or June in its moſt vigorous ſtate, and at this moſt favourable ſeaſon the eggs are depoſited: and in the ſhort ſpace of two months, from an animalcule, the inſect grows up to the ſize abovementioned; but its infant ſtate is expoſed to a variety of dangers; the violent blaſts of the north wind ſweep away the eggs from the foliage of the plant; and, what is equally fatal to their tender conſtitutions, ſhowers, fogs, and froſts, often attack them, and deſtroy the leaves, leaving the careful cultivator this only reſource, namely, that of making fires at certain diſtances, and filling the air with ſmoke, which frequently preſerves them from the fatal effects of the inclemency of the weather.

The breeding of cochineal is alſo greatly obſtructed by birds of differed kinds, which are very fond of theſe inſects; and the ſame danger is to be apprehended from the worms, *&c.* which are found among the plantations of nopals: ſo that unleſs conſtant care be taken to fright the birds away from the plantation, and to clear the ground of thoſe various kinds of vermin, which multiply ſo faſt in it, the owner will be greatly diſappointed in his expectations.

When the inſects are at their full growth, they are gathered and put into pots of earthen ware; but great attention is requiſite to prevent tnem from getting out, as, in that caſe, great numbers of them would be loſt; though there is no danger of it, where they are at liberty on the nopal leaves, thoſe being their natural habitation; and where they enjoy a plenty of delicious food; for, though they often remove from one leaf to another, they never quit the plant; nor is it uncommon to ſee the leaves entirely covered with them, eſpecially when they are arrived at maturity. When they have been confined ſome time in theſe pots, they are killed and put in bags. The Indians have three different methods of killing theſe inſects, one by hot water, another by fire, and a third by the rays of the ſun: and to theſe are owing the ſeveral gradations of the colour, which in ſome is dark, and in others bright; but all require a certain degree of heat. Thoſe therefore who uſe hot water are very careful to give it the requiſite heat, and that the quantity of water be proportioned to the number of inſects. The method of killing the creatures by fire is to put them on ſhovels into an oven moderately heated for that intention; the fine quality of the cochineal depending on its not being over dried at the time of killing the inſects: and it muſt be owned, that among the ſeveral ways made uſe of to deſtroy this valuable creature, that of the rays of the ſun ſeems to bid faireſt for performing it in the moſt perfect manner.

Beſides the precaution requiſite in killing the cochineal, in order to preſerve its quality, it is equally neceſſary to know when it is in a proper ſtate for being removed from the leaves of the nopal; but as experience only can teach the cultivator this neceſſary criterion, no fixed rule can be laid down. Accordinly in thoſe provinces where the cultivation of theſe inſects is chiefly carried on, thoſe gathered by Indians of one village differ from thoſe gathered in another; and even thoſe gathered by one perſon in the ſame village, are often different from thoſe gathered by another; every individual adhering to his own method.

The cochineal infect may, in fome circumftances, be compared to the filk worm, particularly in the manner of depofiting its eggs. The infects deftined for this particular are taken at a proper time of their growth, and put into a box well clofed, and lined with a coarfe cloth that none of them be loft: and in this confinement they lay their eggs and die. The box is kept clofe fhut till the time of placing the eggs on the nopal, when, if any motion is perceived, it is a fufficient indication that the animalcule has life, tho' the egg is fo minute as hardly to be perceived; and this is the feed placed on the foliage of the nopal, and the quantity contained in the fhell of a hen's egg is fufficient for covering a whole plant. It is remarkable that this infect does not, or at leaft in any vifible manner, injure the plant, but extracts its nourifhment from the moft fucculent juice, which it fucks by means of its probofcis through the fine teguments of the leaves.

The principal countries where the cochineal infects are bred, are Oaxaca, Flafcala, Chulula, Nueva Gallicia, and Chiapa, in the kingdom of New Spain; and Hambato, Loja, and Tucuman in Peru: but it is only in Oaxaca, that they are gathered in large quantities, and form a branch of commerce, the cultivation of thefe little creatures being there the chief employment of the Indians.

COCCOTHRAUSTES, in ornithology, the trivial name of a fpecies of loxia. See Loxia.

COCCULUS INDICUS, the name of a poifonous berry, too frequently ufed by brewers in order to render their malt liquors intoxicating. It is the fruit of the menifpermum cocculus. See Menispermum.

COCCUS, in zoology, a genus belonging to the order of hemiptera. The roftrum proceeds from the breaft; the belly is briftly behind; the wings of the male are erect; and the female has no wings. The fpecies are twenty-two, denominated principally from the plants they frequent.

COCCYGÆUS musculus, in anatomy. See Vol. I. p. 220.

COCCYX, or Coccygis os, in anatomy. See Vol. I. p. 171.

COCHIN, a port-town of India, on the Malabar-coaft, about on hundred miles fouth of Calicut: W. long. 75°, and N. lat. 9° 30′. Here the Dutch have a factory, and a very ftrong fort.

Cochn china, a kingdom of India, fituated between 104° and 109° E. long. and between 10° and 17° N. lat. being bounded by the kingdom of Tonquin on the north, by the Indian ocean on the eaft and fouth, and by the kingdom of Cambodia on the weft: it is upwards of four hundred miles long, and one hundred and fifty broad, producing chiefly filk and rice.

COCHINEAL. See coccinella.

COCHLEA, the snail-shell, in zoology. See Limax.

Cochlea, in anatomy. See Vol. I. p. 297.

COCHLEARIA, scurvy-grass, in botany, a genus of the tetradynamia filiculofa clafs. The pod is emarginated, turgid, and fcabrous; and the valves are obtufe and gibbous. The fpecies are eight, fix of which are natives of Britain, *viz.* the officinalis, or common fcurvy-grafs, the leaves of which are famous for curing the fcurvy; the groenlandica, or Groenland fcurvy-grafs; the anglica, or common fea fcuryy grafs; the danica, or Danifh fcurvy-grafs; the coronopus, or fwine-creffes; and the armoracia, or horfe-radifh.

COCHLITES, in natural hiftory, an appellation given to the petrified fhells of the cochleæ, or fnails.

COCK, in zoology, the Englifh name of the males of gallinaceous birds, but more efpecially ufed for the common dunghill-cock. See Phasianus.

Cock's-comb, in botany. See Phinanthus.

Cock-pit, a fort of theatre upon which game-cocks fight.

Cock-pit, in a man of war, a place on the lower floor, or deck, abaft the main-capftain, lying between the platform and the fteward's room, where are partitions for the purfer, furgeon, and his mates.

Cock-swain, or Coxon, an officer on board a man of war, who has the care of the barge and all things belonging to it, and muft be alfo ready with his crew to man the boat on all occafions: he fits at the ftern of the boat, and fteers.

COCKERMOUTH, a borough-town of Cumberland, fituated on the river Derwent, near the Irifh fea, about twenty-five miles fouth-weft of Carlifle: W. lon. 3° 10′, and N. lat. 54° 35′. It fends two members to parliament.

COCKET is a feal belonging to the king's cuftom-houfe, or rather a fcroll of parchment fealed and delivered by the officers of the cuftoms to merchants, as a warrant that their merchandifes are cuftomed.

It is alfo ufed for the office where goods tranfported were firft entered, and paid their cuftom, and had a cocket or certificate of difcharge.

COCOA, or Cacao, in botany. See Theobroma.

COCOI, in ornithology. See Arctea.

COCONATO, a town of Italy in the province of Piedmont, about twenty miles eaft of Turin; it is faid to be the birth-place of the famous Columbus, who difcovered America: E. long. 8°, and N. lat. 44° 50′.

COCTION, a general term for all alterations made in bodies by the application of fire or heat.

COD, in ichthyology. See Gadus.

Cod is alfo a term ufed, in fome parts of the kingdom, for a pod. See Pod.

Cod-cape, in geography, a promontory on the coaft of New England, near the entrance of Bofton harbour: W. long. 69° 50′, and N. lat. 42°.

CODDY-MODDY, the Englifh name of a fpecies of larus. See Larus.

CODE, a collection of the laws and conftitutions of the Roman emperors, made by order of Juftinian. See Law.

CODEX, in antiquity, denotes a book or tablet, on which the ancients wrote. It was of the bark of a tree, of ivory, of parchment, or of paper.

CODIA, among botanifts, fignifies the head of any plant, but more particularly a poppy-head, whence its fyrup is called diacodium.

CODICIL,

CODICIL is a writing by way of supplement to a will, when any thing is omitted which the testator would have added, or wants to be explained, altered, or recalled.

CODLIN, an apple useful in the kitchen, being proper for baking.

CODLING, an appellation given to the cod fish, when young. See GADUS.

COECUM, in anatomy. See Vol. I. p. 260.

COEFFICIENTS, in algebra. See Vol. I. p. 80.

COELESTIAL, in general, denotes any thing belonging to the heavens: thus we say, cœlestial observations, the cœlestial globe, *&c.*

COELIAC *artery*, in anatomy. See Vol. I. p. 232.

COELIAC *passion*, in medicine, a kind of flux, or diarrhœa, wherein the aliments, either wholly changed, or only in part, pass off by stool. See MEDICINE.

COELIAC *vein*, in anatomy. See Vol. I. p. 245.

COELOMA, among physicians, a hollow ulcer seated in the cornea tunica of the eye.

COENOBITE, in church-history, a sort of monks in the primitive Christian church. They were so called from living in common; in which they differed from the anachorites, who retired from society.

COENOBITE, in a modern sense, is a religious who lives in a convent or community, under certain rules.

COEUR, in heraldry, a short line of partition in pale, in the centre of the escutcheon, which extends but a little way, much short of the top and bottom, being met by other lines, which form an irregular partition of the escutcheon. See Plate LXV. fig. 7.

COEVORDEN, a town of the province of Overyssel, strongly fortified by the famous Coehorn, on account of its situation, it being the key to the provinces of Groningen and Friezland.

COFFEA, the COFFEE-TREE, in botany, a genus of the pentandria monogynia class. The corolla is hypocrateriform; the stamina are above the tube; the berry is below the flower, and contains two seeds, which are arillated. The species are two, *viz.* the arabica, a native of Arabia and Æthiopia; and the occidentalis, a native of America. The berries of both species have much the same qualities. This fruit is used rather as food than as a medicine. The medical effects expected from it are, to assist digestion, promote the natural secretions, and to prevent or remove a disposition to sleep.

Coffee pays on importation 1 l. 13 s. $6\frac{15}{100}$ d. the hundred weight; the drawback on exportation is 1 l. 10 s. $2\frac{25}{100}$ d. Upon payment of the above duty, the coffee is to be put into warehouses; and upon delivery from thence, if to be consumed in Great Britain, is to pay for every hundred weight 8 l. 8 s. if of the British plantations in America, and 11 l. 4 s. if it comes from any other place.

COFFERER *of the king's household*, a principal officer in the court, next under the comptroller, who, in the counting-house, and elsewhere at other times, has a special charge and oversight of other officers of the house, for their good demeanor and charge in their offices, to all which he pays their wages.

COGENDE, a city of Tartary in Asia, situated in 74° E. long. and 41° N. lat. remarkable for its commerce in musk.

COGGLE. See COGS.

COGGSHALL's *sliding rule*. See SLIDING RULE.

COGITATION, a term used by some for the act of thinking.

COGNATE, in Scots law, any male relation through the mother.

COGNATION, in the civil law, a term for that line of consanguinity which is between males and females, both descended from the same father; as agnation is for the line of parentage between males only descended from the same stock.

COGNI, the capital of Caramania, in the lesser Asia, anciently called Iconium, about two hundred and fifty miles south-east of Constantinople: E. long. 33°, and N. lat. 38°.

COGNITIONIS CAUSA, in Scots law: When a creditor charges the heir of his debitor to enter, in order to constitute the debt against him, and the heir renounces the succession, the creditor can obtain no decreet of constitution of that debt against the heir; but only a decreet subjecting the *hereditas jacens*, or the estate which belonged to the debitor, to his diligence: and this is called a decreet *cognitionis causa*. See SCOTS LAW, title, *Comprisings and adjudications*.

COGNIZANCE, in heraldry. See CREST.

COGNIZANCE, or CONNUSANCE, in law, has divers significations: sometimes it is an acknowledgment of a fine, or confession of something done; sometimes the hearing of a matter judicially, as to take cognizance of a cause; and sometimes a particular jurisdiction, as cognizance of pleas is an authority to call a cause or plea out of another court, which no person can do but the king, except he can shew a charter for it. This cognizance is a privilege granted to a city or town, to hold plea of all contracts, *&c.* within the liberty; and if any one is impleaded for such matters in the courts at Westminster, the mayor, *&c.* of such franchise may demand cognizance of the plea, and that it be determined before them.

COGNIZANCE is also used for a badge on a waterman's or serving-man's sleeve, which is commonly the giver's crest, whereby he is decerned to belong to this or that nobleman or gentleman.

COGS, or COGGLES, a kind of flat-bottomed boats used in rivers.

COHABITATION, denotes the state of a man and a woman who live together like husband and wife, without being legally married.

By the common law of Scotland, cohabitation for year and day, or a complete twelvemonth, is deemed equivalent to matrimony.

CO-HEIR, one who succeeds to a share of an inheritance, to be divided among several.

COHESION, in philosophy, that action by which the particles of the same body adhere together, as if they were but one. See MECHANICS.

COHORT, in Roman antiquity, the name of part of the

the Roman legion, comprehending about ſix hundred men. There were ten cohorts in a legion, the firſt of which exceeded all the reſt, both in dignity and number of men. When the army was ranged in order of battle, the firſt cohort took up the right of the firſt line, the reſt followed in their natural order, ſo that the third was in the centre of the firſt line of the legion, and the fifth on the left, the ſecond between the firſt and third, and the fourth between the third and fifth: the five remaining cohorts formed a ſecond line, in their natural order.

COIF, the badge of a ſerjeant at law, who is called ſerjeant of the coif, from the lawn-coif they wear under their caps when they are created ſerjeants.

The uſe of the coif was to cover the clerical tonſure. See Tonsure.

COIL. See Quoil.

COILON in the ancient Grecian theatres, the ſame with the cavea of the Romans. See Cavea.

COILOPHYLLUM, in botany. See Sarracena.

COIMBRA, a large city of Portugal, in the province of Beira, ſituated on the river Mondego, about nineſix miles north of Liſbon: W. long. 9°, and N. lat. 40° 20′.

COIN denotes all manner of the ſeveral ſtamps and ſpecies of money in any nation. See Money.

Coin, in architecture, a kind of dye cut diagonal-wiſe, after the manner of a flight of a ſtair-caſe, ſerving at bottom to ſupport columns in a level, and at top to correct the inclination of an entablature ſupporting a vault.

Coin is alſo uſed for a ſolid angle compoſed of two ſurfaces inclined towards each other, whether that angle be exterior, as the coin of a wall, a tree, *&c.* or interior, as the coin of a chamber or chimney. See Quoin.

COINAGE, or Coining, the art of making money, as performed either by the hammer or mill.

Formerly the fabric of coins was different from what it is at preſent. They cut a large plate of metal into ſeveral little ſquares, the corners of which were cut off with ſheers. After having ſhaped theſe pieces, ſo as to render them perfectly conformable, in point of weight, to the ſtandard piece, they took each piece in hand again, to make it exactly round, by a gentle hammering. This was called a planchet, and was fit for immediate coining. Then engravers prepared, as they ſtill do, a couple of ſteel maſſes in form of dyes, cut and terminated by a flat ſurface, rounded off at the edges. They engraved or ſtamped on it the hollow of a head, a croſs, a ſcutcheon, or any other figure, according to the cuſtom of the times, with a ſhort legend. As one of theſe dyes was to remain dormant, and the other moveable, the former ended in a ſquare priſm, that it might be introduced into the ſquare hole of the block, which, being fixed very faſt, kept the dye as ſteady as any vice could have done. The planchet of metal was horizontally laid upon this inferior maſs, to receive the ſtamp of it on one ſide, and that of the upper dye, wherewith it was covered, on the other. This moveable dye, having its round engraved ſurface reſting upon the planchet, had at its oppoſite extremity a flat ſquare, and larger ſurface, upon which they gave ſeveral heavy blows, with a hammer of an enormous ſize, till the double ſtamp was ſufficiently, in relievo, impreſſed on each ſide of the planchet. This being finiſhed, was immediately ſucceeded by another, and they thus became a ſtandard coin, which had the degree of fineneſs, the weight and mark, determined by the judgment of the inſpectors, to make it good current money. The ſtrong tempering which was and is ſtill given to the two dyes, rendered them capable of bearing thoſe repeated blows Coining has been conſiderably improved and rendered expeditious, by ſeveral ingenious machines, and by a wiſe application of the ſureſt phyſical experiments to the methods of fining, dying, and ſtamping the different metals.

The three fineſt inſtruments the mint-man uſes, are the laminating engine, the machine for making the impreſſions on the edges of coins, and the mill.

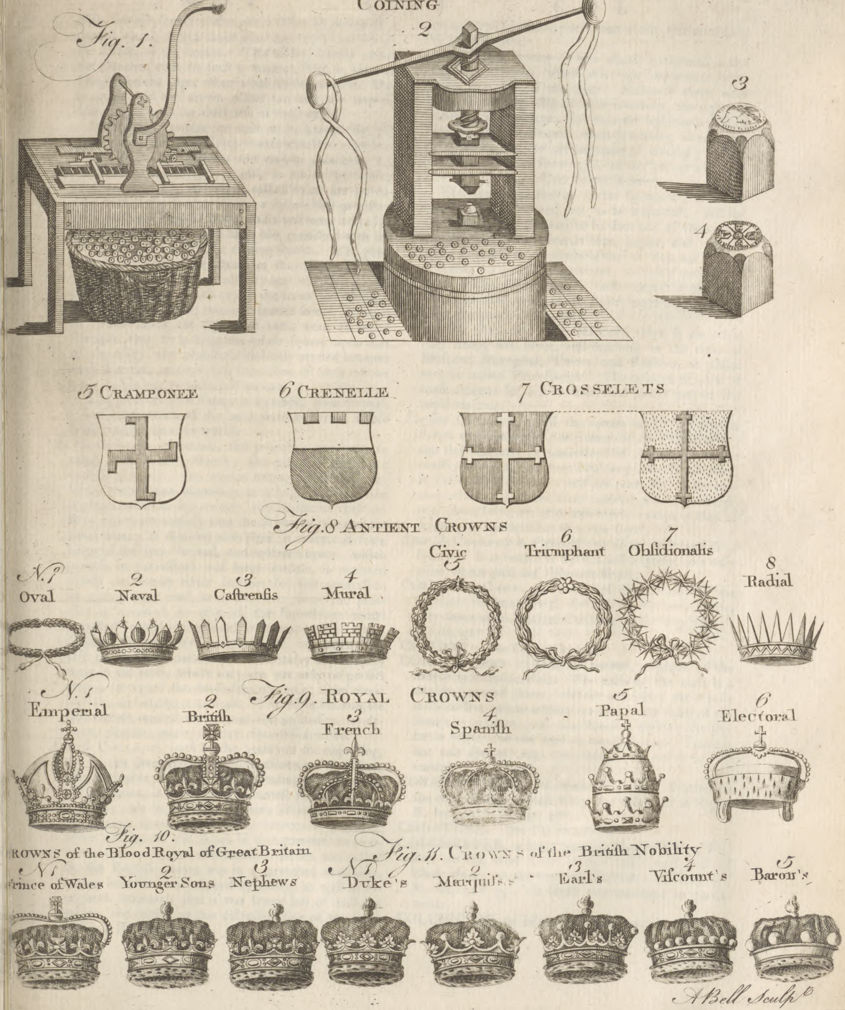
After they have taken the laminæ, or plates of metal, out of the mould into which they are caſt, they do not beat them on the anvil, as was formerly done, but they make them paſs and repaſs between the ſeveral rollers of the laminating engine, which being gradually brought cloſer and cloſer to each other, preſently give the lamina its uniform and exact thickneſs. Inſtead of dividing the lamina into ſmall ſquares, they at once cut clean out of it as many planchets as it can contain, by means of a ſharp ſteel trepan, of a roundiſh figure, hollow within, and of a proportionable diameter, to ſhape and cut off the piece at one and the ſame time. After theſe planchets have been prepared and weighed with ſtandard-pieces, filed or ſcraped to get off the ſuperfluous part of the metal, and then boiled and made clean, they arrive, at laſt, at the machine, (Plate LXVI. fig. 1.), which marks them upon the edge; and finally, the mill, (fig. 2.) which, ſqueezing each of them ſingly between the two dyes, brought near each other with one blow, forces the two ſurfaces or fields of the piece to fill exactly all the vacancies of the two figures engraved hollow. The engine which ſerves to laminate lead, gives a ſufficient notion of that which ſerves to flaten gold and ſilver laminæ between rollers of a leſſer ſize. See Laminating.

The principal pieces of the machine, (fig. 1.), to ſtamp coins on the edge, are two ſteel laminæ, about a line thick. One half of the legend, or of the ring, is engraved on the thickneſs of one of the laminæ, and the other half on the thickneſs of the other; and theſe two laminæ are ſtraight, although the planchet marked with them be circular.

When they ſtamp a planchet, they firſt put it between the laminæ in ſuch a manner, as that theſe being each of them laid flat upon a copper-plate, which is faſtened upon a very thick wooden table, and the planchet being likewiſe laid flat upon the ſame plate, the edge of the planchet may touch the two laminæ on each ſide, and in their thick part.

One of theſe laminæ is immoveable, and faſtened with

Plate LXVI


COINING
Fig. 1.
2
3
4
5 CRAMPONEE
6 CRENELLE
7 CROSSELETS
Fig. 8 ANTIENT CROWNS
N.° 1 Oval
2 Naval
3 Castrensis
4 Mural
5 Civic
6 Triumphant
7 Obsidionalis
8 Radial
Fig. 9. ROYAL CROWNS
N. 1 Emperial
2 British
3 French
4 Spanish
5 Papal
6 Electoral
Fig. 10.
CROWNS of the Blood Royal of Great Britain
N. 1 Prince of Wales
2 Younger Sons
3 Nephews
Fig. 11. CROWNS of the British Nobility
N. 1 Duke's
2 Marquis's
3 Earl's
4 Viscount's
5 Baron's
A Bell Sculp.

with feveral fcrews; the other flides by means of a dented wheel, which takes into the teeth that are on the furface of the lamina. This fliding lamina makes the planchet turn in fuch a manner, that it remains ftamped on the edge, when it has made one turn. Only crown and half-crown pieces can bear the impreffion of letters on the thicknefs of their edges.

The coining engine or mill is fo handy (fig. 2.) that a fingle man may ftamp twenty thoufand planchets in one day: gold, filver, and copper planchets, are all of them coined with a mill, to which the coining fquares, (fig. 3.), commonly called dyes, are faftened; that of the face under, in a fquare box garnifhed with male and female fcrews, to fix and keep it fteady; and the other above, in a little box garnifhed with the fame fcrews, to faften the coining fquare. The planchet is laid flat on the fquare of the effigy, which is dormant; and they immediately pull the bar of the mill by its cords, which caufes the fcrew fet within it to turn. This enters into the female fcrew, which is in the body of the mill, and turns with fo much ftrength, that by pufhing the upper fquare upon that of the effigy, the planchet, violently preffed between both fquares, receives the impreffion of both at one pull, and in the twinkling of an eye.

The planchet thus ftampt and coined, goes through a final examination of the mint wardens, from whofe hands it goes into the world.

In the Coining *of medals*, the procefs is the fame, in effect, with that of money; the principal difference confifting in this, that money having but a fmall relievo, receives its impreffion at a fingle ftroke of the engine; whereas for medals, the height of their relievo makes it neceffary that the ftroke be repeated feveral times: to this end the piece is taken out from between the dyes, heated, and returned again; which procefs in medallions and large medals, is repeated fifteen or twenty times before the full impreffion be given, care muft be taken, every time the planchet is removed, to take off the fuperfluous metal ftretched beyond the circumference with a file. Medallions, and medals of a high relievo, are ufually firft caft in fand, by reafon of the difficulty of ftamping them in the prefs, where they are put only to perfect them; in regard the fand does not leave them clear, fmooth, and accurate enough. Therefore we may fee that medals receive their form and impreffion by degrees, whereas money receives them all at once.

Britifh Coinage, both by the beauty of the engraving, and by the invention of the impreffions on the edges, that admirable expedient for preventing the alteration of the fpecies, is carried to the utmoft perfection.

It was only in the reign of king William III. that the hammer-money ceafed to be current in England, where till then it was ftruck in that manner, as in other nations. Before the hammer fpecies was called in, the Englifh money was in a wretched condition, having been filed and clipped by natives as well as foreigners, infomuch that it was fcarce left of half the value: the retrieving this diftreffed ftate of the Englifh money is looked upon as one of the glories of king William's reign.

The Britifh coinage is now wholly performed in the Tower of London, where there is a corporation for it, under the title of the mint. Formerly there were here, as there are ftill in other countries, the rights of feinorage and braffage: but fince the eighteenth year of king Charles the Second, there is nothing taken either for the king, or for the expences of coining; fo that weight is returned for weight, to any perfon who carries their gold and filver to the Tower.

The fpecies coined in Great Britain are efteemed contraband goods, and not to be exported. All foreign fpecies are allowed to be fent out of the realm, as well as gold and filver in bars, ingots, duft, *&c.*

Barbary Coinage, particularly that of Fez and Tunis, is under no proper regulations, as every goldfmith, Jew, or even private perfon, undertakes it at pleafure; which practice renders their money exceeding bad, and their commerce very unfafe.

Mufcovite Coinage. In Mufcovy there is no other coin ftruck but filver, and that only in the cities of Mufcow, Novogrod, Twere, and Plefkow, to which may be added Peterfburgh. The coinage of each of thefe cities is let out to farm, and makes part of the royal revenue.

Perfian Coinage. All the money made in Perfia is ftruck with a hammer, as is that of the reft of Afia; and the fame may be underftood of America, and the coafts of Africa, and even Mufcovy: the king's duty, in Perfia, is feven and a half *per cent.* for all the monies coined, which are lately reduced to filver and copper, there being no gold coin there, except a kind of medals, at the acceffion of a new fophi.

Spanifh Coinage is efteemed one of the leaft perfect in Europe. It is fettled at Seville and Segovia, the only cities where gold and filver are ftruck.

COIRE, or Chur, the capital of the country of the Grifons, in Switzerland, fituated on the river Rhine, fifty-three miles fouth of Conftance: E. long. 9° 25′, N. lat. 46° 40′.

COITION. See Generation.

COIX, or Job's tears, in botany, a genus of the monoecia triandria clafs. The calix of the male is a double-flowered glume, without any awn; the corolla is likewife a glume without an awn: the calix of the female is an open, oval, one-flowered glume; the ftylus is bifid; and the feed is cartilaginous. There is but one fpecies, *viz.* the latifolia, a native of Jamaica.

COKENHAUSEN, a fortrefs of Livonia, fituated on the river Dwina, about thirty-two miles eaft of Riga: E. long. 25°, N. lat. 57°.

COLATURE. See Filtration.

COLCHESTER, a large borough-town of Effex, fituated on the river Coln, twenty miles north-eaft of Chelmsford, on the road to Harwich: E. long. 1°, N. lat. 51° 55′. It fends two members to parliament.

COLCHICUM, or Meadow-saffron, in botany, a

genus of the hexandria trigynia claſs. The corolla is divided into ſix ſegments, and the tube is radicated; it has three inflated capſules united together. The ſpecies are three, only one of which, *viz.* the autumnale, or meadow-ſaffron, is a native of Britain.

COLD, in general, denotes the privation or abſence of heat; and, conſequently, thoſe who ſuppoſe heat to conſiſt in a briſk agitation of the component particles of the hot body, define cold to be ſuch a faint motion of theſe parts, as is either altogether or nearly imperceptible to our organs of feeling: in which ſenſe, cold is a mere term of relation between the cold body and the organs of ſenſation; and, in fact, the ſame body will be felt either hot or cold, according as the ſenſible organ is colder or hotter than it.

COLD, in medicine, is found to be productive of inflammatory diſorders, as coughs, pleuriſies, peripneumonies, rheumatic pains, conſumptions, &c. See MEDICINE.

COLDENIA, in botany, a genus of the tetrandria tetragynia claſs. The calix has four leaves; the corolla is tunnel-ſhaped; the fruit conſiſts of four ſeeds. There is but one ſpecies, a native of India.

COLD-FINCH. See MOTACILLA.

COLDSHIRE-IRON, that which is brittle when cold.

COLE-FISH. See GADUS.

COLE-MOUSE, in ornithology. See PARUS.

COLEOPTERA, the name of Linnæus's firſt order of inſects. The inſects belonging to this order have four wings; the upper pair, which ſerve as covers to the other two, are cruſtaceous, with a ſtraight ridge or ſuture in the middle. See NATURAL HISTORY.

COLE-SEED, the ſeed of the *napus ſativa*, or long-rooted, narrow-leaved rapa, called, in Engliſh, navew, and comprehended by Linnæus among the braſſicas, or cabbage-kind. See BRASSICA.

This plant is cultivated to great advantage in many parts of England, on account of the nape-oil expreſſed from its ſeeds. It requires a rich and ſtrong ſoil, eſpecially in march or fenny lands, thoſe newly recovered from the ſea, or indeed any other land that is rank and fat, whether arable or paſture. The beſt ſeeds are brought from Holland, and ſhould be ſown about Midſummer, the very day that the land is plowed: a gallon will ſerve an acre.

Beſides the oil already mentioned, it is likewiſe cultivated for winter-food to cattle, and is a very good preparative of land for barley or wheat.

COLE-WORT. See BRASSICA.

COLIAS, in ichthyology. See SCOMBER.

COLIC, in medicine, a ſevere pain in the lower venter, ſo called, becauſe the diſorder was formerly ſuppoſed to be ſeated in the colon. See MEDICINE.

COLIC-SHELL. See SYPROEA.

COLIR, an officer in China, who may properly be called an inſpector, having an eye over what paſſes in every court or tribunal of the empire.

In order to render him impartial, he is kept independent, by having poſt for life. The power of the colirs is ſuch, that they make even the princes of the blood tremble.

COLISEUM, in ancient architecture, an oval amphitheatre at Rome, built by Veſpaſian, wherein were ſtatues ſet up, repreſenting all the provinces of the empire: in the middle whereof ſtood that of Rome, holding a golden apple in her hand.

This ſtructure was ſo large, that it would hold near 100,000 ſpectators.

COLITES, in natural hiſtory, a name given by ſome writers to a kind of pebble, found in the ſhape of the human penis and teſtes, and that either ſeparately, or both together.

COLLAR, in Roman antiquity, a ſort of chain put generally round the neck of ſlaves that had run away, after they were taken, with an inſcription round it, intimating their being deſerters, and requiring their being reſtored to their proper owners, &c.

COLLAR, in a more modern ſenſe, an ornament conſiſting of a chain of gold, enamelled, frequently ſet with cyphers or other devices, with the badge of the order hanging at the bottom, wore by the knights of ſeveral military orders over their ſhoulders, on the mantle, and its figure drawn round their armories.

Thus, the collar of the order of the garter conſiſts of S S, with roſes enamelled red, within a garter enamelled blue, and the George at the bottom.

Lord Mayor's COLLAR is more uſually called chain.

Knights of the COLLAR, a military order in the republic of Venice, called alſo the order of St Mark, or the medal.

It is the doge and the ſenate that confer this order; the knights bear no particular habit, only the collar, which the doge puts around their neck, with a medal, wherein is repreſented the winged lion of the republic.

COLLAR *of a draught horſe*, a part of harneſs made of leather and canvas, and ſtuffed with ſtraw or wool, to be put about the horſe's neck.

COLLARAGE, a tax or fine laid for the collars of wine-drawing horſes.

COLLATERAL, any thing, place, country, &c. ſituated by the ſide of another.

COLLATERAL, in genealogy, thoſe relations which proceed from the ſame ſtock, but not in the ſame line of aſcendants or deſcendants, but being, as it were, aſide of each other.

Thus, uncles, aunts, nephews, nieces and couſins, are collaterals, or in the ſame collateral line: thoſe in a higher degree, and nearer the common root, repreſent a kind of paternity with regard to thoſe more remote.

COLLATERAL *ſucceſſion*, in Scots law: When a defunct, for want of heirs deſcended of himſelf, is ſucceeded in his eſtate by a brother or ſiſter, or their deſcendents, the eſtate is ſaid to have gone to *collateral heirs*. See SCOTS LAW, title, *Succeſſion in heretable rights*.

COLLATION, in the canon law, the giving or beſtowing of a benefice on a clergyman by a biſhop, who has it in his own gift or patronage.

COLLATION, in common law, the compariſon or preſentation of a copy to its original, to ſee whether or not it be conformable; or the report or act of the officer

ficer who made the comparifon. A collated act is equivalent to its original, provided all the parties concerned were prefent at the collation.

COLLATION, in Scots law, that right which an heir has of throwing the whole heritable and moveable eftates of the deceafed into one mafs, and fharing it equally with the others in the fame degree of kindred, when he thinks fuch fhare will be more than the value of the heritage to which he had an exclufive title. See SCOTS LAW, title, *Succeffion in moveables*.

COLLATION is alfo vulgarly ufed for a repaft between dinner and fupper.

COLLEAGUE, a partner or affociate in the fame office or magiftrature. See ADJUNCT.

COLLECTS, in an ecclefiaftical fenfe, the fhort prayers into which the public devotions of the church are divided.

In the primitive church, the collects were repeated by the bifhop alone, after the joint prayers of the deacon and congregation.

COLLECTIVE, among grammarians, a term applied to a noun expreffing a multitude, though itfelf be only fingular; as an army, company, troop, *&c.* called collective nouns.

COLLECTOR, in general, denotes a perfon who gets or brings together things formerly difperfed and feparated. Hence,

COLLECTOR, in matters of civil polity, is a perfon appointed by the commiffioners of any duty, the inhabitants of a parifh, *&c.* to raife or gather any kind of tax.

COLLECTOR, among botanifts, one who gets together as many plants as he can, without ftudying botany in a fcientifical manner.

COLLEGATORY, in the civil law, a perfon who has a legacy left him in common with one or more other perfons.

COLLEGE, an affemblage of feveral bodies or focieties, or of feveral perfons into one fociety.

College, among the Romans, ferved indifferently for thofe employed in the offices of religion, of government, the liberal, and even mechanical arts and trades; fo that, with them, the word fignified what we call a corporation or company.

Each of thefe colleges had diftinct meeting-places or halls; and likewife, in imitation of the ftate, a treafury and common cheft, a regifter, and one to reprefent them upon public occafions, and acts of government. Thefe colleges had the privilege of manumitting flaves, of being legates, and making by-laws for their own body, provided they did not clafh with thofe of the government.

There are various colleges on foot among the moderns, founded on the model of thofe of the ancients. Such are the three colleges of the empire, *viz.*

COLLEGE *of electors, or their deputies*, affembled in the diet of Ratifbon.

COLLEGE *of princes*, the body of princes, or their deputies, at the diet of Ratifbon.

COLLEGE *of cities*, is, in like manner, the body of deputies which the imperial cities fend to the diet.

COLLEGE *of cardinals*, or the *facred* COLLEGE, a body compofed of the three orders of cardinals. See CARDINALS.

COLLEGE is alfo ufed for a public place endowed with certain revenues, where the feveral parts of learning are taught.

An affemblage of feveral of thefe colleges conftitute an univerfity. The erection of colleges is part of the royal prerogative, and not to be done without the king's licenfe. See UNIVERSITY.

COLLEGE *of civilians*, commonly called *Doctors-commons*, founded by Dr Harvey, dean of the arches, for the profeffors of the civil law refiding in the city of London. The judges of the arches, admiralty, and prerogative court, with feveral other eminent civilians, commonly refide here.

To this college belong thirty-four proctors, who make themfelves parties for their clients, manage their caufes, give licenfes for marriages, *&c.*

In the common hall of Doctors-commons are held feveral courts, under the jurifdiction of the civil law, particularly the high court of admiralty, the court of delegates, the arches court of Canterbury, and the prerogative court of Canterbury, whofe terms for fitting are much like thofe at Weftminfter, every one of them holding feveral court-days; moft of them fixed and known by preceding holidays, and the reft appointed at the judge's pleafure.

COLLEGE *of phyficians*, a corporation of phyficians in London, whofe number, by charter, is not to exceed eighty. The chief of them are called fellows, and the next candidates, who fill up the places of fellows as they become vacant by death, or otherwife. Next to thefe are the honorary fellows; and laftly, the licentiates, that is, fuch as being found capable, upon examination, are allowed to practife phyfic.

This college has feveral great privileges granted by charter and acts of parliament. No man can practife phyfic in, or within feven miles of London, without licenfe of the college, under the penalty of 5 *l.* Alfo, perfons practifing phyfic in other parts of England are to have letters teftimonial from the prefident and three elects, unlefs they be graduate phyficians of Oxford or Cambridge. Every member of the college is authorifed to practife furgery in London or elfewhere; and that they may be able at all times to attend their patients, they are freed from all parifh-offices.

The college is governed by a prefident, four cenfors, and twelve electors. The cenfors have, by charter, power to furvey, govern, and arreft all phyficians, or others, practifing phyfic in or within feven miles of London; to fine, amerce, and imprifon them at difcretion; to fearch apothecaries fhops, *&c.* in and about London; to fee if their drugs, *&c.* be wholefome, and the compofitions according to the form prefcribed by the college in their difpenfaries; and to burn, or otherwife deftroy, thofe that are defective or decayed, and not fit for ufe.

In 1696, forty-two members of the college made a fubfcription, to fet on foot a difpenfary for the relief of the fick poor, who are advifed gratis every day but Sunday,

Sunday, and medicines ſold at the intrinſic value: ſince this they have erected two other diſpenſaries.

COLLEGE *of juſtice*, in Scots law, the ſupreme civil court of Scotland; otherwiſe called *Court of ſeſſion*, or, *of council and ſeſſion*. See SCOTS LAW, title; *Supreme judges and courts of Scotland*.

Sion COLLEGE, or the college of the London clergy, was formerly a religions houſe, next to a ſpittal or hoſpital; and now it is a compoſition of both, *viz.* a college for the clergy of London, who were incorporated in 1631, at the requeſt of Dr White, under the name of the preſident and fellows of Sion-college; and an hoſpital of ten poor men, the firſt within the gates of the houſe, and the latter without.

This college conſiſts of a preſident, two deans, and four aſſiſtants, who are annually choſen from among the rectors and vicars in London, ſubject to the viſitation of the biſhop. They have one of the fineſt libraries in England, built and ſtocked by Mr Simpſon, chiefly for the clergy of the city, without excluding other ſtudents on certain terms; they have alſo a hall with chambers for the ſtudents, generally filled with the miniſters of the neighbouring pariſhes.

Greſham-COLLEGE, or COLLEGE *of philoſophy*, a college founded by Sir Thomas Greſham, who built the Royal-exchange; a moiety of the revenue whereof he gave in truſt to the mayor and commonalty of London, and their ſucceſſors for ever, and the other moiety to the company of mercers; the firſt to find four able perſons to read in the college divinity, aſtronomy, muſic, and geometry; and the laſt, three or more able men to read rhetoric, civil law, and phyſic; a lecture upon each ſubject is to be read in term-time, every day, except Sundays, in Latin, in the forenoon, and the ſame in Engliſh in the afternoon; only the muſic-lecture is to be read alone in Engliſh. The lecturers have each 50 *l. per annum*, and a lodging in the college.

In this college formerly met the royal ſociety, that noble academy, celebrated throughout the world for their improvements in natural knowledge. See SOCIETY.

COLLEGE *of heralds*, commonly called the *heralds office*, a corporation founded by charter of king Richard III. who granted them ſeveral privileges, as to be free from ſubſidies, tolls, offices, *&c.* They had a ſecond charter from king Henry VI.; and a houſe built near Doctors-commons, by the earl of Derby, in the reign of king Henry VII. was given them by the duke of Norfolk, in the reign of queen Mary, which houſe is now rebuilt.

This college is ſubordinate to the earl-marſhal of England. They are aſſiſtants to him in his court of chivalry, uſually held in the common hall of the college, where they ſit in their rich coats of his majeſty's arms. See HERALD.

COLLEGIATE *churches*, thoſe which though no biſhop's ſee, yet have the retinue of the biſhop, the canons and prebends. Such are, among us, Weſtminſter, Windſor, Rippon, Wolverhampton, Southwell, Mancheſter, *&c.* governed by deans and chapters.

COLLET, among jewelers, denotes the horizontal face or plane at the bottom of brilliants. See BRILLIANT.

COLLET, in glaſs-making, is that part of glaſs veſſels which ſticks to the iron inſtrument wherewith the metal was taken out of the melting-pot: theſe are afterwards uſed for making green glaſs.

COLLETICS, in pharmacy, denote much the ſame with agglutinants or vulneraries. See VULNERARY.

COLLINSONIA, in botany, a genus of the decandria monogynia claſs. The corolla is unequal, the inferior lip being multifid and capillary. It has but one ſeed. There is only one ſpecies, a native of Canada.

COLLIQUAMENTUM, in natural hiſtory, an extreme tranſparent fluid in an egg, obſervable after two or three days incubation, containing the firſt rudiments of the chick. It is included in one of its own proper membranes, diſtinct from the albumen. Harvey calls it the oculus.

COLLIQUATION, in chemiſtry, is applied to animal, vegetable, and mineral ſubſtances, tending towards fuſion. See FUSION.

COLLIQUATION, in phyſic, a term applied to the blood, when it loſes its craſis or balſamic texture; and to the ſolid parts, when they waſte away, by means of the animal fluids flowing off through the ſeveral glands, and particularly thoſe of the ſkin, faſter than they ought: which occaſions fluxes of many kinds, but moſtly profuſe, greaſy, and clammy ſweats.

COLLIQUATIVE *fever*, in phyſic, a fever attended with a diarrhœa, or profuſe ſweats.

COLLISION, the ſtriking of one hard body againſt another; or the friction or percuſſion of bodies moving violently with different directions, and daſhing againſt each other. See MECHANICS.

COLLURIO, in ornithology. See LANIUS.

COLLUSION, in law, a ſecret underſtanding between two parties, who plead or proceed fradulently againſt each, to the prejudice of a third perſon.

COLLUM, the ſame with neck. See NECK, and CERVIX.

COLLYRIUM, in pharmacy, a topical remedy for a diſorder of the eyes; deſigned to cool and repel hot, ſharp humours.

They are generally of two kinds, the one liquid, and the other dry: liquid collyrias are compoſed of ophthalmic powders in waters, as roſe-water, plantain-water, or that of fennel, eye-bright, *&c.* wherein tutty, white vitriol, or ſome other proper powder, is diſſolved.

The dry collyrium is troches of rhaſis, ſugar-candy, tutty prepared, *&c.* blown into the eye.

COLOCASIA, in botany. See ARUM.

COLOCYNTHIS, in botany. See CUCUMIS.

COLOGNE, the capital of the circle of the Lower Rhine, in Germany, ſituated on the Rhine, about forty-five miles eaſt of Mæſtricht; E. long. 6° 40′, N. lat. 50° 50′. It is one of the largeſt and moſt elegant cities of Germany, being the ſee of an archbiſhop, who is one of the electors of the empire, and has a yearly revenue of 130,000 *l.*

COLOGNE-

COLOGNE-*earth*, a kind of very light baſtard ochre, of a deep brown colour.

COLON, in anatomy. See Vol. I. p. 261.

COLON, in grammar, a point or character marked thus, (:), ſhewing the preceding ſentence to be perfect or entire; only that ſome remark, farther illuſtration, or other matter connected therewith, is ſubjoined.

COLONEL, in military matters, the commander in chief of a regiment, whether horſe, foot, or dragoons.

A colonel may lay any officer of his regiment in arreſt, but muſt acquaint the general with it; he is not allowed a guard, only a centry from the quarter-guard.

COLONEL-*lieutenant*, he who commands a regiment of guards, whereof the king, prince, or other perſon of the firſt eminence, is colonel. Theſe colonel-lieutenants have always a colonel's commiſſion, and are uſually general officers.

Lieutenant-COLONEL, the ſecond officer in a regiment, who is at the head of the captains, and commands in the abſence of the colonel.

COLONNA, a town of Italy, in the Campagna of Rome, eighteen miles eaſtward of that city: E. long. 13° 15′, N. lat. 42°.

COLONNADE, in architecture, a periſtyle of a circular figure; or a ſeries of columns diſpoſed in a circle, and inſulated within ſide.

A polyſtile COLONNADE, is that whoſe numbers of columns is too great to be taken in by the eye at a ſingle view. Such is the colonnade of the palace of St Peter's at Rome, conſiſting of 284 columns of the Doric order, each above four foot and an half diameter, all in Tiburtine marble.

COLONY, a company of people tranſplanted into a remote province, in order to cultivate and inhabit it.

Colonies are of three ſorts: the firſt are thoſe that ſerve to eaſe and diſcharge the inhabitants of a country, where the people are become too numerous; the ſecond are thoſe eſtabliſhed by victorious princes in the middle of vanquiſhed nations, to keep them in awe and obedience; and the third ſort are thoſe eſtabliſhed for the promotion of trade, called colonies of commerce; ſuch are thoſe eſtabliſhed by European nations in ſeveral parts of Aſia, Africa, and America.

COLOPHONY, in pharmacy, black reſin, or turpentine, boiled in water, and afterwards dried; or, which is ſtill better, the caput mortuum remaining after the diſtillation of the etherial oil, being further urged by a more intenſe and long continued fire.

COLOQUINTIDA, in botany. See CUCUMIS.

COLORATURA, in muſic, denotes all manner of variations, trillos, diminutions, &c. ſerving to make a ſong agreeable.

COLOSSUS, a ſtatue of a gigantic, or enormous ſize.

The moſt famous of this kind was the coloſſus of Rhodes, made, in honour of Apollo, by Chares the diſciple of Lyſippus. It was eighty-ſix feet high, and its thumb ſo large, that few people could fathom it. This ſtatue was placed acroſs the mouth of the harbour at Rhodes, and the ſhips with full ſails paſſed betwixt its legs.

COLOSTRUM, the firſt milk of any animal after bringing forth young, called beeſtings. It is remarkable that this milk is generally cathartic, and purges off the meconium; thus ſerving both as an aliment and medicine.

An emulſion prepared with turpentine, diſſolved with the yolk of an egg, is ſometimes called by this name.

COLOUR. See OPTICS.

COLOUR, in painting, is applied both to the drugs, and to the tints produced by thoſe drugs variouſly mixed and applied.

The principal colours uſed by painters are red and white lead, or ceruſs; yellow and red ochres; ſeveral kinds of earth, umbre, orpiment, lamp-black, burnt ivory, black lead, cinnabar or vermillion, gumboge, lacca, blue and green aſhes, verdigris, biſtre, bicce, ſmalt, carmine, ultra marine: each of which, with their uſes, &c. are to be found under their proper articles.

Of theſe colours ſome are uſed tempered with gum-water, ſome ground with oil, others only in freſco, and others for miniature.

Painters reduce all the colours they uſe under theſe two claſſes, of dark and light colours: dark colours are black, and all others that are obſcure and earthy, as umbre, biſtre, &c.

Under light colours are comprehended white, and all that approach neareſt to it.

Painters alſo diſtinguiſh colours into ſimple and mineral.

Under ſimple colours they rank all thoſe which are extracted from vegetables, and which will not bear the fire; as the yellow, made of ſaffron, French berries, lacca, and other tinctures extracted from flowers, uſed by limners, illuminers, &c.

The mineral colours are thoſe which being drawn from metals, &c. are able to bear the fire, and therefore uſed by enamellers. Changeable and permanent colours is another diviſion, which, by ſome, is made of colours.

Changeable colours are ſuch as depend on the ſituation of the objects with reſpect to the eye, as that of a pigeon's neck, taffeties, &c. the firſt however being attentively viewed by the microſcope, each fibre of the feathers appears compoſed of ſeveral little ſquares, alternately red and green, ſo that they are fixed colours.

Local COLOURS. See LOCAL.

Water COLOURS. See WATER.

COLOUR, in dying. There are, in the art of dying, five colours, called ſimple, primary, or mother colours, from the mixture of which all other colours are formed; theſe are blue, yellow, brown, red, and black. Of theſe colours, variouſly mixed and combined, they form the following colours, panſy, blue, and red; from the mixture of blue and ſcarlet are formed amaranth, violet, and panſy; from the ſame mixture of blue, crimſon, and red, are formed the columbine, or dove-colour, purple-crimſon, amaranth, panſy, and crimſon-violet. See BOTANY, Vol. I. p. 633.

Here it is to be obſerved, that they give the name crimſon to all colours made with cochineal.

Colour, in heraldry. The colours generally uſed in heraldry are red, blue, black, green, and purple, which the heralds call gules, azure, ſable, vert or ſinople, and purpure; tenne or tawny, and ſanguine, are not ſo common: as to yellow and white, called *or* and *argent*, they are metals, not colours.

The metals and colours are ſometimes expreſſed in blazon by the names of precious ſtones, and ſometimes by thoſe of planets or ſtars. See Blazoning.

Oenomaus is ſaid to have firſt invented the diſtinction of colours, to diſtinguiſh the gundillæ of combatants of the Circenſian games; the green for thoſe who repreſented the earth, and blue for thoſe who repreſented the ſea.

Colours, in the military art, include the banners, flags, enſigns, &c. of all kinds, borne in the army or fleet. See Flag, and Standard.

Field-Colour. See Field.

Colours, in the Latin and Greek churches, are uſed to diſtinguiſh ſeveral myſteries and feaſts, celebrated therein.

Five colours only are regularly admitted into the Latin church; theſe are white, green, red, violet, and black: the white is for the myſteries of our Saviour, the feaſts of the virgin, thoſe of the angels, ſaints, and confeſſors; the red is for the myſteries and ſolemnities of the holy ſacrament, the feaſts of the apoſtles and martyrs; the green for the time between pentecoſt and advent, and from epiphany to ſeptuageſima; the violet in advent and Chriſtmas, in vigils, rogations, &c. and in votive maſſes in time of war; laſtly, the black is for the dead, and the ceremonies thereto belonging.

In the Greek church, the uſe of colours is almoſt aboliſhed, as well as among us: red was, in the Greek church, the colour for Chriſtmas, and the dead, as black among us.

To Colour *ſtrangers goods*, is when a freeman allows a foreigner to enter goods at the cuſtom-houſe in his name.

COLOURING, among painters, the manner of applying and conducting the colours of a picture; or the mixtures of light and ſhadows, formed by the various colours employed in painting. See Painting.

Colouring *of glaſs*. See Glass.

Colouring *of porcelain*. See Porcelain.

COLT, in zoology. See Equus.

Colt-evil, among farriers, a ſwelling of the yard and ſcrotum, incident both to ſtoned horſes and geldings; for which, after waſhing the part with lukewarm vinegar, it is uſual to anoint them with juice of rue, mixed with honey, and boiled in hog's greaſe, adding bay-leaves and the powder of fenugreek.

Colt's-foot, in botany. See Tussilago.

COLTIE, a term uſed by timber-merchants for a defect, or blemiſh, in ſome of the annular circles of a tree, whereby its value is much diminiſhed.

COLUBER, in zoology, a genus of ſerpents belonging to the claſs of amphibia. The characters are theſe: They have a number of ſcuta, or hard cruſts, on the belly; and ſcutellæ, or ſcales, on the tail. Linnæus enumerates no leſs than 97 ſpecies under this genus, diſtinguiſhed ſolely by the number of ſcuta and ſcutellæ. For the ſake of brevity, we ſhall give the numbers in figures, the firſt denoting the number of ſcuta, and the ſecond the number of ſcutellæ, thus, 140-22.

The firſt ſpecies is the vipera, 118-22. This is the viper of the ſhops, the fleſh of which has been much recommended in ſcrophulous, leprous, and other obſtinate chronical diſorders: but its virtues in theſe caſes have been too much exaggerated: the fleſh of the viper is however highly nutritive, and is therefore properly eſteemed to be a good reſtorative: but, to anſwer any good purpoſe, even when given with this intention, it ought to be uſed liberally, and for a conſiderable time, as food. This animal is a native of Egypt. The body is very ſhort, and of a pale colour, with browniſh ſpots; and the head is gibbous, and covered with ſmall ſcales. 2. The atropos, 131-22, is a native of America; the body is white, and the eyes are brown, with a white iris. 3. The leberis, 110-50, is a native of Canada, and has many linear black rings. 4. The ammodites, 142-32, is about ſix inches long, and has an erect fleſhy protuberance on its noſe. It is a native of the Eaſt. 5. The berus, 146-39, or common Britiſh viper, is found in moſt countries in Europe: It is of a duſky blackiſh colour. 6. The cherſea, 150-34, is a native of Sweden, and rather leſs than the aſp. 7. The preſter, 152-32, is found in the northern parts of Europe, and the whole body is black. 8. The aſpis, 146-46, is a native of France, and is of a reddiſh colour, with duſky ſpots on the back. 9. Lebetinus, 155-46, is a native of Aſia, and is of a cloudy colour, with red ſpots on the belly. 10. The ſeverus, 170-42, is likewiſe a native of Aſia, and is aſh-coloured, with white belts. 11. The ſtolatus, 143-76, is a native of Aſia, and is of a greyiſh colour, with two white fillets. 12. The lacteus, 203-32, is a native of the Indies; the colour is white, with black ſpots. 13. The naja, 193-60, is a native of the Eaſt Indies; and is the moſt poiſonous of all ſerpents; they are eat by the ichneumon. 14. The atrox, 196-69, is a native of Aſia; it is of a hoary colour; and the head is compreſſed and covered with ſmall ſcales. 15. The niveus, 209-62, is white, without any ſpots. It is a native of Africa. 16. The corallinus, 193-82, is a native of Aſia: It is greyiſh, with three brown fillets. 17. The dipſas, 152-135, is a native of America: it is of a blueiſh colour, with the margins of the ſcales white. 18. The mycterizans, 192-167, is a native of America; the ſnout is ſtretched out, and triangular. Although this genus comprehends 97 ſpecies, the above 18 are all whoſe bite is ſuppoſed to be poiſonous. The poiſon is contained in a little bag at the baſe of their long fangs. See Natural History.

The 19th ſpecies is the lutrix, 134-27; the back and belly are yellow; and the ſides are blueiſh. It is a native of the Indies. 20, The calamarius, 140-22, is of a livid colour interſperſed with duſky ſpots and

and lines, and is found in America. 21. The fimus, 124-46, is a native of Carolina; the head is roundifh, flat, and gibbous; the body is interfperfed above with black and white; and the belly is black. 22. The ftriatulus, 126 45, is likewife a native of Carolina: the back is dufky and ftriated; and the belly is pale. 23. The ceraftes, 150-25, is a native of Afia; the fcales of the head are round and fmall: this is the horned viper of Haffelquift; but the horns are a mere impofition; the Arabians fix the fpurs of a cock or other bird upon the head of the viper, in order to raife the admiration of travellers. 24. The plicatilis, 131-46, is of a livid colour, with dufky fides. 25. The domicella, 118-60, is a native of Afia; it is white, with black belts. 26. The alidras, 121-58, is a native of India, and is all white. 27. The punctatus, 136-43, is a native Carolina: It is afh-coloured, variegated with yellow fpots. 28. The buccatus, 107-72, is dufky-coloured, with white belts, and is a native of Afia. 29. The angulatus 117-70, is a native of Afia, and of a greyifh colour, with black fillets. 30. The cæruleus, 165-24, is blueifh, with white fcales on one fide: It is a native of America. 31. The albus, 170-20, is entirely white, and is a native of Afia. 32. The typhlus, 140-53, is a native of the Indies, and of a blueifh colour. 33. The fafciatus, 128-67, is a native of Carolina; the fcales are carinated, and the colour is blackifh. 34. The melanocephalus, 140 62, is a native of America; the body is very fmooth; the colour is dufky, and the head is black. 35. The cobella, 150-54, is very frequent in America: it is afh-coloured, interfperfed with white lines. 36. The reginæ, 137-70, is a native of the Indies; the body is dufky, and the belly is black and white. 37. The dollatus, 164-43, is a native of Carolina; this is a fmall ferpent, of a whitifh colour, with black rings. 38. The ordinatus, 138-72, is likewife found in Carolina: It is blueifh, and clouded with black fpots. 39. The Mexicanus, 134-77, is a native of America. 40. The aurora, 179 37, is a native of America: it is livid, with a yellow back. 41. The fipedon, 144-73, is yellowifh, and a native of North America. 42. The maurus, 152-66, is a native of Algiers: the body is yellowifh above, and the belly is red. 43. The vittatus, 142-78, is a native of America; the edges of the fcales are yellowifh, and there is a white dentated fillet under the anus. 44. The miliaris, 162-59, is a native of the Indies: the body is yellow, with a white fpot in each fcale; and the belly is white. 45. The æfculapii, 180-43, is a native of the Indies: it has white and black belts. 46. The rhombeatus, 157-70, is a native of the Indies: the colour is blueifh, with black fpots. 47. The cyaneus, 119-110, is a native of America: it is of an azure colour, and the belly is green. 48. The natrix, 170 60, is a native of Europe: it is black, with a white fpot on each fide of the neck. 49. The agilis, 184-50, is a native of the Indies: it has yellow and white belts. 50. The jaculatrix, 163-77, is a native of Surinam. 51. The aulicus, 184-60, is a native of America, and is of a greyifh colour, with white belts. 52. The monilis, 164-82, is a native America; the body is annulated, with three white fpots on the collar. 53. The fulvius, 218-31, is a native of Carolina: it has 22 black rings, and as many yellow, placed alternately. 54. The pallidus, 156-96, is a native of the Indies, and is of a pale colour, with grey and yellow fpots. 55. The lineatus, 169-84, is a native of Afia: it is blueifh, with four linear fillets. 56. The padera, 198 56, is a native of the Indies: it is white, with yellowifh fpots. 57. The canus, 188-70, is a native of the Indies: it is of a hoary colour, with yellowifh belts. 58. The getulus, 215 44, is a native of Carolina: it is of a blackifh blue colour, with yellow linear belts. 59. The fibilans, 160-100, is a native of Afia; and is blue, with black fillets, and a white belly. 60. The laticaudatus, 220-42, is a native of the Indies: it is afh-coloured, with yellow belts; and the tail is obtufe and compreffed. 61. The firtalis, 150 114, is a native of Canada: the body is of a dirty yellow colour, with three blueifh green fillets. 62. The fibon, 180-85, is a native of Africa: it is of a yellowifh iron-colour, interfperfed with white; and the belly is white, with yellow fpots. 68. The nebulatus, 185-81, is a native of America: it is clouded with yellow and an afh colour, and the belly is variegated with yellow and white. 64. The fufcus, 149-117, is a native of Afia; it is yellow and afh-coloured, and there are yellow fpots behind the eyes. 65. The faturninus, 147-120, is a native of the Indies: it is livid and coloured with an afh-colour, and the eyes are very large. 66. The candidus, 220-50, is a native of the Indies: it is white, with yellow belts. 67. The fcaber, 228-44, is a native of the Indies: it is clouded with black and yellow, and the fcales are carinated. 68. The carinatus, 157-115, is a native of the Indies: it is of a lead colour, and the edges of the fcales are tipped with white; the belly is white, and the back is carinated. 69. The ovivorus, 203 73, is a native of America. 70. The faurita, 156-121, is a native of Carolina: it is of a greenifh colour. 71. The conftrictor, 186 92, is a native of North America: it is black and fmooth; the belly is of a palifh green; and the nape of the neck is white. This fpecies is fo bold, that it even attacks men, twifting about their legs, and breaking their bones: it runs very quickly; but its bite is not poifonous. 72. The exoletus, 147-132, is a native of the Indies. It is blueifh and afh-coloured. 73. The fitula, 236-45, is a native of Egypt: It is greyifh. 74. The trifcalis, 195-86, is a native of the Indies: It is of an azure colour. 75. The guttatus, 227-60, is a native of Carolina: It is of a livid colour, with red and black fpots on the back. 76. The lemnifcatus, 250-35, is a native of Afia: The body is very fmooth, and variegated with white and black rings. 77. The annulatus, 190-96, is a native of America: It is white, with round yellow fpots. 78. The pelias, 187-103, is a native of the Indies: It is yellow behind the eyes, and the reft is blackifh. 79. The tyria, 210-83, is a native of Egypt: It is whitifh, with yellow fpots. 80. The jugularis, 195-102, is a native

tive of Egypt: It is black, with a red neck. 81. The pethola, 209-90, is a native of Africa: It is of a leaden colour. 82. The æſtivus, 155-144, is a native of Carolina: It is blue, and very ſmooth; and the belly is of a paliſh green. 83. The molurus, 248 59, is a native of the Indies: This ſpecies is very like the boa; but the ſcuta and ſcales are larger. 84. The ahætulla, 163-150, is a native of Aſia and America: It is of a yellowiſh green colour, and the tops of the ſcales are black; it has likewiſe a black belt acroſs the eyes. 85. The petalarius, 212-102, is a native of the Indies: It is yellow, with white belts. 86. The haje, 207-109, is a native of Egypt. This is a large ſerpent, with oblique red belts, and about one half of each ſcale white. 87. The filiformis, 165-158, is a native of the Indies: It is black, with a white belly; and the head is thicker than the body. 88. The pullatus, 217-108, is a native of Aſia: It has red belts, with white ſpots. 89. The hippocrepis, 282-94, is a native of America: It is of a livid colour, with yellow ſpots. 90. The minervæ, 238-90, is a native of the Indies: It is of an azure colour, with a yellow fillet on the back. 91. The cinereus, 200-137, is a native of the Indies: It is of an aſh-colour, with a white belly. 92. The viridiſſimus, 217-122, is a native of Surinam: It is of a fine green colour. 93. The mucoſus, 200-140, is a native of the Indies: the head is blueiſh. 94. The domeſticus, 245-94, frequents the dwelling-houſes of Barbary: It greatly reſembles the hippocrepis. 95. The cenchoa, 220-124, is a native of America: It is yellowiſh, with pale ſpots and white belts: The head is globular. 96. The cæruleſcens, 215-170, is a native of the Indies, and is of an azure colour. 97. The argus, is a native of Africa; but hitherto we have had no juſt deſcription of it.—For the inſtincts, manner of living, *&c.* of ſerpents in general, ſee NATURAL HISTORY.

COLUBRINUM LIGNUM, or SNAKE-WOOD. See STRYCHNOS.

COLUMBA, PIGEON, in ornithology, a genus belonging to the order of paſſeres. The characters of this genus are theſe: The bill is ſtrait, and deſcends towards the point; the noſtrils are oblong, and half covered with a ſoft tumid membrane; and the tongue is entire, *i. e.* not cloven. There are 40 ſpecies, *viz.* 1. The œnas, or domeſtic pigeon, is blueiſh, with a greeniſh ſhining neck; on the back, towards the tail, it is white, with a blackiſh ſtreak on the point of the wings and tail. It is the ſtock-dove or wood-pigeon of Ray, and is a bird of Europe. The pigeon lays two eggs, and hatches them every month, for eight or nine months in the year, which, in the ſpace of four years, amounts to about 18000 deſcendants. They always bill before copulation: Their method of feeding their young is curious; they firſt macerate peaſe or other grain for ſome time in their crop, and then vomit it up into the mouths of the young ones. The male and female ſit upon their eggs by turns. 2. The hiſpanica, with white mealy wax on the bill. It is about double the ſize of the common pigeon. 3. The daſypus, with rough feathered legs. 4. The gutturoſa, or cropper, has a power of inflating its crop till it be as large as the animal's body. It is a native of Arabia Felix. 5. The cucullata has the feathers on the back-part of the head erect and reflected; and the bill is ſhort. 6. The hiſpida, or rough pigeon, with the ſmall feathers of the back and wings erected. It is a native of the Eaſt Indies. 7. The turbita, with the feathers on the breaſt bent backward, a ſhort bill, and a plain vertex. 8. The laticauda, or broad-tailed pigeon, has an erect open tail conſiſting of many feathers. 9. The gyratrix turns itſelf round when flying: it is a little leſs than the common pigeon. 10. The galeata, with the head and prime feathers of the wings and tail of the ſame colour, and always different from the reſt of the body. 11. The turcica, with red papillous wax. It is a bird of Arabia. 12. The tabellaria has naked eye-brows, and broad, white, fleſhy wax on the bill. Although this bird be carried to a very great diſtance from home, it returns with vaſt ſpeed; and hence the ancients employed it for the purpoſe of conveying back letters. 13. The montana has naked red orbits, a reddiſh body, and a yellow belly; the bill and feet are red. It is the mountain-partridge of Ray, and is a native of Jamaica. 14. The leucocephala, with the top of the head and the orbits red, and a blueiſh body. It is a native of North America. 15. The leucoptera, with naked blue orbits, and the prime wing-feathers white at the points, and the intermediate ones yellowiſh. It is the Indian turtle of Edwards, and is a native of Aſia. 16. The guinea, with naked red orbits, a yellowiſh bill, triangular white ſpots on the wings, and the prime wing-feathers black at the points. It is a native of Africa. 17. The coronata has black orbits, a large erect creſt on the head, and a blueiſh body. It is almoſt as large as a peacock, and is a native of Banda. 18. The ſtriata, with hoary orbits, and the body variegated with black and aſh-coloured belts. It is a native of the Eaſt Indies. 19. The palumbus, with the prime tail-feathers red behind, the prime wing-feathers edged with white, a white neck, and feathered legs. It is a native of Europe and Aſia. 20. The cyanocephala, with a blue head, and a white belt below the eye. It is a native of America. 21. The madagaſcarenſis, with feathered legs, a violet tail, a greeniſh blue body, and the beak and feet red. It is found in Madagaſcar. 22. The aenea, with feathered legs, greeniſh legs and bill, and a braſs-coloured body. It is a native of the Molucca Iſles. 23. The viridis, with a braſs-coloured body, a violet belly, and red legs half covered with feathers. It is found at Amboina. 24. The martinica, with a violet body, a yellowiſh belly, and the prime wing-feathers red on the inſide. It is found in Martinico. 25. The jamaicenſis, with blueiſh prime tail-feathers terminated by a white line. It is found in Jamaica. 26. The Senegalenſis, with the three outmoſt prime tail-feathers white, and the neck ſpotted with black. It is found in Senegal. 27. The nicobarica has a white tail, a black body, blue prime wing-feathers, a green-

iſh

ifh fhining back, and long feathers on the neck. It is found in the ifland of Nicombar near Pegu. 28. The finica is yellowifh, and belted with black; the belly is reddifh, the wings yellow, the prime wing-feathers black, and a black bill. It is a native of China. 29. The indica, with a purple body, green fhoulders, and the top of the head blueifh. It is a native of the Eaft Indies. 30. The canadenfis, with the prime wing-feathers yellow at the points, and the prime tail-feathers afh-coloured. It is a native of Canada. 31. The afra, with the exterior prime tail-feathers white at the points, and violet fpots on the wing-feathers. It is a native of Senegal. 32. The turtur, with the prime tail-feathers white, a greyifh back, and a flefh-coloured breaft. It is a native of India. 33. The riforia is clay-coloured above, and has a black crefcent on the neck. It is a native of India. 34. The poffyrina, with a purple body, and a yellow bill and legs. It inhabits America within the tropics. 35. The minuta is the fmalleft of all pigeons, is of a dufky colour, with five fteel-coloured fpots on the wings, and the outmoft prime tail-feathers white. It is a native of America. 36. The migratoria has a wedge-fhaped tail, red naked orbits, and a reddifh breaft. This fpecies is very frequent in North America: They live upon the feeds of the elm, oak, wheat, *&c.* and they winter in Carolina. 37. The carolinenfis has a wedge-fhaped tail, blue orbits, and a reddifh belly. It is a native of America. 38. The amboinenfis has a wedge-fhaped tail, a reddifh body, and a greenifh neck. It is found at Amboina. 39. The capenfis has a wedge-fhaped tail, and the prime wing-feathers red on the interior fide. It is found at the Cape of Good Hope. 40. The marginata has a wedge-fhaped tail, a red breaft, and the points of the prime tail-feathers black and edged with white.

COLUMBINE, in botany. See AQUILEGIA.

Feathered COLUMBINE. See THALICTRUM.

COLUMBUS, or *Congregation of St* COLUMBUS, a fociety of regular canons, who formerly had an hundred abbeys or monafteries in the Britifh iflands.

COLUMELLA, in botany. See Vol. I. p. 637.

COLUMN, in architecture, a round pillar, made to fupport and adorn a building, and compofed of a bafe, a fhaft, and a capital. See ARCHITECTURE.

COLUMN, in the military art, a long deep file of troops or baggage.

The firft and fecond lines of the army as they are encamped, make generally two columns on a march, filing off either from the right or left: fometimes the army marches in four, fix, or eight columns, according as the ground will allow; and each column is led by a general officer.

COLUMNEA, in botany, a genus of the didynamia angiofpermia clafs. The calix is divided into five fegments; the upper labium of the corolla is vaulted and entire, and gibbous at the bafe; the antheræ are connected; and the capfule is bilocular. There is but one fpecies, *viz.* the fcandens, a native of Martinico.

COLURES, in aftronomy and geography, two great circles fuppofed to interfect each other at right angles in the poles of the world, and to pafs through the folftitial and equinoctial points of the ecliptic. See GEOGRAPHY, and ASTRONOMY.

COLURI, a little ifland in the gulph of Engia, in the Archipelago, about feven miles fouth of Athens: of this ifland Ajax was fovereign: E. long. 24°, N. lat. 38°.

COLUTEA, BASTARD-SENA, in botany, a genus of the diadelphia decandria clafs. The pod is inflated, and opens at the top; and the calix is bilabiated. The fpecies are three, none of them natives of Britain.

COLYMBUS, the DIVER, in ornithology, a genus belonging to the order of anferes. The bill has no teeth, is fubulated, ftrait, and fharp-pointed; the teeth are in the faux or throat; the noftrils are linear, and at the bafe of the bill; and the legs are unfit for walking. There are eleven fpecies, *viz.* 1. The grylle, with palmated and three-toed feet, a red body, and the covering feathers of the wings white. It flies very low, and is a native of Greenland. 2. The troile, with palmated three-toed feet, a black body, a white breaft and belly, and the fecondary prime feathers of the wings white at the points. It is found within the arctic circle. 3. The feptentrionalis, with palmated four-toed feet, and an iron-coloured fpot under the neck. It is a native of the northern lakes of Europe. They build their nefts upon the fhore without art, and lay a couple eggs: they run with great quicknefs upon the water; and prefage ftorms by flying and crying with a miferable tone of voice. 4. The arcticus, with palmated four-toed feet, a hoary head, and a violet neck. It frequents the northern feas and lakes. 5. The glacialis, with palmated four-toed feet, and a violet head and neck. It inhabits the northern feas. 6. The immer, with palmated four-toed feet, the upper part of the body black and undulated with white, and a white belly. It inhabits the frozen feas. 7. The cryftallus, with lobated feet, a red head, a black collar, and white fecondary prime wing-feathers. It is a native of Europe. 8. The auritus, with lobated feet, a black head, and the ears are crefted and of an iron colour. It frequents the lakes of Europe and America. 9. The urinator, with lobated feet, a fmooth head, and white fpots on the wings. It is a native of the fouthern parts of Europe. 10. The dominicus, with lobated feet, a fmooth head, and the belly very much fpotted. 11. The padiceps, with lobated feet and a yellowifh body. It is a native of North America.

COLYTEA, in botany. See CERCIS.

COMA, or COMA-VIGIL, a preternatural propenfity to fleep, when neverthelefs the patient does not fleep, or, if he does, awakes immediately without any relief. See MEDICINE.

COMA SOMNOLENTUM, is when the patient continues in a profound fleep, and, when awaked, immediately relapfes, without being able to keep open his eyes. See MEDICINE.

COMARUM, in botany, a genus of plants of the icofandria polygynia clafs. The calix is divided into ten fectments; the petals are five, and lefs than the calix, and

and the feeds are ovated, fpongy, and perfiftent. There is but one fpecies, *viz.* the paluftre, a native of Europe.

COMB, an inftrument to clean, untangle, and drefs flax, wool, hair, *&c.*

Combs for wool are prohibited to be imported into Britain.

COMB is alfo the creft or red flefhy tuft growing upon a cock's head.

Lady's COMB, in botany. See SCANDIX.

COMB-FISH, in the hiftory of fhell-fifh. See OSTREA.

COMBAT, in a general fenfe, denotes an engagement, or a difference decided by arms. See BATTLE.

COMBAT, in our ancient law, was a formal trial of fome doubtful caufe or quarrel by the fwords or baftons of two champions. This form of proceeding was very frequent not only in criminal but in civil caufes; being built on a prefumption, that God would never grant the victory but to him who had the beft right. The laft trial of this kind in England, was between Donald lord Ray, appellant, and David Ramfay, efq; defendant; when, after many formalities, the matter was referred to the king's pleafure.

COMBATANT, in heraldry, a term for two beafts, as lions, *&c.* borne in a coat of arms in a fighting pofture, with their faces to each other.

COMBINATION, properly denotes an affemblage of feveral things two by two.

COMBINATION, in mathematics, is the variation or alteration of any number of quantities, letters, or the like, in all the different manners poffible.

COMEDY. See EPIC and DRAMATIC COMPOSITIONS.

COMET, an opake, fpherical, and folid body like a planet, performing revolutions about the fun in elliptical orbits, which have the fun in one of the foci. See ASTRONOMY, p. 444.

COMETARIUM, a curious machine exhibiting an idea of the revolution of a comet about the fun. See Plate XLVIII. fig. 2.

COMFREY, in botany. See SYMPHYTUM.

COMITIA, in Roman antiquity, an affembly of the people, either in the comitium or campus martius, for the election of magiftrates, or confulting on the important affairs of the republic.

There were certain days fixed for thefe affemblies, called *dies comitiales*, marked with a C in Julius Cæfar's calendar,

There were three kinds of comitia, *viz.* curiata, centuriata, and tributa, fo diftinguifhed from the manner wherein the people voted, and gave their fuffrages, *viz.* by curiæ, or parifhes, tribes, or centuries. The comitia curiata, owe their original to the divifion which Romulus made of the people into thirty curiæ, which anfwer in moft refpects to our parifhes. The comitia centuriata were inftituted by Servius Tullius. Comitial affemblies held for the election of confuls, were called confular comitia. In like manner the other comitia were named from the officer to be created, whether a tribune, pontif, ædile, or the like. The power of calling thefe affemblies, belonged at firft only to the kings: but on the eftablifhment of the democracy, the fame privilege was allowed to moft of the chief magiftrates, and fometimes to the pontiff.

COMITIALIS MORBUS, an appellation given to the epilepfy, by reafon the comitia of ancient Rome were diffolved, if any perfon in the affembly happened to be taken with this diftemper.

COMITIUM, in Roman antiquity, a large hall in the forum, where the comitia were ordinarily held.

COMMA, among grammarians, a point or character marked thus (,) ferving to denote a fhort ftop, and to divide the members of a period.

COMMA, in mufic, an interval equal to the difference of the tone major or minor, and expreffed by the ratio 81 : 80.

COMMELINA, in botany, a genus of the triandria monogynia clafs. The corolla is divided into fix fegments; it has three crofs-like nectaria inferted by their proper filaments. The fpecies are ten, none of them natives of Britain.

COMMEMORATION, in a general fenfe, the remembrance of any perfon or thing; or the doing any thing in honour of a perfon's memory, or in remembrance of any paft event. Thus the euchariſt is a commemoration of the fufferings of Jefus Chrift.

COMMENDAM, in the ecclefiaftical law, the truft or adminiftration of the revenues of a benefice, given either to a layman, to hold, by way of *depofitum*, for fix months, in order to repairs, *&c.* or to an ecclefiaftic, or beneficed perfon, to perform the paftoral duties thereof, till once the benefice is provided with a regular incumbent.

COMMENSURABLE, among geometricians, an appellation given to fuch quantities as are meafured by one and the fame common meafure.

COMMENSURABLE NUMBERS, whether integers or fractions, are fuch as can be meafured or divided by fome other number, without any remainder: fuch are 12 and 18, as being meafured by 6 or 3.

COMMENSURABLE in POWER, is faid of right lines, when their fquares are meafured by one and the fame fpace or fuperficies.

COMMENSURABLE SURDS, thofe that being reduced to their leaft terms, become true figurative quantities of their kind; and are therefore as a rational quantity to a rational one.

COMMENTARY, or COMMENT, in matters of literature, an illuftration of the difficult or obfcure paffages of an author.

COMMENTARY, or COMMENTARIES, likewife denotes a kind of hiftory, or memoirs of certain tranfactions, wherein the author had a confiderable hand: fuch are the commentaries of Cæfar.

COMMERCE.

C O M M E R C E.

COMMERCE is an operation, by which the wealth, or work, either of individuals, or of ſocieties, may be exchanged, by a ſet of men called merchants, for an equivalent, proper for ſupplying every want, without any interruption to induſtry, or any check upon conſumption.

We ſhall begin by tracing commerce to its ſource, in order to reduce it to its firſt principles.

The moſt ſimple of all trade, is that which is carried on by bartering the neceſſary articles of ſubſiſtence. If we ſuppoſe the earth free to the firſt poſſeſſor, this perſon who cultivates it will firſt draw from it his food, and the ſurplus will be the object of barter: he will give this in exchange to any one who will ſupply his other wants. This naturally ſuppoſes both a ſurplus quantity of food produced by labour, and alſo free hands; for he who makes a trade of agriculture cannot ſupply himſelf with all other neceſſaries, as well as food; and he who makes a trade of ſupplying the farmers with ſuch neceſſaries, in exchange for his ſurplus of food, cannot be employed in producing that food. The more the neceſſities of man increaſe, the more free hands are required to ſupply them; and the more free hands are required, the more ſurplus food muſt be produced by additional labour, to ſupply their demand.

This is the leaſt complex kind of trade, and may be carried on to a greater or leſs extent, in different countries, according to the different degrees of the wants to be ſupplied. In a country where there is no money, nor any thing equivalent to it, the wants of mankind will be confined to few objects; to wit, the removing the inconveniencies of hunger, thirſt, cold, heat, danger, and the like. A free man, who, by his induſtry, can procure all the comforts of a ſimple life, will enjoy his reſt, and work no more: and, in general, all increaſe of work will ceaſe, ſo ſoon as the demand for the purpoſes mentioned comes to be ſatisfied. There is a plain reaſon for this. When the free hands have procured, by their labour, wherewithal to ſupply their wants, their ambition is ſatisfied: ſo ſoon as the huſbandmen have produced the neceſſary ſurplus for relieving theirs, they work no more. Here then is a natural ſtop put to induſtry, conſequently to bartering.

The next thing to be examined is, how bartering grows into trade, properly ſo called and underſtood, according to the definition given of it above; how trade comes to be extended among men; how manufactures, more ornamental than uſeful, come to be eſtabliſhed; and how men come to ſubmit to labour, in order to acquire what is not abſolutely neceſſary for them.

This, in a free ſociety, is chiefly owing to the introduction of money, and a taſte for ſuperfluities in thoſe who poſſeſs it.

In ancient times, money was not wanting; but the taſte for ſuperfluities not being in proportion to it, the ſpecie was locked up. This was the caſe in Europe four hundred years ago. A new taſte for ſuperfluity has drawn, perhaps, more money into circulation, from our own treaſures, than from the mines of the new world. The poor opinion we entertain of the riches of our forefathers, is founded upon the modern way of eſtimating wealth, by the quantity of coin in circulation, from which we conclude, that the greateſt part of the ſpecie now in our hands muſt have come from America.

It is more, therefore, through the taſte of ſuperfluity, than in conſequence of the quantity of coin, that trade comes to be eſtabliſhed; and it is only in conſequence of trade that we ſee induſtry carry things in our days to ſo high a pitch of refinement and delicacy. Let us illuſtrate this, by comparing together the different operations of barter, ſale, and commerce.

When reciprocal wants are ſupplied by barter, there is not the ſmalleſt occaſion for money: this is the moſt ſimple of all combinations.

When wants are multiplied, bartering becomes more difficult; upon this money is introduced. This is the common price of all things: it is a proper equivalent in the hands of thoſe who want, perfectly calculated to ſupply the occaſions of thoſe who, by induſtry, can relieve them. This operation of buying and ſelling is a little more complex than the former; but ſtill we have here no idea of trade, becauſe we have not introduced the merchant, by whoſe induſtry it is carried on.

Let this third perſon be brought into play, and the whole operation becomes clear. What before we called wants, is here repreſented by the conſumer; what we called induſtry, by the manufacturer; what we called money, by the merchant. The merchant here repreſents the money, by ſubſtituting credit in its place; and as the money was invented to facilitate barter, ſo the merchant, with his credit, is a new refinement upon the uſe of money. This renders it ſtill more effectual in performing the operations of buying and ſelling. This operation is trade: it relieves both parties of the whole trouble of tranſportation, and adjuſting wants to wants, or wants to money; the merchant repreſents by turns both the conſumer, the manufacturer, and the money. To the conſumer he appears as the whole body of manufacturers; to the manufacturers as the whole body of conſumers; and to the one and the other claſs his credit ſupplies the uſe of money. This is ſufficient at preſent for an illuſtration. We now return to the ſimple operations of money in the hands of the two contracting parties, the buyer and the ſeller, in order to ſhow how men come to ſubmit to labour in order to acquire ſuperfluities.

So ſoon as money is introduced into a country, it becomes an univerſal object of want to all the inhabitants.

The conſequence is, that the free hands of the ſtate, who

who before ſtopt working, becauſe all their wants were provided for, having this new object of ambition before their eyes, endeavour, by refinements upon their labour, to remove the ſmaller inconveniences which reſult from a ſimplicity of manners. People, who formerly knew but one ſort of clothing for all ſeaſons, willingly part with a little money to procure for themſelves different ſorts of apparel properly adapted to ſummer and winter, which the ingenuity of manufacturers, and their deſire of getting money, may have ſuggeſted to their invention.

Indeed theſe refinements ſeem more generally owing to the induſtry and invention of the manufacturers, (who by their ingenuity daily contrive means of ſoftening or relieving inconveniencies, which mankind ſeldom perceive to be ſuch, till the way of removing them is contrived), than to the taſte of luxury in the rich, who, to indulge their eaſe, engage the poor to become induſtrious.

Let any man make an experiment of this nature upon himſelf, by entering into the firſt ſhop. He will no where ſo quickly diſcover his wants as there. Every thing he ſees appears either neceſſary, or at leaſt highly convenient; and he begins to wonder how he could have been ſo long without that which the ingenuity of the workman alone had invented, in order that from the novelty it might excite his deſire; for perhaps when it is bought, he will never once think of it more, nor ever apply it to the uſe for which it at firſt appeared ſo neceſſary.

Here then is a reaſon why mankind labour though not in want. They become deſirous of poſſeſſing the very inſtruments of luxury, which their avarice or ambition prompted them to invent for the uſe of others.

What has been ſaid repreſents trade in its infancy, or rather the materials with which that great fabrick is built.

We have formed an idea of the wants of mankind multiplied even to luxury, and abundantly ſupplied by the employment of all the free hands ſet apart for that purpoſe. But if we ſuppoſe the workman himſelf diſpoſing of his work, and purchaſing with it food from the farmer, cloaths from the clothier; and, in general, ſeeking for the ſupply of every want from the hands of the perſon directly employed for the purpoſe of relieving it; this will not convey an idea of trade, according to our definition.

Trade and commerce are an abbreviation of this long proceſs; a ſcheme invented and ſet on foot by merchants, from a principle of gain, ſupported and extended among men, from a principle of general utility to every individual, rich or poor, to every ſociety, great or ſmall.

Inſtead of a pin-maker exchanging his pins with fifty different perſons, for whoſe labour he has occaſion, he ſells all to the merchant for money or for credit; and, as occaſion offers, he purchaſes all his wants, either directly from thoſe who ſupply them, or from other merchants who deal with manufacturers in the ſame way his merchant dealt with him.

Another advantage of trade is, that induſtrious people in one part of the country, may ſupply cuſtomers in another, though diſtant. They may eſtabliſh themſelves in the moſt commodious places for their reſpective buſineſs, and help one another reciprocally, without making the diſtant parts of the country ſuffer for want of their labour. They are likewiſe expoſed to no avocation from their work, by ſeeking for cuſtomers.

Trade produces many excellent advantages; it marks out to the manufacturers when their branch is under or over ſtocked with hands. If it is underſtocked, they will find more demand than they can anſwer: if it is overſtocked, the ſale will be ſlow.

Intelligent men, in every profeſſion, will eaſily diſcover when theſe appearances are accidental, and when they proceed from the real principles of trade.

Poſts, and correſpondence by letters, are a conſequence of trade; by the means of which merchants are regularly informed of every augmentation or diminution of induſtry in every branch, in every part of the country. From this knowldge they regulate the prices they offer; and as they are many, they ſerve as a check upon one another, from the principles of competition.

From the current prices the manufacturers are as well informed as if they kept the correſpondence themſelves: the ſtateſman feels perfectly where hands are wanting, and young people deſtined to induſtry, obey, in a manner, the call of the public, and fall naturally in to ſupply the demand.

Two great aſſiſtances to merchants, eſpecially in the infancy of trade, are public markets for collecting the work of ſmall dealers, and large undertakings in the manufacturing way by private hands. By theſe means the merchants come at the knowledge of the quantity of work in the market, as on the other hand the manufacturers learn, by the ſale of the goods, the extent of the demand for them. Theſe two things being juſtly known, the price of goods is eaſily fixed.

Public ſales ſerve to correct the ſmall inconveniencies which proceed from the operations of trade. A ſet of manufacturers got all together into one town, and entirely taken up with their induſtry, are thereby as well informed of the rate of the market as if every one of them carried thither his work, and upon the arrival of the merchant, who readily takes it off their hands, he has not the leaſt advantage over them from his knowledge of the ſtate of demand. This man both buys and ſells in what is called wholeſale; and from him retailers purchaſe, who diſtribute the goods to every conſumer throughout the country. Theſe laſt buy from wholeſale merchants in every branch, that proportion of every kind of merchandize which is ſuitable to the demand of their borough, city, or province.

Thus all inconveniencies are prevented, at ſome additional coſt to the conſumer, who muſt naturally reimburſe the whole expence. The diſtance of the manufacturer, the obſcurity of his dwelling, the caprice in ſelling his work, are quite removed; the retailer has all in his ſhop, and the public buys at a current price.

How the Prices of Goods are determined by Trade.

In the price of goods, two things muſt be conſidered as really exiſting, and quite different from one another; to

to wit, the real value of the commodity, and the profit upon alienation.

I. The firſt thing to be known of any manufacture, when it comes to be ſold, is, how much of it a perſon can perform in a day, a week, a month, according to the nature of the work, which may require more or leſs time to bring it to perfection. In making ſuch eſtimates, regard is to be had only to what, upon an average, a workman of the country in general may perform, without ſuppoſing him the beſt or the worſt in his profeſſion, or having any peculiar advantage or diſadvantage as to the place where he works.

Hence the reaſon why ſome people thrive by their induſtry, and others not; why ſome manufactures flouriſh in one place, and not in another.

II. The ſecond thing to be known, is the value of the workman's ſubſiſtence, and neceſſary expence, both for ſupplying his perſonal wants, and providing the inſtruments belonging to his profeſſion, which muſt be taken upon an average as above; except when the nature of the work requires the preſence of the workman in the place of conſumption: for although ſome trades, and almoſt every manufacture, may be carried on in places at a diſtance, and therefore may fall under one general regulation as to prices; yet others there are which, by their nature, require the preſence of the workman in the place of conſumption; and in that caſe the prices muſt be regulated by circumſtances relative to every particular place.

III. The third and laſt thing to be known, is the value of the materials, that is, the firſt matter employed by the workman; and if the object of his induſtry be the manufacture of another, the ſame proceſs of inquiry muſt be gone through with regard to the firſt, as with regard to the ſecond: and thus the moſt complex manufactures may be at laſt reduced to the greateſt ſimplicity.

Theſe three articles being known, the price of manufacture is determined. It cannot be lower than the amount of all the three, that is, than the real value; whatever it is higher, is the manufacturer's profit. This will ever be in proportion to demand, and therefore will fluctuate according to circumſtances.

Hence appears the neceſſity of a great demand, in order to promote flouriſhing manufactures.

By the extenſive dealings of merchants, and their conſtant application to the ſtudy of the balance of work and demand, all the above circumſtances are known to them, and are made known to the induſtrious, who regulate their living and expence according to their certain profit.

Employ a workman in a country where there is little trade or induſtry, he proportions his price always to the urgency of your want, or your capacity to pay; but ſeldom to his own labour. Employ another in a country of trade, he will not impoſe upon you, unleſs perhaps you be a ſtranger, which ſuppoſes your being ignorant of the value; but employ the ſame workman in a work not uſual in the country, conſequently not demanded, conſequently not regulated as to the value, he will proportion his price as in the firſt ſuppoſition.

We may therefore conclude from what has been ſaid, that in a country where trade has been eſtabliſhed, manufactures muſt flouriſh, from the ready ſale, the regulated price of work, and the certain profit reſulting from induſtry. Let us next inquire into the conſequences of ſuch a ſituation.

How foreign Trade opens to an induſtrious People, and the Conſequences of it to the Merchants who ſet it on foot.

The firſt conſequence of the ſituation deſcribed in the preceding ſection is, that wants are eaſily ſupplied, for the adequate value of the thing wanted.

The next conſequence is, the opening of foreign trade under its two denominations of paſſive and active. Strangers and people of diſtant countries, finding the difficulty of having their wants ſupplied at home, and the eaſe of having them ſupplied from this country, immediately have recourſe to it. This is paſſive trade. The active is when merchants, who have executed this plan at home with ſucceſs, begin to tranſport the labour of their countrymen into other regions, which either produce, or are capable of producing ſuch articles of conſumption, proper to be manufactured, as are moſt demanded at home; and conſequently will meet with the readieſt ſale, and fetch the largeſt profits.

Here then is the opening of foreign trade, under its two denominations of active and paſſive.

What then are the conſequences of this new commerce to our merchants, who have left their homes in queſt of gain aboard?

The firſt is, that, arriving in any new country, they find themſelves in the ſame ſituation, with regard to the inhabitants, as the workman in the country of no trade, with regard to thoſe who employed him; that is, they proportion the price of their goods to the eagerneſs of acquiring, or the capacity of paying, in the inhabitants, but never to their real value.

The firſt profits then, upon this trade, muſt be very conſiderable; and the demand from ſuch a country will be *high* or *low*, *great* or *ſmall*, according to the ſpirit, not the real wants of the people: for theſe in all countries muſt firſt be ſupplied by the inhabitants themſelves, before they ceaſe to labour.

If the people of this not-trading country be abundantly furniſhed with commodities uſeful to the traders, they will eaſily part with them, at firſt, for the inſtruments of luxury and eaſe; but the great profit of the traders will inſenſibly increaſe the demand for the productions of their new correſpondents; this will have the effect of producing a competition between themſelves, and thereby of throwing the demand on their ſide. This is perpetually a diſadvantage in traffic: the moſt unpoliſhed nations in the world quickly perceive the effects of it; and are taught to profit by the diſcovery, in ſpite of the addreſs of thoſe who are the moſt expert in commerce.

The traders will therefore be very fond of falling upon every method and contrivance to inſpire this people with a taſte of refinement and delicacy. Abundance of fine preſents, conſiſting of every inſtrument of luxury and ſuperfluity, the beſt adapted to the genius of the people, will be given to the prince and leading men among them. Workmen will even be employed at home to ſtudy the taſte

taste of the strangers, and to captivate their desires by every possible means. The more eager they are of presents, the more lavish the traders will be in bestowing and diversifying them. It is an animal put up to fatten, the more he eats the sooner he is fit for slaughter. When their taste for superfluity is fully formed, when the relish for their former simplicity is sophisticated, poisoned, and obliterated, then they are surely in the fetters of the traders, and the deeper they go, the less possibility there is of their getting out. The presents then will die away, having served their purpose; and if afterwards they are found to be continued, it will probably be to support the competition against other nations, who will incline to share of the profits.

If, on the contrary, this not-trading nation does not abound with commodities useful to the traders, these will make little account of trading with them, whatever their turn may be; but, if we suppose this country inhabited by a laborious people, who, having taken a taste for refinement from the traders, apply themselves to agriculture, in order to produce articles of subsistence, they will solicit the merchants to give them part of their manufactures in exchange for those; and this trade will undoubtedly have the effect of multiplying numbers in the trading nation. But if food cannot be furnished, nor any other branch of production found out to support the correspondence, the taste for refinement will soon die away, and trade will stop in this quarter.

Had it not been for the furs in those countries adjacent to Hudson's Bay, and in Canada, the Europeans never would have thought of supplying instruments of luxury to those nations; and if the inhabitants of those regions had not taken a taste for the instruments of luxury, furnished to them by the Europeans, they never would have become so indefatigable nor so dextrous hunters. At the same time we are not to suppose, that ever these Americans would have come to Europe in quest of our manufactures. It is therefore owing to our merchants, that these nations are become in any degree fond of refinement; and this taste, in all probability, will not soon exceed the proportion of the productions of their country. From these beginnings of foreign trade it is easy to trace its increase.

One step towards this, is the establishing correspondences in foreign countries; and these are more or less necessary in proportion as the country where they are established is more or less polished or acquainted with trade. They supply the want of posts, and point out to the merchants what proportion the productions of the country bear to the demand of the inhabitants for manufactures. This communicates an idea of commerce to the not-trading nation, and they insensibly begin to fix a determined value upon their own productions, which perhaps bore no determined value at all before.

Let us trace a little the progress of this refinement in the savages, in order to shew how it has the effect of throwing the demand upon the traders, and of creating a competition among them, for the productions of the new country.

Experience shews, that, in a new discovered country, merchants constantly find some article or other of its productions, which turns out to a great account in commerce; and we see that the longer such a trade subsists, and the more the inhabitants take a taste far European manufactures, the more their own productions rise in their value, and the less profit is made by trading with them, even in cases where the trade is carried on by companies; which is a very wise institution for one reason, that it cuts off a competition between our merchants.

This is the best means of keeping prices low in favour of the nation; however it may work a contrary effect with respect to individuals who must buy from these monopolies.

When companies are not established, and when trade is open, our merchants, by their eagerness to profit by the new trade, betray the secrets of it, they enter into competition for the purchase of the foreign produce, and this raises prices, and favours the commerce of the most ignorant savages.

Consequences of the Introduction of a passive foreign Trade among a People who live in Simplicity and Idleness.

We now suppose the arrival of traders, all in one interest, with instruments of luxury and refinement, at a port in a country of great simplicity of manners, abundantly provided by nature with great advantages for commerce, and peopled by a nation capable of adopting a taste for superfluities.

The first thing the merchants do is, to expose their goods, and point out the advantages of many things, either agreeable or useful to mankind in general, such as wines, spirits, instruments of agriculture, arms, and ammunition for hunting, nets for fishing, manufactures for clothing, and the like. The advantages of these are presently perceived, and such commodities are eagerly sought after.

The natives on their side produce what they most esteem, generally something superfluous or ornamental. The traders, after examining all circumstances, determine the object of their demand, giving the least quantity possible in return for this superfluity, in order to impress the inhabitants with a high notion of the value of their own commodities; but as this parsimony may do more hurt than good to their interest, they are very generous in making presents, from the principles mentioned above.

When the exchange is completed, and the traders depart, regret is commonly mutual; the one and the other are sorry that the superfluities of the country fall short. A return is promised by the traders, and assurances are given by the natives of a better provision another time.

What are the first consequences of this revolution?

It is evident, that, in order to supply an equivalent for this new want, more hands must be set to work than formerly. And it is evident also, that this augmentation of industry will not essentially increase numbers: Why? Because the produce of the industry is, in this case, intended to be exported. But, if we can find out any additional consumption at home, even implied by this

this new trade, it will have the effect of augmenting numbers. An example will make this plain.

Let us fuppofe the fuperfluity of this country to be the fkins of wild beafts, not proper for food; the manufacture fought for, brandy. The brandy is fold for furs. He who has furs, or he who can fpare time to hunt for them, will drink brandy in proportion: but there is no reafon to conclude from this fimple operation, that one man more in the country muft neceffarily be fed, or that any augmentation of agriculture muft of confequence enfue from this new traffic.

But let us throw in a circumftance which may apply an additional confumption at home, and then examine the confequences.

A poor creature who has no equivalent to offer for food, who is miferable, and ready to perifh for want of fubfiftence, goes a hunting, and kills a wolf; he comes to a farmer with the fkin, and fays. You are well fed, but you have no brandy; if you will give me a loaf, I will give you this fkin, which the ftrangers are fo fond of, and they will give you brandy. But, fays the farmer, I have no more bread than what is fufficient for my own family. As for that, replies the other, I will come and dig in your ground, and you and I will fettle our account as to the fmall quantity I defire of you. The bargain is made; the poor fellow gets his loaf, and lives at leaft; perhaps he marries, and the farmer gets a dram. But had it not been for this dram, that is, this new want, which was purchafed by the induftry of this poor fellow, by what argument could he have induced the farmer to part with a loaf?

Here the fentiment of chartiy is excluded. This alone is a principle of multiplication; but as true it is, on the other hand, that conld the poor fellow have got bread by begging, he would not probably have gone a-hunting.

Here then it appears, that the very dawning of trade, in the moft unpolifhed countries, implies a multiplication. This is enough to point out the firft ftep, and to connect the fubject of our prefent inquiries with what has been already difcuffed in relation to other circumftances.

So foon as all the furs are difpofed of, and a tafte for fuperfluity is introduced, both the traders and the natives will be equally interefted in the advancement of induftry in this country. Many new objects of profit for the firft will be difcovered, which the proper employment of the inhabitants, in reaping the natural advantages of their foil and climate, will make effectual. The traders will therefore endeavour to fet on foot many branches of induftry among the favages, and the allurements of brandy, arms, and clothing, will animate thefe in the purfuit of them.

When once this revolution is brought about; when thofe who formerly lived in fimplicity become induftrious; manners put one a new face.

That is to fay, we now find two trading nations inftead of one, with this difference, however, that as hitherto we have fuppofed the merchants all in one intereft, the compound demand, that is, the competition of the buyers, has been, and muft ftill continue on the fide of the natives. This is a great prejudice to their intereft; but as it is not fuppofed fufficient to check their induftry, nor to reftrain their confumption of the manufactures, let us here examine a little more particularly the confequences of the principle of demand in fuch a fituation; for although we allow, that it can never change fides, yet it may admit of different modifications, and produce different effects, as we fhall prefently perceive.

The merchants we fuppofe all in one intereft, confequently there can be no competition among them; confequently no check can be put upon their raifing their prices, as long as the prices they demand are complied with. So foon as they are raifed to the full extent of the abilities of the natives, or of their inclination to buy, the merchants have the choice of three things, which are all perfectly in their option; and the preference to be given to the one or the other, depends entirely upon themfelves, and upon the circumftances we are going to point out.

Firft, they may fupport they *high* demand; that is, not lower their price; which will preferve a high eftimation of the manufactures in the opinion of the inhabitants, and render the profits upon their trade the greateft poffible. This part they may poffibly take, if they perceive the natives doubling their diligence, in order to become able, in time, to purchafe confiderable cargoes at a high value; from which fuppofition is implied a ftrong difpofition in the people to become luxurious, fince nothing but want of ability prevents them from complying with the higheft demand: but ftill another circumftance muft concur, to engage the merchants not to lower their price. The great proportion of the goods they feek for in return, muft be found in the hands of a few. This will be the cafe if flavery be eftablifhed: for then there muft be many poor and few rich: and they are commonly the rich confumers who proportion the price they offer, rather to their defires, than to the value of the thing.

The fecond thing which may be done is, to open the door to a *great* demand; that is, to lower their prices. This will fink the value of the manufactures in the opinion of the inhabitants, and render profits lefs in proportion, although indeed, upon the voyage, the profits may be greater.

This part they will take, if they perceive the inhabitants do not incline to confume great quantities of the merchandize at a high value, either for want of abilities or inclination; and alfo, if the profits upon the trade depend upon a large confumption, as is the cafe in merchandize of a low value, and fuited chiefly to the occafions of the lower fort. Such motives of expediency will be fufficient to make them neglect a *high* demand, and prefer a *great* one; and the more, when there is a likelihood that the confumption of low-priced goods in the beginning may beget a tafte for others of a higher value, and thus extend in general the tafte of fuperfluity.

A third part to be taken, is the leaft politic, and perhaps the moft familiar. It is to profit by the competition between the buyers, and encourage the rifing of demand as long as poffible; when this comes to a ftop, to make a kind of auction, by firft bringing down the prices

to

to the level of the higheſt bidders, and ſo to deſcend by degrees, in proportion as demand ſinks. Thus we may ſay with propriety, that demand commonly becomes *great*, in proportion as prices ſink. By this operation, the traders will profit as much as poſſible, and ſell off as much of their goods as the profits will permit.

But this plan, in a new diſcovered country, is not politic, as it both diſcovers a covetouſneſs and a want of faith in the merchants, and alſo throws open the ſecrets of their trade to thoſe who ought to be kept ignorant of them.

Let us next ſuppoſe, that the large profits of our merchants ſhall be diſcovered by others, who arrive at the ſame ports in a ſeparate intereſt, and who enter into no combination which might prevent the natural effects of competition.

Let the ſtate of demand among the natives be ſuppoſed the ſame as formerly, both as to *height* and *greatneſs*, in conſequence of the operation of the different principles, which might have induced our merchants to follow one or other of the plans we have been deſcribing; we muſt however ſtill ſuppoſe, that they have been careful to preſerve conſiderable profits upon every branch.

If we ſuppoſe the inhabitants to have increaſed in numbers, wealth, and taſte for ſuperfluity, ſince the laſt voyage, demand will be found rather on the riſing hand. Upon the arrival of the merchants in competition with the former, both will offer to ſale: but if both ſtand to the ſame prices, it is very natural to ſuppoſe, that the former dealers will obtain a preference; as, *cæteris paribus*, it is always an advantage to know and to be known. The laſt comers, therefore, have no other way left to counter-balance this advantage, but to lower their prices.

This is a new phenomenon: here the fall of prices is not voluntary as formerly; nor conſented to from expediency; not owing to a failure of demand, but to the influence of a new principle of commerce, to wit, a double competition, which we ſhall now examine.

Of Double Competition.

When *competition* is much ſtronger on one ſide of the contract than on the other, it is called *ſimple*. This is the ſpecies of competition which is implied in the term *high demand*, or when it is ſaid that *demand raiſes prices*.

Double competition is, when, in a certain degree, it takes place on both ſides of the contract at once, or vibrates alternately from one to the other. This is what reſtrains prices to the adequate value of merchandize.

The great difficulty is to diſtinguiſh clearly between the principles of *demand*, and thoſe of *competition*: here then follows the principal differences between the two, relatively to the effects they produce ſeverally in the mercantile contract of buying and ſelling, which we here expreſs ſhortly by the word *contract*.

Simple demand is what brings the quantity of a commodity to market. Many demand, who do not buy; many offer, who do not ſell. This demand is called *great* or *ſmall*; it is ſaid to *increaſe*, to *augment*, to *ſwell*; and is expreſſed by theſe and other ſynonimous terms, which mark an augmentation or diminution of quantity. In this ſpecies, two people never demand the ſame thing, but a part of the ſame thing, or things quite alike.

Compound demand is the principle which raiſes prices, and never can make them ſink; becauſe in this caſe more than one demands the very ſame thing. It is ſolely applicable to the buyers, in relation to the price they offer. This demand is called ***high*** or ***low***, and is ſaid to *riſe*, to *fall*, to *mount*, to *ſink*, and is expreſſed by theſe and other ſynonimous terms.

Simple competition, when between buyers, is the ſame as *compound* or *high demand*; but differs from it in ſo far, as this may equally take place among ſellers, which *compound demand* cannot; and then it works a contrary effect: it makes prices *ſink*, and is ſynonimous with *low demand*: it is this competition which overturns the balance of work and demand.

Double competition is what is underſtood to take place in almoſt every operation of trade; it is this which prevents their exceſſive riſe of prices; it is this which prevents their exceſſive fall. While *double competition* prevails, the balance is perfect, trade and induſtry flouriſh.

The capital diſtinction, therefore, between the terms *demand* and *competition* is, that *demand* is conſtantly relative to the buyers; and when money is not the price, as in barter, then it is relative to that ſide upon which the greateſt *competition* is found.

We therefore ſay, with regard to *prices*, demand is *high* or *low*. With regard *to the quantity of merchandize*, demand is *great* or *ſmall*. With regard *to competition*, it is always called *great* or *ſmall*, *ſtrong* or *weak*.

Competition is, with equal propriety, applicable to both parties in the contract. A *competition* among buyers is a proper expreſſion; a *competition* among ſellers, who have the merchandize, is fully as eaſily underſtood, tho' it be not quite ſo ſtriking, for reaſons which an example will make plain.

You come to a fair, where you find a great variety of every kind of merchandize, in the poſſeſſion of different merchants. Theſe, by offering their goods to ſale, conſtitute a tacit competition; every one of them wiſhes to ſell in preference to another, and at the ſame time with the beſt advantage to himſelf.

The buyers begin, by cheapning at every ſhop. The firſt price aſked marks the covetouſneſs of the ſeller; the firſt price offered, the avarice of the buyer. From this operation competition begins to work its effects on both ſides, and ſo becomes double. The principles which influence this operation are now to be deduced.

It is impoſſible to ſuppoſe the ſame degree of eagerneſs, either to buy or to ſell, among ſeveral merchants; becauſe the degree of eagerneſs is exactly in proportion to their view of profit; and as theſe muſt neceſſarily be influenced and regulated by different circumſtances, that buyer, who has the beſt proſpect of ſelling again with profit, obliges him, whoſe proſpect is not ſo good, to content himſelf with leſs; and that ſeller, who has bought to the beſt advantage, obliges him, who has paid dearer

dearer for the merchandize, to moderate his desire of gain.

It is from these principles, that competition among buyers and sellers must take place. This is what confines the fluctuation of prices within limits which are compatible with the reasonable profits of both buyers and sellers; for we must constantly suppose the whole operation of buying and selling to be performed by merchants; the buyer cannot be supposed to give so high a price as that which he expects to receive, when he distributes to the consumers, nor can the seller be supposed to accept of a lower than that which he paid to the manufacturer. This competition is properly called double, because of the difficulty to determine upon which side it stands; the same merchant may have it in his favour upon certain articles, and against him upon others; it is continually in vibration, and the arrival of every post may less or more pull down the heavy scale.

In every transaction between merchants, the profit resulting from the sale must be exactly distinguished from the value of the merchandize. The first *may* vary, the last never *can*. It is this profit alone which can be influenced by competition; and it is for that reason we find such uniformity every where in the prices of goods of the same quality.

The competition between sellers does not appear so striking, as that between buyers; because he who offers to sale, appears only passive in the first operation; whereas the buyers present themselves one after another; they make a demand when the merchandize is refused to one at a certain price, a second either offers more, or does not offer all: but so soon as another seller finds his account in accepting the price the first had refused, then the first enters into competition, providing his profits will admit his lowering the first price, and thus competition takes place among the sellers, until the profits upon their trade prevent prices from falling lower.

In all markets this competition is varying, though insensibly, on many occasions; but in others, the vibrations are very perceptible. Sometimes it is found strongest on the side of the buyers; and in proportion as this grows, the competition between the sellers diminishes. When the competition between the former has raised prices to a certain standard, it comes to a stop; then the competition changes sides, and takes place among the sellers, eager to profit of the highest price. This makes prices fall, and according as they fall, the competition among the buyers diminishes. They still wait for the lowest period. At last it comes; and then perhaps some new circumstance, by giving the balance a kick, disappoints their hopes. If therefore it ever happens, that there is but one interest upon one side of the contract, as in the example in the former section, where we supposed the sellers united, you perceive, that the rise of the price, occasioned by the competition of the buyers, and even its coming to a stop, could not possibly have the effect of producing any competition on the other side; and therefore, if prices come afterwards to sink, the fall must have proceeded from the prudential considerations of adapting the price to the faculties of those who, from the height of it, had withdrawn their demand.

From these principles of competition, the forestalling of markets is made a crime, because it diminishes the competition which ought to take place between different people, who have the same merchandize to offer to sale. The forestaller buys all up, with an intention to sell with more profit, as he has by that means taken other competitors out of the way, and appears with a single interest on one side of the contract, in the face of many competitors on the other. This person is punished by the state, because he has prevented the price of the merchandice from becoming justly proportioned to the real value; he has robbed the public, and enriched himself; and in the punishment he makes restitution. Here occur two questions to be resolved, for the sake of illustration.

Can competition among buyers possibly take place, when the provision made is more than sufficient to supply the quantity demanded? On the other hand, can competition take place among the sellers, when the quantity demanded exceeds the total provision made for it?

We think it may in both cases; because in the one and the other, there is a competition implied on one side of the contract, and the very nature of this competition implies a possibility of its coming on the other, provided separate interests be found upon both sides. But to be more particular:

1. Experience shews, that however justly the proportion between the demand and the supply may be determined in fact, it is still next to impossible to discover it exactly, and therefore the buyers can only regulate the prices they offer, by what they may reasonably expect to sell for again. The sellers, on the other hand, can only regulate the prices they expect, by what the merchandize has cost them when brought to market. We have already shewn, how, under such circumstances, the several interests of individuals affect each other, and make the balance vibrate.

2. The proportion between the supply and the demand is seldom other than *relative* among merchants, who are supposed to buy and sell, not from necessity, but from a view to profit. What we mean by *relative* is, that their demand is *great* or *small*, according to prices; there may be a great demand for grain at 35 s. *per* quarter, and no demand at all for it at 40 s.; that is, among merchants.

It is essential to attend to the smallest circumstance in matters of this kind. The circumstance we mean, is the difference we find in the effect of competition, when it takes place purely among merchants on both sides of the contract, and when it happens, that either the consumers mingle themselves with the merchant buyers, or the manufacturers, that is, the furnishers, mingle themselves with the merchant-sellers. This combination we shall illustrate, by the solution of another question, and then conclude with a few reflections upon the whole.

Can there be no case formed, where the competition upon one side may subsist, without a possibility of its taking

king place on the other, although there ſhould be ſeparate intereſts upon both ?

The caſe is hardly ſuppoſable among merchants, who buy and ſell with a view to profit; but it is abſolutely ſuppoſable, and that is all, when the direct conſumers are the buyers; when the circumſtances of one of the parties is perfectly known; and when the competition is ſo ſtrong upon one ſide, as to prevent a poſſibility of its becoming double, before the whole proviſion is ſold off, or the demand ſatisfied. Let us have recourſe to examples.

Grain arriving in a ſmall quantity, at a port where the inhabitants are ſtarving, produces ſo great a competition among the conſumers, who are the buyers, that their neceſſity becomes evident; all the grain is generally bought up before prices can riſe ſo high as to come to a ſtop; becauſe nothing but want of money, that is, an impoſſibilily of complying with the prices demanded by the merchants, can reſtrain them: but if you ſuppoſe, even here, that prices come naturally to a ſtop; or that, after ſome time, they fall lower, from prudential conſiderations; then there is a poſſibility of a competition taking place among the ſellers, from the principles above deduced. If, on the contrary, the ſtop is not natural, but occaſioned by the interpoſition of the magiſtrate, from humanity, or the like, there will be no competition, becauſe then the principles of commerce are ſuſpended; the ſellers are reſtrained on one ſide, and they reſtrain the buyers on the other. Or rather, indeed, it is the magiſtrate, or compaſſion, who in a manner fixes the price, and performs the office of both buyer and ſeller.

A better example ſtill may be found, in a competition among ſellers; where it may be ſo ſtrong, as to render a commodity in a manner of no value at all, as in the caſe of an uncommon and unexpected draught of fiſh, in a place of ſmall conſumption, when no preparations have been made for ſalting them. There can be then no competition among the buyers; becauſe the market cannot laſt, and they find themſelves entirely maſters, to give what price they pleaſe, being ſure the ſellers muſt accept of it, or loſe their merchandize. In the firſt example, humanity commonly ſtops the activity of the principle of competition; in the other it is ſtopt by a certain degree of fair-dealing, which forbids the accepting of a merchandize for nothing.

In proportion therefore as the riſing of prices can ſtop demand, or the ſinking of prices can increaſe it, in the ſame proportion will competition prevent either the riſe or the fall from being carried beyond a certain length: and if ſuch a caſe can be put, where the riſing of prices cannot ſtop demand, nor the lowering of prices augment it, in ſuch caſes double competition has no effect; becauſe theſe circumſtances unite the moſt ſeparate intereſts of buyers and ſellers in the mercantile contract; and when upon one ſide there is no ſeparate intereſt, there can then be no competition.

From what has been ſaid, we may form a judgment of the various degrees of competition. A book not worth a ſhilling, a fiſh of a few pounds weight, are often ſold for conſiderable ſums. The buyers here are not merchants. When an ambaſſador leaves a court in a hurry, things are ſold for leſs than the half of their value: he is no merchant, and his ſituation is known. When, at a public market, there are found conſumers, who make their proviſion; or manufacturers, who diſpoſe of their goods for preſent ſubſiſtence; the merchants, who are reſpectively upon the oppoſite ſide of the contract to theſe, profit of their competition; and thoſe who are reſpectively upon the ſame ſide with them, ſtand by with patience, until they have finiſhed their buſineſs. Then matters come to be carried on between merchant and merchant, and then profits may riſe and fall, in the proportion of quantity to demand; that is to ſay, if the proviſion is leſs than the demand, the competition among the demanders, or the riſe of the price, will be in the compound proportion of the falling ſhort of the commodity, and of the proſpect of ſelling again with profit. It is this combination which regulates the competition, and keeps it within bounds. It can affect but the profits upon the tranſaction; the intrinſic value of the commodity ſtands immoveable: nothing is ever ſold below the real value; nothing is ever bought for more than it may probably bring. We mean in general. Whereas, ſo ſoon as conſumers and needy manufacturers mingle in the operation, all proportion is loſt. The competition between them is too ſtrong for the merchants; the balance vibrates by jerks. In ſuch markets merchants ſeldom appear: the principal objects there, are the fruits and productions of the earth, and articles of the firſt neceſſity for life, not manufactures ſtrictly ſo called. A poor fellow often ſells, to purchaſe bread to eat; not to pay what he did eat while he was employed in the work he diſpoſes of. The conſumer often meaſures the value of what he is about to purchaſe, by the weight of his purſe, and his deſire to conſume.

Of what is called Expence, Profit, and Loſs.

The term *expence*, when ſimply expreſſed, without any particular relation, is always underſtood to be relative to money. This kind is diſtinguiſhed under the three heads of *private*, *public*, and *national*.

1. *Private* expence is, what a private perſon, or private ſociety, lays out, either to provide articles of conſumption, or ſomething more permanent, which may be conducive to their eaſe, convenience, or advantage. Thus we ſay, *a large domeſtic expence*, relative to one who ſpends a great income. We ſay, a merchant has been at *great expence* for magazines, for living, for clerks, &c. but never that he has been at any in buying goods. In the ſame way a manufacturer may expend for building, machines, horſes, and carriages, but never for the matter he manufactures. When a thing is bought, in order to be ſold again, the ſum employed is called money *advanced*; when it is bought not to be ſold, it may be ſaid to be *expended*.

2. *Public expence* is, the employment of that money, which has been contributed by individuals, for the current ſervice of the ſtate. The contribution, or gathering it together, repreſents the effects of many articles of *private expence*; the laying it out when collected, is *public expence*.

3. *National*

3. *National expence*, is what is expended out of the country: this is what diminiſhes national wealth. The principal diſtinction to be here attended to, is between *public expence*, or the laying out of public money, and *national expence*, which is the alienating the nation's wealth in favour of ſtrangers. Thus the greateſt *public expence* imaginable, may be no national expence; becauſe the money may remain at home. On the other hand, the ſmalleſt *public*, or even *private expence*, may be a national expence; becauſe the money may go abroad.

Profit and *loſs* is divided into *poſitive*, *relative*, and *compound*. *Poſitive profit*, implies no loſs to any body; it reſults from an augmentation of labour, induſtry, or ingenuity, and has the effect of ſwelling or augmenting the public good.

Poſitive loſs, implies no profit to any body; it is what reſults from the ceſſation of the former, or of the effects reſulting from it, and may be ſaid to diminiſh the public good.

Relative profit, is what implies a loſs to ſome body; it marks a vibration of the balance of wealth between parties, but implies no addition to the general ſtock.

Relative loſs, is what, on the contrary, implies a profit to ſome body; it alſo marks a vibration of the balance, but takes nothing from the general ſtock.

The *compound* is eaſily underſtood; it is that ſpecies of profit and loſs which is partly *relative*, and partly *poſitive*.

The general Conſequences reſulting to a trading Nation, upon the opening of an active foreign Commerce.

A NATION which remains paſſive in her commerce, is at the mercy of thoſe who are active, and muſt be greatly favoured, indeed, by natural advantages, or by a conſtant flux of gold and ſilver from her mines, to be able to ſupport a correſpondence, not entirely hurtful to the augmentation of her wealth.

When we look upon the wide field which here opens to our view, we are perplexed with too great a variety of objects. In one part, we ſee a decent and comely beginning of induſtry; wealth flowing gently in, to recompence ingenuity; numbers both augmenting, and every one becoming daily more uſeful to another; agriculture proportionally extending itſelf; no violent revolutions; no exorbitant profits; no inſolence among the rich; no exceſſive miſery among the poor; multitudes employed in producing; great oeconomy upon conſumption; and all the inſtruments of luxury, daily produced by the hands of the diligent, going out of the country for the ſervice of ſtrangers; not remaining at home for the gratification of ſenſuality. At laſt the augmentations come inſenſibly to a ſtop. Then theſe rivers of wealth, which were in briſk circulation through the whole world, and which returned to this trading nation as blood returns to the heart, only to be thrown out again by new pulſations, begin to be obſtructed in their courſe; and flowing abroad more ſlowly than before, come to form ſtagnations at home. Theſe, impatient of reſtraint, ſoon burſt out into domeſtic circulation. Upon this cities ſwell in magnificence of buildings; the face of the country is adorned with palaces, and becomes covered with groves; luxury ſhines triumphant in every part; inequality becomes more ſtriking to the eye; and want and miſery appear more deformed, from the contraſt: even fortune grows more whimſical in her inconſtancy; the beggar of the other day, now rides in his coach; and he who was born in a bed of ſtate, is ſeen to die in a goal, or in an almshouſe. Such are the effects of great domeſtic circulation.

The ſtateſman looks about with amazement; he, who was wont to conſider himſelf as the firſt man in the ſociety in every reſpect, perceives himſelf, perhaps, eclipſed by the luſtre of private wealth, which avoids his graſp when he attempts to ſeize it. This makes his government more complex and more difficult to be carried on; he muſt now avail himſelf of art and addreſs, as well as of power and force. By the help of cajoling and intrigues, he gets a little into debt; this lays a foundation for public credit, which, growing by degrees, and in its progreſs aſſuming many new forms, becomes, from the moſt tender beginnings, a moſt formidable monſter, ſtriking terror into thoſe who cheriſhed it in its infancy. Upon this, as upon a triumphant war-horſe, the ſtateſman gets a-ſtride; he then appears formidable a-new; his head turns giddy; he is choaked with the duſt he has raiſed; and at the moment he is ready to fall, to his utter aſtoniſhment and ſurprize, he finds a ſtrong monied intereſt, of his own creating, which, inſtead of ſwallowing him up as he apprehended, flies to his ſupport. Through this he gets the better of all oppoſition, he eſtabliſhes taxes, multiplies them, mortgages his fund of ſubſiſtence; either becomes a bankrupt, and riſes again from his aſhes; or if he be leſs audacious, he ſtands trembling and tottering for a while on the brink of the political precipice. From one or the other of theſe perilous ſituations, he begins to diſcover an endleſs path, which, after a multitude of windings, ſtill returns into itſelf, and continues an equal courſe through this vaſt labyrinth.

It is now full time to leave off rhapſody, and return to reaſoning and cool inquiry, concerning the more immediate and more general effects and revolutions produced by the opening of a foreign trade in a nation of induſtry.

The firſt and moſt ſenſible alteration will be an increaſe of demand for manufacturers, becauſe by ſupplying the wants of ſtrangers, the number of conſumers will now be conſiderably augmented. What again will follow upon this, muſt depend upon circumſtances.

If this revolution in the ſtate of demand ſhould prove too violent, the conſequence of it will be to *raiſe* demand; if it ſhould prove gradual, it will *increaſe* it. This diſtinction is well underſtood, and the conſequence appears juſt: for, if the ſupply do not increaſe in proportion to the demand, a competition will enſue among the demanders; which is the common effect of ſuch ſudden revolutions. If, on the other hand, a gentle increaſe of demand ſhould be accompanied with a proportional ſupply, the whole induſtrious ſociety will grow in vigour, and in wholſome ſtature, without being ſenſible

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of any great advantage or inconveniency; the change of their circumſtances will even be imperceptible.

The immediate effects of the violent revolution will, in this example, be flattering to ſome, and diſagreeable to others. Wealth will be found daily to augment, from the riſing of prices, in many branches of induſtry. This will encourage the induſtrious claſſes, and the idle conſumers at home will complain. We have already dwelt abundantly long upon the effects reſulting from this to the lower claſſes of the people, in providing them with a certain means of ſubſiſtence. Let us now examine in what reſpect even the higher claſſes will be made likewiſe to feel the good effects of this general change, although at firſt they may ſuffer a temporary inconveniency from it.

Farmers, as has been obſerved, will have a greater difficulty in finding ſervants, who, inſtead of labouring the ground, will chuſe to turn themſelves to manufactures. This we have conſidered in the light of purging the lands of ſuperfluous mouths; but every conſequence in this great chain of politics draws other conſequences after it, and as they follow one another, things put on different faces, which affect claſſes differently. The purging of the land is but one of the firſt; here follows another.

The deſertion of the lands employed in a trifling agriculture will at firſt, no doubt, embarraſs the farmers; but in a little time every thing becomes balanced in a trading nation, becauſe *here* every *induſtrious* man muſt advance in proſperity, in ſpite of all general combinations of circumſtances.

In the caſe before us, the relative profits upon farming muſt ſoon become greater than formerly, becauſe of this additional expence which muſt affect the whole claſs of farmers; conſequently, this additional expence, inſtead of turning out to be a loſs to either landlord or farmer, will, after ſome little time, turn out to the advantage of both: becauſe the produce of the ground, being indiſpenſably neceſſary to every body, muſt in every article increaſe in its value. Thus in a ſhort time accounts will be nearly balanced on all hands; that is to ſay, the ſame proportion of wealth will, *cæteris paribus*, continue the ſame among the induſtrious. We ſay among the induſtrious; for thoſe who are either idle, or even negligent, will be great loſers.

A proprietor of land, inattentive to the cauſes of his farmer's additional expence, may very imprudently ſuffer his rents to fall, inſtead of aſſiſting him on a proper occaſion, in order to make them afterwards riſe the higher.

Thoſe who live upon a determined income in money, and who are nowiſe employed in traffic, nor in any ſcheme of induſtry, will, by the augmentation of prices, be found in worſe circumſtances than before.

In a trading nation every man muſt turn his talents to account, or he will undoubtedly be left behind in this univerſal emulation, in which the moſt induſtrious, the moſt ingenious, and the moſt frugal will conſtantly carry off the prize.

This conſideration ought to be a ſpur to every body. The richeſt men in a trading nation have no ſecurity againſt poverty; we mean proportional poverty; for though they diminiſh nothing of their income, yet, by not increaſing it in proportion to others, they loſe their rank in wealth, and from the firſt claſs in which they ſtood they will ſlide inſenſibly down to a lower.

There is one conſequence of an additional beneficial trade, which raiſes demand and increaſes wealth; but if we ſuppoſe no proportional augmentation of ſupply, it will prove at beſt but an airy dream which laſts for a moment, and when the gilded ſcene is paſſed away, numberleſs are the inconveniencies which are ſeen to follow.

We ſhall now point out the natural conſequences of this augmentation of wealth drawn from foreign nations, when the ſtateſman remains inattentive to increaſe the ſupply both of food and manufactures, in proportion to the augmentation of mouths, and of the demand for the produce of induſtry.

In ſuch a ſituation profits will daily ſwell, and every ſcheme for reducing them within the bounds of moderation, will be looked upon as a hurtful and unpopular meaſure: be it ſo; but let us examine the conſequences.

We have ſaid, that the riſe of demand for manufactures naturally increaſes the value of work: now we muſt add, that under ſuch circumſtances, the augmentation of riches, *in a country, either not capable of improvement as to the ſoil, or where precautions have not been taken for facilitating a multiplication of inhabitants, by the importation of ſubſiſtence*, will be productive of the moſt calamitous conſequences.

On one ſide, this wealth will effectually diminiſh the maſs of the food before produced; and on the other, will increaſe the number of uſeleſs conſumers. The firſt of theſe circumſtances will raiſe the demand for food; and the ſecond will diminiſh the number of uſeful free hands, and conſequently raiſe the price of manufactures: here are ſhortly the outlines of this progreſs.

The more rich and luxurious a people are, the more delicate they become in their manner of living; if they fed on bread formerly, they will now feed on meat; if they fed on meat, they will now feed on fowl. The ſame ground which feeds a hundred with bread, and a proportional quantity of animal food, will not maintain an equal number of delicate livers. Food muſt then become more ſcarce; demand for it riſes; the rich are always the ſtrongeſt in the market; they conſume the food, and the poor are forced to ſtarve. Here the wide door to modern diſtreſs opens; to wit, a hurtful competition for ſubſiſtence. Farther, when a people become rich, they think leſs of œconomy; a number of uſeleſs ſervants are hired, to become an additional dead weight on conſumption; and when their ſtarving countrymen cannot ſupply the extravagance of the rich ſo cheaply as other nations, they either import inſtruments of foreign luxury, or ſeek to enjoy them out of their own country, and thereby make reſtitution of their gains.

Is it not therefore evident, that if, before things come to this paſs, additional ſubſiſtence be not provided by one method or other, the number of inhabitants muſt diminiſh; although riches may daily increaſe by a balance of additional matter, ſuppoſed to be brought into the country

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in consequence of the hitherto beneficial foreign trade. This is not all. We say farther, that the beneficial trade will last for a time only. For the infallible consequence of the rise of prices at home will be, that those nations which at first consumed your manufactures, perceiving the gradual increase of their price, will begin to work for themselves; or finding out your rivals who can supply them cheaper, will open their doors to them. These again, perceiving the great advantages gained by your traders, will begin to supply the market; and since every thing must be cheaper in countries where we do not suppose the concurrence of all the circumstances mentioned above, these nations will supplant you, and be enriched in their turn.

Here comes a new revolution. Trade is come to a stop: what then becomes of all the hands which were formerly employed in supplying the foreign demands?

Were revolutions so sudden as we are obliged to represent them, all would go to wreck; in proportion as they happen by quicker or slower degrees, the inconveniencies are greater or smaller.

Prices, we have said, are made to rise by competition. If the competition of the strangers was what raised them, the distress upon the manufacturers will be in proportion to the suddenness of their deserting the market. If the competition was divided between the strangers and the home-consumers, the inconveniencies which ensue will be less; because the desertion of the strangers will be in some measure made up by an increase of home-consumption which will follow upon the fall of prices. And if, in the third case, the natives have been so imprudent, as not only to support a competition with the strangers, and thereby disgust them from coming any more to market, but even to continue the competition between themselves, the whole *loss* sustained by the revolution will be national. Wealth will cease to augment; but the inconveniencies, in place of being felt by the manufacturers, will only affect the state; those will continue in affluence, extolling the generosity of their countrymen, and despising the poverty of the strangers who had enriched them.

Domestic luxury will here prove an expedient for preserving from ruin the industrious part of a people, who in subsisting themselves had enriched their country. No change will follow in their condition; they will go on with a painful assiduity to labour, and if the consequences of it become now hurtful to one part of the state, they must at least be allowed to be essentially necessary for the support of the other.

But that luxury is no necessary concomitant of foreign trade, in a nation where the true principles of it are understood, will appear very plain, from a contrast we are now going to point out, in the example of a modern state, renowned for its commerce and frugality. The country is Holland.

A set of industrious and frugal people were assembled in a country by nature subject to many inconveniencies, the moving of which necessarily employed abundance of hands. Their situation upon the continent, the power of their former masters, and the ambition of their neighbours, obliged them to keep great bodies of troops. These two articles added to the numbers of the community, without either enriching the state by their labour exported, or producing food for themselves or countrymen.

The scheme of a commonwealth was calculated to draw together the industrious; but it has been still more useful in subsisting them: the republican form of government being there greatly subdivided, vests authority sufficient in every part of it, to make suitable provision for their own subsistence; and the tie which unites them, regards only matters of public concern. Had the whole been governed by one sovereign, or by one council, this important matter never could have been effectuated.

It would be impossible for the most able minister that ever lived, to provide nourishment for a country so extended as France, or even as England, supposing these as fully peopled as Holland is: even although it should be admitted that a sufficient quantity of food might be found in other countries for their subsistence. The enterprise would be too great, abuses would multiply; the consequence would be, that the inhabitants would die for want. But in Holland the case is different, every little town takes care of its own inhabitants; and this care being the object of application and profit to so many persons, is accomplished with success.

When once it is laid down as a maxim in a country, that food must of necessity be got from abroad in order to feed the inhabitants at home, the corn-trade becomes considerable, and at the same time certain, regular, and permanent. This was the case in Holland: as the inhabitants were industrious, the necessary consequence has been, a very extraordinary multiplication; and at the same time such an abundance of grain, that, instead of being in want themselves, they often supply their neighbours. There are many examples of England's being supplied with grain from thence, and, which is still more extraordinary, from the re-exportation of the very produce of its own fruitful soil.

It is therefore evident, that the only way to support industry, is to provide a supply of subsistence, constantly proportional to the demand that may be made for it. This is a precaution indispensably necessary for preventing hurtful competition. This is the particular care of the Dutch: so long as it can be effectual, their state can fear no decline; but whenever they come to be distressed in the markets, upon which they depend for subsistence, they will sink into ruin. It is by mere dint of frugality, cheap and parsimonious living, that the navigation of this industrious people is supported. Constant employment, and an accumulation of almost imperceptible gains, fills their coffers with wealth, in spite of the large outgoings to which their own proper nourishment yearly forces them. The large profits upon industry in other countries, which are no proof of generosity, but a fatal effect of a scanty subsistence, is far from dazzling their eyes. They seldom are found in the list of competitors at any foreign port; if they have their cargo to dispose of, they wait with pleasure in their own vessels, consuming their own provisions, and at last accept of what others have left. It may be said, that many other circumstances concur in favour of the Dutch, besides the article of subsistence.

 With-

Without disputing this matter, it may be observed, that if a computation be made of the hands employed in providing subsistence, and of those who are severally taken up in supplying every other want, their numbers will be found nearly to balance one another in the most luxurious countries. From this we may conclude, that the article of food, among the lower classes, must bear a very high proportion to all the other articles of their consumption; and therefore a diminution upon the price of subsistence, must be of infinite consequence to manufacturers, who are obliged to buy it. From this consideration, let us judge of the consequence of such augmentations upon the price of grain as are familiar to us; 30 or 40 *per cent.* seems nothing. Now this augmentation operates upon two thirds, at least, of the whole expence of a labouring man: let any one who lives in tolerable affluence make the application of this to himself, and examine how he would manage his affairs if, by accidents of rains or winds, his expences were to rise 30 *per cent.* without a possibility of restraining them; for this is unfortunately the case with all the lower classes. From whence it may be concluded, that the keeping food cheap, and still more the preserving it at all times at an equal standard, is the fountain of the wealth of Holland; and that any hurtful competition in this article must beget a disorder which will affect the whole of the manufacturers of a state.

COMMINATORY, an appellation given to whatever threatens punishment, or some penalty.

COMMINUTION, denotes the breaking, or rather grinding, a body to very small particles.

COMMISSARY, in the ecclesiastical law, an officer of the bishop, who exercises spiritual jurisdiction in places of a diocese so far from the episcopal see, that the chancellor cannot call the people to the bishop's principal consistory court, without giving them too much inconveniency.

COMMISSARY-*court*, in Scots law, a court originally constituted by the bishops for executing in their name an usurped jurisdiction, and was anciently called the *bishops court*, *curia Christianitatis*, or *consistorial court*. This court was new-modelled by Queen Mary at the Reformation, and continues till this day. See SCOTS LAW, title, *Ecclesiastical persons*.

COMMISSARY, in a military sense, is of three sorts.

COMMISSARY-*general of the musters*, an officer appointed to muster the army, as often as the general thinks proper, in order to know the strength of each regiment and company, to receive and inspect the muster-rolls, and to keep an exact state of the strength of the army.

COMMISSARY-*general of stores*, an officer in the artillery, who has the charge of all the stores, for which he is accountable to the office of ordnance.

COMMISSARY-*general of provisions*, an officer who has the inspection of the bread and provisions of the army.

COMMISSION, in common-law, the warrant or letters patent which all persons exercising jurisdiction have to empower them to hear or determine any cause or suit: as, the commission of the judges, &c.

COMMISSION *of bankruptcy*, is the commission that issues from the lord chancellor, on a person's becoming a bankrupt within any of the statutes, directed to certain commissioners appointed to examine into it, and to secure the bankrupt's lands and effects for the satisfaction of his creditors.

COMMISSION *of lunacy* issues out of the court of chancery, to inquire whether a person represented to be a lunatic be so or not.

COMMISSION, in commerce. See FACTORAGE.

COMMISSIONER, a person authorised by commission, letters-patent, or other lawful warrant, to examine any matters, or execute any public office, &c.

Besides those relating to judicial proceedings, there are

COMMISSIONERS *of the customs*. See CUSTOMS.

COMMISSIONERS *of excise*. See EXCISE.

COMMISSIONERS *of the navy*. See NAVY.

Lords COMMISSIONERS *of the treasury*. See TREASURY and EXCHEQUER.

COMMITTEE, one or more persons, to whom the consideration or ordering of a matter is referred, either by some court, or by the consent of parties, to whom it belongs.

COMMITTEE *of parliament*, a certain number of members appointed by the house, for the examination of a bill, making a report of an inquiry, process of the house, &c.

When a parliament is called, and the speaker and members have taken the oaths, there are committees appointed to sit on certain days, *viz.* the committee of privileges and elections, of religion, of trade, &c. which are standing committees.

Sometimes the whole house resolves itself into a committee; on which occasion each person has a right to speak and reply as often as he pleases, which is not the case when a house is not in a committee.

COMMIXTION, in Scots law, is a method of acquiring property, by mixing or blending together different substances belonging to different proprietors. If this commixtion was made without the consent of the different proprietors, and the materials cannot again be disjoined, it draws after it the property of the materials. See SCOTS LAW, title, *Division of rights*.

COMMODATE, in Scots law, is a gratuitous loan, wherein the property of the thing but continues with the lender, and only the use of it given to the borrower, who must restore the individual thing borrowed. See SCOTS LAW, title, *Obligations and contracts in general*.

COMMODITY, in a general sense, denotes all sorts of wares and merchandizes whatsoever that a person deals or trades in.

Staple COMMODITIES, such wares and merchandizes as are

are commonly and readily ſold in a market, or exported abroad: being, for the moſt part, the proper produce or manufacture of the country.

COMMODORE, in maritime affairs, an officer of the Britiſh navy, commiſſioned by the lords of the admiralty, or by an admiral, to command a ſquadron of men of war in chief.

COMMON, ſomething that belongs to all alike, in contradiſtinction to proper, peculiar, *&c.*

Common council. Council.

Common law, that body of rules received as law in England, before any ſtatute was enacted in parliament to alter the ſame. See Law.

Common-place book, is a regiſter of what things occur, worthy to be noted, in the courſe of a man's thinking or ſtudy, ſo diſpoſed, as that, among a number of ſubjects, any one may be eaſily found. The advantages of making a common-place book are many: it not only makes a man read with accuracy and attention, but induces him inſenſibly to think for himſelf, provided he conſiders it not ſo much as a regiſter of ſentiments that ſtrike him in the courſe of reading, but as a regiſter of his own thoughts upon various ſubjects. Many valuable thoughts occur even to men of no extraordinary genius. Theſe, without the aſſiſtance of a common place-book, are generally loſt both to himſelf and others. There are various methods of arranging common-place books; that of Mr Locke is as good as any that have hitherto been contrived.

The firſt page of the book you intend to take down their *common-place* in, is to ſerve as a kind of index to the whole; and to contain references to every place or matter therein: in the commodious contrivance of which index, ſo as it may admit of a ſufficient copia or variety of materials, without any confuſion, all the ſecret of the method conſiſts.

In order to this, the firſt page, as already mentioned, or, for more room, the two firſt pages that front each other, are to be divided, by parallel lines, into 25 equal parts; whereof, every fifth line to be diſtinguiſhed, by its colour or other circumſtance. Theſe lines are to be cut perpendicularly by others, drawn from top to bottom; and in the ſeveral ſpaces thereof, the ſeveral letters of the alphabet, both capital and minuſcule, are to be duly wrote.

The form of the lines and diviſions, both horizontal and perpendicular, with the manner of writing the letters therein, will be conceived from the following ſpecimen; wherein, what is to be done in the book for all the letters of the alphabet, is here ſhewn in the firſt four, *A*, *B*, *C*, and *D*.

	a			*a*	
	e			*e*	
A	*i*		*C*	*i*	
	o			*o*	
	u			*u*	
	a			*a*	
	e	2.3		*e*	
B	*i*		*D*	*i*	
	o			*o*	
	u			*u*	

The index of the *common-place* book thus formed, matters are ready for the taking down any thing therein.

In order to this, conſider to what head the thing you would enter is moſt naturally referred; and under which one would be led to look for ſuch a thing: in this head, or word, regard is had to the initial letter, and the firſt vowel that follows it; which are the characteriſtic letters whereon all the uſe of the index depends.

Suppoſe, (*e. gr.*) I would enter down a paſſage that refers to the head *Beauty*; *B*, I conſider, is the initial letter, and *e* the firſt vowel: then, looking upon the index for the partition *B*, and therein the line *e*, (which is the place for all words whoſe firſt letter is *B*, and firſt vowel *e*; as *Beauty*, *Beneficence*, *Bread*, *Breeding*, *Blemiſhes*,) and finding no numbers already down to direct me to any page of the the book where words of this characteriſtic have been entered, I turn forward to the firſt blank page I find, which, in a freſh book, as this is ſuppoſed to be, will be page 2, and here write what I have occaſion for on the head *Beauty*; beginning the head in the margin, and indenting all the other ſubſervient lines, that the head may ſtand out and ſhew itſelf: this done, I enter the page where it is wrote, *viz.* 2, in the index, in the ſpace, *B e*; from which time, the claſs *B e* becomes wholly in poſſeſſion of the 2d and 3d pages, which are conſigned to letters of this characteriſtic.

Had I found any page or number already entered in the ſpace *B e*, I muſt have turned to the page, and have wrote my matter in what room was left therein: ſo, if after entering the paſſage on beauty, I ſhould have occaſion for *benevolence*, or the like, finding the number 2 already poſſeſſed of the ſpace of this characteriſtic, I begin the paſſage on benevolence in the remainder of the page, which not containing the whole, I carry it on to page 3, which is alſo for *B e*; and add the number 3 in the index.

Common pleas is one of the king's courts now held conſtantly

constantly in Weftminfter hall, but in former times was moveable.

All civil caufes, as well real as perfonal, are, or, were formerly, tried in this court, according to the ftrict law of the land. In perfonal and mixed actions it has a concurrent jurifdiction with the king's bench, but has no cognizance of pleas of the crown. The actions belonging to the court of common pleas come thither by original, as arrefts and outlawries; or by privilege, or attachment for or againft privileged perfons; or out of inferior courts, not of record, by *pone, recordari, accedas ad curiam*, writ of falfe judgment, *&c*. The chief judge of this court is called lord chief juftice of the common pleas, who is affifted by three other judges: the other officers of the court are the *cuftos brevium*, who is the chief clerk; three prothonotaries, and their fecondaries; the clerk of the warrants, clerk of the effoins, fourteen filazers, four exigentors, a clerk of the juries, the chirographer, the clerk of the king's filver, clerk of the treafury, clerk of the feal, clerk of the outlawries, clerk of the inrolment of fines and recoveries, and clerk of the errors.

COMMON, in law, that foil, the ufe of which is common to this or that town or lordfhip. There is common of pafture for cattle, and alfo common of fifhing, common of eftovers, common of turbary, *&c*.

COMMON PRAYER is the liturgy in the church of England. Clergymen are to ufe the public form of prayers prefcribed by the Book of Common Prayer; and refufing to do fo, or ufing any other public prayers, are punifhable by 1 Eliz. c. ii.

COMMON, in grammar, denotes the gender of nouns, which are equally applicable to both fexes: thus *parens*, a parent, is of the common gender.

COMMON, in geometry, is applied to an angle, line, or the like, which belongs equally to two figures.

COMMON DIVISOR, a quantity or number which exactly divides two or more other quantities or numbers, without leaving any remainder.

COMMONER, or GENTLEMAN COMMONER, in the univerfities, a ftudent entered in a certain rank.

COMMONS, or HOUSE OF COMMONS a denomination given to the lower houfe of parliament. See PARLIAMENT.

COMMONS, or COMMONALTY, likewife fignifies the whole body of the people under the degree of a baron, whether knights, gentlemen, burgeffes, yeomen, *&c*.

Doctors COMMONS, See COLLEGE *of civilians*.

Proctor of the COMMONS. See PROCTOR.

COMMONTY, in Scots law, fometimes fignifies lands belonging to two or more common proprietors; fometimes a heath or muir though it fhould belong in property to one, if there has been a promifcuous poffeffion upon it by pafturage; and the act 1695 mentions *commonties* belonging in property to the king and to royal borroughs. See title, *Obligations arifing from confent*.

COMMONWEALTH. See REPUBLIC.

COMMUNICATION, in a general fenfe, the act of imparting fomething to another.

COMMUNICATION is alfo ufed for the connection of one thing with another, or the paffage from one place to another: thus a gallery is a communication between two apartments.

COMMUNICATION *of idioms*, in theology, the act of imparting the attributes of one of the natures in Jefus Chrift to the other.

COMMUNICATION *of motion*, the act whereby a body at reft is put into motion by a moving body; or, it is the acceleration of motion in a body already moving. See MECHANICS,

Lines of COMMUNICATION, in military matters, trenches made to continue and preferve a fafe correfpondence between two forts or pofts; or at a fiege, between two approaches, that they may relieve one another.

COMMUNION, in matters of religion, the being united in doctrine and difcipline; in which fenfe of the word, different churches are faid to hold communion with each other.

In the primitive chriftian church, every bifhop was obliged, after his ordination, to fend circular letters to foreign churches, to fignify that he was in communion with them. The three grand communions into which the Chriftian church is at prefent divided, is that of the church of Rome, the Greek church, and the Proteftant church: but originally all Chriftians were in communion with each other, having one common faith and difcipline.

COMMUNION is alfo ufed for the act of communicating in the facrament of the euchariſt, or the Lord's fupper. See RELIGION.

COMMUNION SERVICE, in the liturgy of the church of England, the office for the adminiftration of the holy facrament, extracted from feveral ancient liturgies, as thofe of St Bafil, St Ambrofe, *&c*.

By the laft rubric, part of this fervice is appointed to be read every funday and holyday, after the morning prayer, even though there be no communicants.

COMMUNITY, a fociety of men living in the fame place, under the fame laws, the fame regulations, and the fame cuftoms.

COMMUTATION, in law, the change of a penalty or punifhment from a greater to a lefs; as when death is commuted for banifhment, *&c*.

COMORIN, or CAPE COMORIN, the moft foutherly promontary of the hither India, lying north-weft of the ifland of Ceylon.

COMPACT, in phyfiology, is faid of bodies which are of a clofe, denfe, and heavy texture, with few pores, and very fmall.

COMPANY, in a commercial fenfe, is a fociety of merchants, mechanics, or other traders, joined together in one common intereft.

When there are only two or three joined in this manner, it is called a partnerfhip; the term *company* being reftrained to focieties confifting of a confiderable number of members, affociated together by a charter obtained from the prince.

The mechanics of all corporations, or towns incorporated, are thus erected into companies, which have charters of privileges and large immunities.

We

We ſhall here give ſome account of the principal companies of merchants, ſome of which trade with joint ſtocks, and all of them enjoy by charter many excluſive privileges: for however injurious theſe companies may, at this time of day, be reckoned to the nation in general, yet it is certain, that they were the original parents of all our foreign commerce; private traders upon their own bottom being diſcouraged from hazarding their fortunes in foreign countries, till the methods of traffic had been ſettled by joint-ſtock companies: and from this very principle it is, that we find ſeveral nations at preſent endeavouring to extend their trade by the ſame means. The moſt ancient trading company, in Britain, is the Hamburgh company, originally called merchants of the ſtaple, and afterwards merchant-adventurers: they were incorporated by king Edward IV. from which time they traded with ſucceſs till the reign of queen Elizabeth, who, for a farther encouragement of their induſtry, not only confirmed, but inlarged their privileges. However, it ought to be obſerved, that this trade is now open to private merchants, upon paying a very ſmall ſum to the company. The company of this kind, next incorporated, was that of the Ruſſia-merchants; who having improved their trade and commerce in thoſe remote parts, were incorporated by Edward VI. greatly encouraged by queen Mary, and had their confirmation, with an enlargement of their privileges, from Elizabeth. This company is not very conſiderable at preſent; the trade of thoſe parts being moſtly carried on by private merchants, on paying the ſum of 5 l. to the company.

The Eaſtland-company, formerly called merchants of Elbin, were encorporated by queen Elizabeth, and by her greatly encouraged; but, like the former company, it is now become inconſiderable, the trade of Norway and Sweden being laid open by act of parliament.

The Turkey, or Levant-company, was likewiſe incorporated by the ſame princeſs, and its charter confirmed and enlarged by king James I. who impowered them to trade to the Levant, or eaſtern parts of the Mediterranean; particularly to Smyrna, Aleppo, Alexandria, Grand-Cairo, and the other parts of the Turkiſh dominions. But this trade is now alſo laid open to private merchants, upon paying a ſmall conſideration.

The next in order is the Eaſt-India company, firſt incorporated in the year 1600, and impowered to trade to all countries lying eaſtward of the cape of Good Hope. Towards the end of king William's reign, an act of parliament paſſed, granting all private merchants, who ſhould raiſe a certain ſum for the ſupply of the government, the privilege of trading to theſe parts. Accordingly, a great many ſubſcribed, and were called the new Eaſt-India-company; which ſoon found it neceſſary to unite with the old one, and trade with one joint ſtock: ſince which time, they have been ſtyled the united Eaſt-India-company; and are at preſent in a flouriſhing condition, and in poſſeſſion of many conſiderable forts and factories on the coaſt of Malabar, the Coromandel-coaſt, the bay of Bengal, &c.

The royal African-company was firſt erected in the year 1661, with an excluſive privilege to trade from cape Blanc, on the coaſt of Africa, in 20° N. lat. as far as the cape of Good Hope. But this trade is now laid open by act of parliament.

The Eaſtland-company, the Greenland-company, the Hudſon's-bay-company, the South-ſea-company, have likewiſe their ſeveral charters and privileges for trading to the places from which they take their denominations.

Theſe are the principal trading company's belonging to the crown of Great Britain; and of a ſimilar nature are the Dutch Eaſt and Weſt India companies, the French Eaſt and Weſt India companies, &c.

Concerning theſe companies, it may be proper to remark, that however neceſſary they might be in the infancy of trade, they are now looked upon by moſt men in the light of monopolies: hence it is, that their privileges have from time to time been leſſened, in order to eſtabliſh an abſolutely free and general trade; and experience hath ſhewn, that the trade of the nation has advanced in proportion as monopolies have beed laid aſide. Indeed, to carry on trade with diſtant countries, where forces and forts are to be maintained, a company with a joint ſtock ſeems neceſſary; or, at leaſt, certain duties ought to be paid by all who trade thither, towards defraying the ſaid expences: for not to ſpeak of the Eaſt-India, Hudſon's bay, &c. companies, the expence of maintaining whoſe forts muſt be very conſiderable, even the Turkey, Hamburgh, Muſcovy, and Eaſtland companies, which do not trade with a joint ſtock, are nevertheleſs obliged to be at conſiderable charges, in making preſents to the grand ſeignior and his miniſters, maintaining conſuls, &c. It would therefore be injuſtice that any ſhould trade to the places within their charters, without paying the ſame duties towards the company's charge, as the preſent adventurers pay; but then there appears to be no reaſon why any of the king's ſubjects ſhould be barred from trading to thoſe places, or forced to pay a great fine for admiſſion, that are willing to pay the company's duties, and ſubmit to their regulations and orders in other reſpects.

On the whole, as all reſtrictions of trade are found to be hurtful, nothing can be more evident than that no company whatſoever, whether they trade in a joint ſtock, or only under regulation, can be for the public good, except it may be eaſy for all or any of his majeſty's ſubjects to be admitted into all or any of the ſaid companies, at any time, and for a very inconſiderable fine.

Company, in military affairs, a ſmall body of foot, commanded by a captain, who has under him a lieutenant and enſign.

The number of centinels or private ſoldiers in a company, may be from 50 to 80; and a battalion conſiſts of thirteen ſuch companies, one of which is always grenadiers, and poſted on the right: next them ſtand the eldeſt company, and on the left the ſecond company; the

the youngeſt one being always poſted in the centre.

Companies not incorporated into regiments are called irregulars, or independent companies.

Artillery COMPANY. See ARTILLERY.

COMPANY *of ſhips*, a fleet of merchantmen, who make a charter-party among themſelves; the principal conditions whereof uſually are, that certain veſſels ſhall be acknowledged admiral, vice-admiral, and rear-admiral; that ſuch and ſuch ſignals ſhall be obſerved; that thoſe which bear no guns, ſhall pay ſo much *per cent.* of their cargo; and in caſe they be attacked, that what damages are ſuſtained, ſhall be reimburſed by the company in general. In the Mediterranean, ſuch companies are called conſerves.

COMPARATIVE ANATOMY, is that branch of anatomy which conſiders the ſecondary objects, or the bodies of other animals; ſerving for the more accurate diſtinctions of ſeveral parts, and ſupplying the defect of human ſubjects.

It is otherwiſe called the anatomy of beaſts, and ſometimes zootomy; and ſtands in contradiſtinction to human anatomy, or that branch of the art which conſiders the human body, the primary object of anatomy. See ANATOMY.

COMPARATIVE DEGREE, among grammarians, that between the poſitive and ſuperlative degrees, expreſſing any particular quality above or beneath the level of another.

COMPARISON, in a general ſenſe, the conſideration of the relation between two perſons or things, when oppoſed and ſet againſt each other, by which we judge of their agreement or difference.

Inſtruction is the principal, but not the only end of compariſon. It may be employed with ſucceſs in putting a ſubject in a ſtrong point of view. A lively idea is formed of a man's courage by likening it to that of a lion; and eloquence is exalted in our imagination by comparing it to a river overflowing its bank, and involving all in its impetuous courſe. The ſame effect is produced by contraſt: A man in proſperity becomes more ſenſible of his bapppineſs, by comparing his condition with that of a perſon in want of bread. Thus compariſon is ſubſervient to poetry as well as to philoſophy.

Compariſons ſerve two purpoſes: when addreſſed to the underſtanding, their purpoſe is to inſtruct; when to the heart, their purpoſe is to pleaſe. Various means contribute to the latter: firſt, the ſuggeſting ſome unuſual reſemblance or contraſt; ſecond, the ſetting an object in the ſtrongeſt light; third, the aſſociating an object with others that are agreeable; fourth, the elevating an object; and, fifth, the depreſſing it. And that compariſons may give pleaſure by theſe various means, will be made evident by examples, which ſhall be given, after premiſing ſome general obſervations.

Objects of different ſenſes cannot be compared together; for ſuch objects are totally ſeparated from each other, and have no circumſtance in common to admit either reſemblance or contraſt. Objects of hearing may be compared together, as alſo of taſte, of ſmell, and of touch: but the chief fund of compariſon are objects of ſight; becauſe, in writing or ſpeaking, things can only be compared in idea, and the ideas of ſight are more diſtinct and lively than thoſe of any other ſenſe.

When a nation emerging out of barbarity begins to think of the fine arts, the beauties of language cannot long lie concealed; and when diſcovered, they are generally, by the force of novelty, carried beyond all bounds of moderation. Thus, in the earlieſt poems of every nation, we find metaphors and ſimiles founded on the ſlighteſt and moſt diſtant reſemblances, which, loſing their grace with their novelty, wear gradually out of repute; and now, by the improvement of taſte, no metaphor nor ſimile is admitted into any polite compoſition but of the moſt ſtriking kind. To illuſtrate this obſervation, a ſpecimen ſhall be given afterward of ſuch metaphors as we have been deſcribing: with reſpect to ſimiles take the following ſpecimen.

" Behold, thou art fair, my love: thy hair is as a
" flock of goats that appear from Mount Gilead: thy
" teeth are like a flock of ſheep from the waſhing, e-
" very one bearing twins: thy lips are like a thread
" of ſcarlet: thy neck like the tower of David built
" for an armoury, whereon hang a thouſand ſhields of
" mighty men: thy two breaſts like two young roes
" that are twins, which feed among the lilies: thy
" eyes like the fiſh-pools in Heſbon, by the gate of
" Bath-rabbin: thy noſe like the tower of Lebanon,
" looking toward Damaſcus." *Song of Solomon.*

" Thou art like ſnow on the heath; thy hair like
" the miſt of Cromla, when it curls on the rocks and
" ſhines to the beam of the weſt: thy breaſts are like
" two ſmooth rocks ſeen from Branno of the ſtreams:
" thy arms like two white pillars in the hall of the
" mighty Fingal." *Fingal.*

It has no good effect to compare things by way of ſimile that are of the ſame kind; nor to contraſt things of different kinds.

A numerous brigade haſten'd: as when bands
Of pioneers with ſpade and pick-ax arm'd,
Forerun the royal camp to trench a field
Or caſt a rampart. *Milton.*

The following is of things contraſted that are of different kinds.

Queen. What, is my Richard both in ſhape and mind
Transform'd and weak? Hath Bolingbroke depos'd
Thine intellect? Hath he been in thy heart?
The lion, dying, thruſteth forth his paw,
And wounds the earth, if nothing elſe, with rage
To be o'erpower'd: and wilt thou, pupil like,
Take thy correction mildly, kiſs the rod,
And fawn on rage with baſe humility?
Richard II. *act* 5. *ſc.* 1.

This compariſon has ſcarce any force: a man and a lion are of different ſpecies, and therefore are proper ſubjects for a ſimile; but there is no ſuch reſemblance between them in general, as to produce any ſtrong effect by contraſting particular attributes or circumſtances.

A third general obſervation is, That abſtract terms

can never be the ſubject of compariſon, otherwiſe than by being perſonified. Shakeſpear compares adverſity to a toad, and ſlander to the bite of a crocodile; but in ſuch compariſons theſe abſtract terms muſt be imagined ſenſible beings.

To have a juſt notion of compariſons, they muſt be diſtinguiſhed into two kinds; one common and familiar, as where a man is compared to a lion in courage, or to a horſe in ſpeed; the other more diſtant and refined, where two things that have in themſelves no reſemblance or oppoſition, are compared with reſpect to their effects. There is no reſemblance between a flower-plot and a chearful ſong; and yet they may be compared with reſpect to their effects, the emotions they produce in the mind being extremely ſimilar. There is as little reſemblance between fraternal concord and precious ointment; and yet obſerve how ſucceſsfully they are compared with reſpect to the impreſſions they make.

"Behold, how good and how pleaſant it is for "brethren to dwell together in unity. It is like the "precious ointment upon the head, that ran down "upon Aaron's beard, and deſcended to the ſkirts of "his garment." *Pſalm* 133.

For illuſtrating this ſort of compariſon, we ſhall add ſome more examples:

"Delightful is thy preſence, O Fingal! it is like "the ſun on Cromla, when the hunter mourns his "abſence for a ſeaſon, and ſees him between the "clouds.

"Did not Oſſian hear a voice? or is it the ſound "of days that are no more? Often, like the even-"ing-ſun, comes the memory of former times on my "ſoul.

"His countenance is ſettled from war; and is calm "as the evening-beam, that from the cloud of the "weſt looks on Cona's ſilent vale." *Fingal.*

We now proceed to illuſtrate by particular inſtances the different means by which compariſons, whether of the one ſort or the other, can afford pleaſure; and, in the order above eſtabliſhed, we ſhall begin with ſuch inſtances as are agreeable by ſuggeſting ſome unuſual reſemblance or contraſt.

Sweet are the uſes of Adverſity,
Which, like the toad, ugly and venomous,
Wears yet a precious jewel in her head.
As you like it, act 2. *ſc.* 1.

See, how the Morning opes her golden gates,
And takes her farewel of the glorious ſun;
How well reſembles it the prime of youth,
Trimm'd like a yonker prancing to his love.
Second Part Henry VI. *act.* 2. *ſc.* 1.

Thus they their doubtful conſultations dark
Ended, rejoicing in their matchleſs chief:
As when from mountain tops, the duſky clouds
Aſcending, while the North-wind ſleeps, o'erſpread
Heav'n's chearful face, the lowring element
Scowls o'er the darken'd landſcape, ſnow, and ſhower;
If chance the radiant ſun with farewel ſweet
Extends his ev'ning-beam, the fields revive,
The birds their notes renew, and bleating herds
Atteſt their joy, that hill and valley rings.
Paradiſe Loſt, book 2.

None of the foregoing ſimiles tend to illuſtrate the principal ſubject: and therefore the chief pleaſure they afford muſt ariſe from ſuggeſting reſemblances that are not obvious: for undoubtedly a beautiful ſubject introduced to form the ſimile affords a ſeparate pleaſure, which is felt in the ſimiles mentioned, particularly in that cited from Milton.

The next effect of a compariſon in the order mentioned, is to place an object in a ſtrong point of view; which effect is remarkable in the following ſimiles.

As when two ſcales are charg'd with doubtful loads,
From ſide to ſide the trembling balance nods,
(While ſome laborious matron, juſt and poor,
With nice exactneſs weighs her woolly ſtore),
Till pois'd aloft, the reſting beam ſuſpends
Each equal weight; nor this nor that deſcends:
So ſtood the war, till Hector's matchleſs might,
With fates prevailing, turn'd the ſcale of fight.
Fierce as a whirlwind up the wall he flies,
And fires his hoſt with loud repeated cries.
Iliad, b. xii. 521.

——— Out, out, brief candle!
Life's but a walking ſhadow, a poor player,
That ſtruts and frets his hour upon the ſtage,
And then is heard no more.
Macbeath, act 5. *ſc.* 5.

O thou Goddeſs,
Thou divine nature! how thyſelf thou blazon'ſt
In theſe two princely boys! they are as gentle
As zephyrs blowing below the violet,
Not wagging his ſweet head; and yet as rough,
(Their royal blood inchaf'd) as the rud'ſt wind,
That by the top doth take the mountain-pine,
And make him ſtoop to th' vale.
Cymbeline, act 4. *ſc.* 4.

"Why did not I paſs away in ſecret, like the "flower of the rock that lifts its fair head unſeen, "and ſtrows its withered leaves on the blaſt?"
Fingal.

As words convey but a faint and obſcure notion of great numbers, a poet, to give a lively notion of the object he deſcribes with regard to number, does well to compare it to what is familiar and commonly known. Thus Homer compares the Grecian army in point of number to a ſwarm of bees: in another paſſage he compares it to that profuſion of leaves and flowers which appear in the ſpring, or of inſects in a ſummer's evening: and Milton,

————— As when the potent rod
Of Amram's ſon in Egypt's evil day
Wav'd round the coaſt, up call'd a pitchy cloud
Of locuſts, warping on the eaſtern wind,
That o'er the realm of impious Pharaoh hung
Like night, and darken'd all the land of Nile:
So numberleſs were thoſe bad angels ſeen,
Hov'ring on wing under the cope of hell,
'Twixt upper, nether, and ſurrounding fires.
Paradiſe Loſt, book 1.

Such comparisons have, by some writers, been condemned for the lowness of the images introduced: but surely without reason; for, with regard to numbers, they put the principal subject in a strong light.

Milton has a peculiar talent in embellishing the principal subject by associating it with others that are agreeable; which is the third end of a comparison. Similes of this kind have, beside, a separate effect: they diversify the narration by new images that are not strictly necessary to the comparison: they are short episodes, which, without drawing us from the principal subject, afford great delight by their beauty and variety.

He scarce had ceas'd, when the superior fiend
Was moving toward the shore; his pond'rous shield,
Ethereal temper, massy, large, and round,
Behind him cast; the broad circumference
Hung on his shoulders like the moon, whose orb
Through optic glass the Tuscan artist views
At ev'ning from the top of Fesole,
Or in Valdarno, to descry new lands,
Rivers, or mountains, in her spotty globe.

Milton, *b*. 1.

As when a vulture on Imaus bred,
Whose snowy ridge the roving Tartar bounds,
Dislodging from a region scarce of prey
To gorge the flesh of lambs, or yeanling kids,
On hills where flocks are fed, flies toward the springs
Of Ganges or Hydaspes, Indian streams,
But in his way lights on the barren plains
Of Sericana, where Chineses drive
With sails and wind their cany waggons light:
So on this windy sea of land, the fiend
Walk'd up and down alone, bent on his prey.

Milton *b*. 3.

Next of comparisons that aggrandise or elevate. These affect us more than any other sort: the reason of which will be evident from the following instances.

As when a flame the winding valley fills,
And runs on crackling shrubs between the hills,
Then o'er the stubble up the mountain flies,
Fires the high woods, and blazes to the skies,
This way and that, the spreading torrent roars;
So sweeps the hero through the wasted shores.
Around him wide, immense destruction pours,
And earth is delug'd with the sanguine show'rs.

Iliad xx. 569.

Methinks, King Richard and myself should meet
With no less terror than the elements
Of fire and water, when their thund'ring shock,
At meeting tears the cloudy cheeks of heaven.

Richard II. *act* 3. *sc*. 5.

"As rusheth a foamy stream from the dark shady
"steep of Cromla, when thunder is rolling above,
"and dark brown night rests on the hill: so fierce,
"so vast, so terrible, rush forward the sons of Erin.
"The chief, like a whale of Ocean followed by all
"its billows, pours valour forth as a stream, rolling
"its might along the shore." *Fingal*, *b*. 1.

The last article mentioned, is that of lessening or depressing a hated or disagreeable object; which is effectually done by resembling it to any thing low or despicable. Thus Milton, in his description of the rout of the rebel-angels, happily expresses their terror and dismay in the following simile:

——————— As a herd
Of goats or timorous flock together throng'd,
Drove them before him thunder-struck, pursu'd
With terrors and with furies to the bounds
And crystal wall of heav'n, which op'ning wide,
Rowl'd inward, and a spacious gap disclos'd
Into the wasteful deep; the monstrous sight
Strook them with horror backward, but far worse
Urg'd them behind; headlong themselves they threw
Down from the verge of Heav'n.

Milton, *b*. 6.

By this time the different purposes of comparison, and the various impressions it makes on the mind, are sufficiently illustrated by proper examples. This was an easy work. It is more difficult to lay down rules about the propriety or impropriety of comparisons; in what circumstances they may be introduced, and in what circumstances they are out of place. It is evident, that a comparison is not proper upon every occasion: a man in his cool and sedate moments, is not disposed to poetical flights, nor to sacrifice truth and reality to the delusive operations of the imagination: far less is he so disposed, when oppressed with care, or interested in some important transaction that occupies him totally. On the other hand, it is observable, that a man, when elevated or animated by any passion, is disposed to elevate or animate all his subjects: he avoids familiar names, exalts objects by circumlocution and metaphor, and gives even life and voluntary action to inanimate beings. In this warmth of mind, the highest poetical flights are indulged, and the boldest similes and metaphors relished. But without soaring so high, the mind is frequently in a tone to relish chaste and moderate ornament; such as comparisons that set the principal object in a strong point of view, or that embellish and diversify the narration. In general, when by any animating passion, whether pleasant or painful, an impulse is given to the imagination; we are in that condition disposed to every sort of figurative expression, and in particular to comparisons. This in a great measure is evident from the comparisons already mentioned; and shall be further illustrated by other instances. Love, for example, in its infancy, rousing the imagination, promps the heart to display itself in figurative language, and in similes:

Troilus. Tell me, Apollo, for thy Daphne's love,
What Cressid is, what Pandar, and what we?
Her bed is India, there she lies, a pearl:
Between our Ilium, and where she resides,
Let it be call'd the wild and wandering flood;
Ourself the merchant, and this sailing Pandar
Our doubtful hope, our convoy, and our bark.

Troilus and Cressida, *act* 1. *sc*. 1.

Again:

Come, gentle Night; come, loving black-brow'd Night!
Give me my Romeo; and, when he shall die,
Take him, and cut him out in little stars,
And he will make the face of heav'n so fine,

That

That all the world ſhall be in love with Night,
And pay no worſhip to the gariſh ſun.

Romeo and Juliet, act 3. ſc. 4.

But it will be a better illuſtration of the preſent head, to give examples where compariſons are improperly introduced. Similes are not the language of a man in his ordinary ſtate of mind, diſpatching his daily and uſual work: for that reaſon, the following ſpeech of a gardener to his ſervant, is extremely improper:

Go bind thou up yon dangling apricocks,
Which, like unruly children, make their ſire
Stoop with oppreſſion of their prodigal weight:
Give ſome ſupportance to the bending twigs.
Go thou, and, like an executioner,
Cut off the heads of too-faſt-growing ſprays,
That look too lofty in our commonwealth:
All muſt be even in our government.

Richard II. *act 3. ſc. 7.*

The fertility of Shakeſpear's vein betrays him frequently into this error.

Rooted grief, deep anguiſh, terror, remorſe, deſpair, and all the ſevere diſpiriting paſſions, are declared enemies, perhaps not to figurative language in general, but undoubtedly to the pomp and ſolemnity of compariſon. Upon this account, the ſimile pronounced by young Rutland, under terror of death from an inveterate enemy, and praying mercy, is unnatural:

So looks the pent-up lion o'er the wretch
That trembles under his devouring paws;
And ſo he walks inſulting o'er his prey,
And ſo he comes to rend his limbs aſunder.
Ah, gentle Clifford, kill me with thy ſword,
And not with ſuch a cruel threat'ning look.

Third part Henry VI. *act 1. ſc. 5.*

A man ſpent and diſpirited after loſing a battle, is not diſpoſed to heighten or illuſtrate his diſcourſe by ſimiles.

York. With this we charg'd again; but out! alas,
We bodg'd again; as I have ſeen a ſwan
With bootleſs labour ſwim againſt the tide,
And ſpend her ſtrength with over-matching waves.
Ah! hark, the fatal followers do purſue;
And I am faint and cannot fly their fury.
The ſands are number'd that make up my life;
Here muſt I ſtay, and here my life muſt end.

Third part Henry VI. *act 1. ſc. 6.*

Similes thus unſeaſonably introduced, are finely ridiculed in the *Rehearſal.*

" *Bayes.* Now here ſhe muſt make a ſimile.
" *Smith.* Where's the neceſſity of that, Mr Bayes?
" *Bayes.* Becauſe ſhe's ſurprized; that's a general
" rule; you muſt ever make a ſimile when you are
" ſurprized; 'tis a new way of writing."

A compariſon is not always faultleſs even where it is properly introduced. A compariſon, like other human productions, may fall ſhort of its end; of which defect inſtances are not rare even among good writers: and to complete the preſent ſubject, it will be neceſſary to make ſome obſervations upon ſuch faulty compariſons. Nothing can be more erroneous than to inſtitute a compariſon too faint: a diſtant reſemblance or contraſt fatigues the mind with its obſcurity, inſtead of amuſing it; and tends not to fulfil any one end of a compariſon. The following ſimiles ſeem to labour under this defect.

K. Rich. Give me the crown.—Here, couſin, ſeize the crown,
Here, on this ſide, my hand; on that ſide, thine.
Now is this golden crown like a deep well,
That owes two buckets, filling one another;
The emptier ever dancing in the air,
The other down, unſeen and full of water;
That bucket down, and full of tears, am I,
Drinking my griefs, whilſt you mount up on high.

Richard II. *act 4. ſc. 3.*

K. John. Oh! couſin, thou art come to ſet mine eye;
The tackle of my heart is crack'd and burnt;
And all the ſhrouds wherewith my life ſhould ſail,
Are turned to one thread, one little hair:
My heart hath one poor ſtring to ſtay it by,
Which holds but till thy news be uttered.

King John, act 5. ſc. 10.

York. My uncles both are ſlain in reſcuing me:
And all my followers to the eager foe
Turn back, and fly like ſhips before the wind,
Or lambs purſu'd by hunger-ſtarved wolves.

Third part Henry VI. *act 1. ſc. 6.*

The latter of the two ſimilies is good: the former, becauſe of the faintneſs of the reſemblance, produces no good effect, and crouds the narration with an uſeleſs image.

In an epic poem, or in any elevated ſubject, a writer ought to avoid raiſing a ſimile upon a low image, which never fails to bring down the principal ſubject. In general, it is a rule, that a grand object ought never to be reſembled to one that is diminutive, however delicate the reſemblance may be: for it is the peculiar character of a grand object to fix the attention, and ſwell the mind; in which ſtate, it is diſagreeable to contract the mind to a minute object, however elegant. The reſembling an object to one that is greater, has, on the contrary, a good effect, by raiſing or ſwelling the mind: for one paſſes with ſatisfaction from a ſmall to a great object; but cannot be drawn down, without reluctance, from great to ſmall. Hence the following ſimiles are faulty.

Meanwhile the troops beneath Patroclus' care,
Invade the Trojans, and commence the war.
As waſps, provok'd by children in their play,
Pour from their manſions by the broad highway,
In ſwarms the guiltleſs traveller engage,
Whet all their ſtings, and call forth all their rage;
All riſe in arms, and with a general cry
Aſſert their waxen domes and buzzing progeny:
Thus from the tents the fervent legion ſwarms,
So loud their clamours, and ſo keen their arms.

Iliad, xvi. 312.

So burns the vengeful hornet (ſoul all o'er)
Repuls'd in vain, and thirſty ſtill of gore;
(Bold ſon of air and heat) on angry wings
Untam'd, untir'd, he turns, attacks, and ſtings.

Fir'd with like ardour, fierce Atrides flew,
And fent his foul with ev'ry lance he threw.
Iliad, xvii. 642.

An error oppofite to the former, is the introducing a refembling image, fo elevated or great as to bear no proportion to the principal fubject. Their remarkable difparity, being the moft ftriking circumftance, feizes the mind, and never fails to deprefs the principal fubject by contraft, inftead of raifing it by refemblance: and if the difparity be exceeding great, the fimile takes on an air of burlefque; nothing being more ridiculous than to force an object out of its proper rank in nature, by equalling it with one greatly fuperior or greatly inferior. This will be evident from the following comparifon.

Loud as a bull makes hill and valley ring,
So roar'd the lock when it releas'd the fpring.
Odyffey, xxi. 51.

Such a fimile upon the fimpleft of all actions, that of opening a lock, is pure burlefque.

A writer of delicacy will avoid drawing his comparifons from any image that is naufeous, ugly, or remarkably difagreeable; for however ftrong the refemblance may be, more will be loft than gained by fuch comparifon. Therefore we cannot help condemning, though with fome reluctancy, the following fimile, or rather metaphor.

O thou fond many! with what loud applaufe
Did'ft thou beat heav'n with bleffing Bolingbroke
Before he was what thou would'ft have him be?
And now being trimm'd up in thine own defires,
Thou, beaftly feeder, art fo full of him,
That thou provok'ft thyfelf to caft him up.
And fo, thou common dog, didft thou difgorge
Thy glutton bofom of the royal Richard,
And now thou would'ft eat thy dead vomit up,
And howl'ft to find it.
Second part Henry IV. *act* 1. *fc*. 6.

The ftrongeft objection that can lie againft a comparifon is, that it confifts in words only, not in fenfe. Such falfe coin, or baftard wit, does extremely well in burlefque; but is far below the dignity of the epic, or of any ferious compofition:

The noble fifter of Poplicola,
The moon of Rome; chafte as the icicle
That's curdled by the froft from pureft fnow,
And hangs on Dian's temple.
Coriolanus, *act* 5. *fc*. 3.

There is evidently no refemblance between an icicle, and a woman, chafte or unchafte: but chaftity is cold in a metaphorical fenfe, and an icicle is cold in a proper fenfe; and this verbal refemblance, in the hurry and glow of compofing, has been thought a fufficient foundation for the fimile. Such phantom fimiles are mere witticifms, which ought to have no quarter, except where purpofely introduced to provoke laughter. Lucian, in his differtation upon hiftory, talking of a certain author, makes the following comparifon, which is verbal merely.

"This author's defcriptions are fo cold, that they "furpafs the Cafpian fnow, and all the ice of the "north."

——But for their fpirits and fouls
This word *rebellion* had froze them up
As fifh are in a pond.
Second part Henry IV. *act* 1. *fc*. 3.

Pope has feveral fimiles of the fame ftamp.

And hence one mafter paffion in the breaft,
Like Aaron's ferpent fwallows up the reft.
Epift. 2. *l*. 131.

And again, talking of this fame ruling or mafter paffion:

Nature its mother, Habit is its nurfe;
Wit, fpirit, faculties, but make it worfe;
Reafon itfelf but gives it edge and pow'r;
As heav'n's blefs'd beam turns vinegar more fowr.
Ibid, *l*. 145.

Where the fubject is burlefque or ludicrous, fuch fimiles are far from being improper. Horace fays pleafantly,

Quamquam tu levior cortice. *L*. 3. *od*. 9.

And Shakefpear,

In breaking oaths he's ftronger than Hercules.

And this leads to obferve, that befides the foregoing comparifons, which are all ferious, there is a fpecies, the end and purpofe of which is to excite gaiety or mirth. Take the following examples.

Falftaff, fpeaking to his page:

"I do here walk before thee, like a fow that hath "overwhelmed all her litter but one"
Second part Henry IV. *act* 1. *fc*. 10.

"I think he is not a pick-purfe, nor a horfe fteal"er; but for his verity in love, I do think him as "concave as a cover'd goblet, or a worm-eaten nut."
As you like it, *act* 3. *fc*. 10.

This fword a dagger had his page,
That was but little for his age;
And therefore waited on him fo,
As dwarfs upon knights-errant do.
Hudibras, *canto* 1.

"Books, like men, their authors, have but one "way of coming into the world; but there are ten "thoufand to go out of it, and return no more."
Tale of a Tub.

"The moft accomplifhed way of ufing books at "prefent is, to ferve them as fome do lords, learn "their *titles*, and then brag of their acquaintance."
Ibid.

"He does not confider, that fincerity in love is as "much out of fafhion as fweet fnuff; no body takes "it now." *Carelefs Hufband*.

Comparison *of ideas*, that operation of the mind whereby it compares its ideas one with another, in regard of extent, degree, time, place, or any other circumftance, and is the ground of relations.

Comparison, in grammar, the inflection of the comparative degree.

COMPARTITION, in architecture, denotes the ufeful and graceful difpofition of the whole ground-plot of an edifice, into rooms of office, and of reception or entertainment.

COMPARTMENT, in general, is a defign compofed of

of ſeveral different figures, diſpoſed with ſymmetry, to adorn a parterre, a ceiling, *&c.*

A compartment of tiles, or bricks, is an arrangement of them, of different colours, and varniſhed, for the decoration of a building. Compartments, in gardening, are an aſſemblage of beds, plats, borders, walks, *&c.* diſpoſed in the moſt advantageous manner that the ground will admit of. Compartments, in heraldry, are otherwiſe called partitions.

COMPASS, or *mariner's* COMPASS, an inſtrument whereby the ſhip's courſe is determined. See NAVIGATION.

Azimuth COMPASS. See NAVIGATION.

COMPASS *dials*, are ſmall horizontal dials, fitted in braſs or ſilver boxes, for the pocket, to ſhew the hour of the day, by the direction of a needle, that indicates how to place them right, by turning the dial about, till the cock or ſtyle ſtand directly over the needle, and point to the northward: but theſe can never be very exact, becauſe of the variations of the needle itſelf. See DIALING.

COMPASSES, or *pair of* COMPASSES, a mathematical inſtrument for deſcribing circles, meaſuring figures, *&c.*

The common compaſſes conſiſt of two ſharp-pointed branches, or legs, of iron, ſteel, braſs, or other metal, joined at top by a rivet, whereon they move as on a centre.

The principal perfection of this, as of all other compaſſes, conſiſts in the eaſy and uniform opening and ſhutting of their legs; one of which may be taken out, in order to make room for others.

There are now uſed compaſſes of various kinds and contrivances, accommodated to the various uſes they are intend d for.

COMPEIGN, a city of France, ſituated on the river Oyſe, about forty-five miles north-eaſt of Paris: E. long. 3°, N. lat. 49° 30′.

COMPENDIUM, in matters of literature, denotes much the ſame with epitome or abridgment. See ABRIDGMENT.

COMPENSATION, in a general ſenſe, an action whereby any thing is admitted as an equivalent to another.

COMPENSATION. Where the ſame perſon is debtor and creditor to another, the mutual obligations, if they are for equal ſums, are extinguiſhed by compenſation; if for unequal, the leſſer obligation is extinguiſhed, and the greater diminiſhed, as far as the concourſe of debt and credit goes. See SCOTS LAW, title, *Extinction of obligations.*

COMPETENCE, or COMPETENCY, in law, the right or authority of a judge, for taking cognizance of any matter.

COMPETITION, in Scots law: In eſcheats, ſee title, *Caſualties due to the ſuperior:* In confirmations by the ſuperior, in reſignations, and in perſonal rights of lands, ſee title, *Of tranſmiſſion of rights by confirmation:* In inhibitions, in adjudications, amongſt aſſignees, arreſters, and poinders, ſee title, *Inhibitions, adjudications, aſſignations, arreſtments, and poindings:* Amongſt creditors of a defunct, ſee title, *Succeſſion in moveables.*

COMPITALIA, or COMPITALITIA, in Roman antiquity, feaſts inſtituted by Servius Tullius in honour of the Lares. See LARES.

Theſe feaſts were obſerved on the 12th of January, and 6th of March.

COMPLEMENT, in geometry, is what remains of a quadrant of a circle, or of 90°, after any certain arch has been taken away from it. Thus, if the arch taken away be 40°, its complement is 50: becauſe $50+40=90$. The ſine of the complement of an arch is called the co-ſine, and that of the tangent the co-tangent, *&c.*

COMPLEX, in a more general ſenſe, a term ſynonymous with compound; though, in ſtrictneſs of ſpeech, there is ſome difference. See COMPOUND.

COMPLEX *terms*, or *ideas*, in logic, are ſuch as are compounded of ſeveral ſimple ones. See TERM, and IDEA.

COMPLEXION, among phyſicians, the temperament, habitude, and natural dipoſition of the body, but more often the colour of the face and ſkin.

COMPLEXUS, in anatomy. See Vol. I. p. 216.

COMPLEXUS *minor*, in anatomy. See Vol. I. p. 216.

COMPLICATION, in general, denotes the blending, or rather interweaving, of ſeveral different things together: thus a perſon afflicted with ſeveral diſorders at the ſame time, is ſaid to labour under a complication of diſeaſes.

COMPOUND, COMPONE, or GOBONY, in heraldry, is ſaid of a bordure made up of angular parts, or chequers, of two different colours. See Plate LXV. fig. 13.

COMPOSITE, in general, denotes ſomething compounded, or made up of ſeveral others united together. Thus,

COMPOSITE *numbers*, are ſuch as can be meaſured exactly by a number exceeding unity; as 6 by 2 or 3, or 10 by 5, *&c.* ſo that 4 is the loweſt compoſite number.

COMPOSITE *order*, in architecture. See Vol. I. p. 352.

COMPOSITION, in a general ſenſe, the uniting or putting together ſeveral things, ſo as to form one whole, called a compound.

COMPOSITION *of ideas*, an act of the mind, whereby it unites ſeveral ſimple ideas into one conception or complex idea.

When we are provided with a ſufficient ſtock of ſimple ideas, and have by habit and uſe rendered them familiar to our minds, they become the component parts of other ideas ſtill more complicated, and form what we may call a ſecond order of compound notions. This proceſs may be continued to any degree of compoſition we pleaſe, mounting from one ſtage to another, and enlarging the number of combinations.

COMPOSITION, in grammar, the joining of two words together; or prefixing a particle to another word, to augment, diminiſh, or change its ſignification.

COMPOSITION, in logic, a method of reaſoning, whereby

by we proceed from ſome general ſelf-evident truth, to other particular and ſingular ones.

In diſpoſing and putting together our thoughts, there are two ways of proceeding, equally within our choice: for we may ſo propoſe the truths, relating to any part of knowledge, as they preſented themſelves to the mind, in the manner of inveſtigation; carrying on the ſeries of proofs in a reverſe order, till they, at laſt, terminate in firſt principles: or beginning with theſe principles, we may take the contrary way, and from them deduce, by a direct train of reaſoning, all the ſeveral propoſitions we want to eſtabliſh.

This diverſity, in the manner of arranging our thoughts, gives riſe to the twofold diviſion of method eſtabliſhed among logicians; the one called analytic method, or the method of reſolution, inaſmuch as it traces things back to their ſource, and reſolves knowledge into its firſt and original principles. This method ſtands in contradiſtinction to the method of compoſition; or, as it is otherwiſe called, the ſynthetic method: for here we proceed by gathering together the ſeveral ſcattered parts of knowledge, and combining them into one ſyſtem, in ſuch a manner, as that the underſtanding is enabled diſtinctly to follow truth through all the different ſtages of gradation.

Composition, in muſic, the art of diſpoſing muſical ſounds into airs, ſongs, *&c.* either in one or more parts, to be ſung by a voice, or played on inſtruments. See Music, and Song.

Under compoſition are comprehended the rules, 1. Of melody, or the art of making a ſingle part; that is, contriving and diſpoſing the ſimple ſounds, ſo as that their ſucceſſion and progreſſion may be agreeable to the ear. See Melody.

2. Of harmony, or the art of diſpoſing and concerting ſeveral ſingle parts together, ſo as that they make one agreeable whole. See Harmony.

COMPOSITION, in literature, the art of forming and arranging ſentiments, and cloathing them with language ſuitable to the nature of the ſubject or diſcourſe. We ſhall firſt give a few thoughts on original compoſition; and, 2dly, by way of example, unfold the nature of epic and dramatic compoſitions.

1. *On Original Compoſition.*

The mind of a man of genius is a fertile and pleaſant field; pleaſant as *Elyſium*, and fertile as *Tempe*; it enjoys a perpetual ſpring. Of that ſpring, *originals* are the faireſt flowers: *imitations* are of quicker growth, but fainter bloom. *Imitations* are of two kinds; one of nature, one of authors: the firſt we call *originals*, and confine the term *imitation* to the ſecond. We ſhall not enter into the curious inquiry of what is, or is not, ſtrictly ſpeaking, *original*, content with what all muſt allow, that ſome compoſitions are more ſo than others; and the more they are ſo, the better. *Originals* are, and ought to be, great favourites, for they are benefactors; they extend the republic of letters, and add a new province to its dominion: *imitators* only give us a ſort of duplicates of what we had, poſſibly much better, before; increaſing the mere drug of books, while all that makes them valuable, *knowledge* and *genius*, are at a ſtand. The pen of an *original* writer, like Armida's wand, out of a barren waſte calls a blooming ſpring: out of that blooming ſpring an *imitator* is a tranſplanter of laurels, which ſometimes die on removal, always languiſh in a foreign ſoil.

But ſuppoſe an *imitator* to be moſt excellent (and ſuch there are), yet ſtill he but nobly builds on another's foundation; his debt is, at leaſt, equal to his glory; which therefore, on the balance, cannot be very great. On the contrary, an *original*, though but indifferent (its *originality* being ſet aſide), yet has ſomething to boaſt; it is ſomething to ſay with him in Horace,

Meo *ſum pauper in ære*;

and to ſhare ambition with no leſs than *Cæſar*, who declared he had rather be the firſt in a village, than the ſecond at Rome.

Still farther: an *imitator* ſhares his crown, if he has one, with the choſen object of his imitation; an *original* enjoys an undivided applauſe. An *original* may be ſaid to be of a *vegetable* nature; it riſes ſpontaneouſly from the vital root of genius; it *grows*, it is not *made*: *imitations* are often a ſort of *manufacture* wrought by thoſe *mechanics*, *art* and *labour*, out of pre-exiſtent materials not their own.

Again: we read *imitation* with ſomewhat of his languor who liſtens to a twice-told tale: our ſpirits rouſe at an *original*; that is a perfect ſtranger, and all throng to learn what news from a foreign land: and though it comes, like an Indian prince, adorned with feathers only, having little of weight; yet of our attention it will rob the more ſolid, if not equally new: thus every teleſcope is lifted at a new-diſcovered ſtar; it makes a hundred aſtronomers in a moment, and denies equal notice to the ſun. But if an *original*, by being as excellent, as new, adds admiration to ſurprize, then are we at the writer's mercy; on the ſtrong wing of his imagination, we are ſnatched from Britain to Italy, from climate to climate, from pleaſure to pleaſure; we have no home, no thought, of our own; till the magician drops his pen: and then falling down into ourſelves, we awake to flat realities, lamenting the change, like the beggar who dreamt himſelf a prince.

It is with thoughts, as it is with words; and with both, as with men; they may grow old and die. Words tarniſhed, by paſſing through the mouths of the vulgar, are laid aſide as inelegant and obſolete. So thoughts, when become too common, ſhould loſe their currency; and we ſhould ſend new metal to the mint, that is, new meaning to the preſs. The diviſion of tongues at Babel did not more effectually debar men from making themſelves a name (as the ſcripture ſpeaks) than the too great concurrence or union of tongues will do for ever. We may as well grow good by another's virtue, or fat by another's food, as famous by another's thought. The world will pay its debt of praiſe but once; and inſtead of applauding, explode a ſecond demand, as a cheat.

If it is ſaid, that moſt of the Latin claſſics, and all the Greek, except, perhaps, Homer, Pindar, and Anacreon,

creon, are in the number of *imitators*, yet receive our higheſt applauſe; our anſwer is, that they, though not *real*, are *accidental originals*; the works they imitated, few excepted, are loſt: they, on their father's deceaſe, enter as lawful heirs on their eſtates in fame: the fathers of our copyiſts are ſtill in poſſeſſion; and ſecured in it, in ſpite of Goths, and flames, by the perpetuating power of the preſs. Very late muſt a modern *imitator*'s fame arrive, if it waits for their deceaſe.

An *original* enters early on reputation: *fame*, fond of new glories, ſounds her trumpet in triumph at its birth; and yet how few are awakened by it into the noble ambition of like attempts? Ambition is ſometimes no vice in life; it is always a virtue in compoſition. High in the towering Alps is the fountain of the Po; high in fame, and in antiquity, is the fountain of an *imitator*'s undertaking; but the river, and the imitation, humbly creep along the vale. So few are our *originals*, that, if all other books were to be burnt, the lettered world would reſemble ſome metropolis in flames, where a few incombuſtible buildings, a fortreſs, temple, or tower, lift their heads, in melancholy grandeur, amid the mighty ruin. Compared with this conflagration, old Omar lighted up but a ſmall bonfire, when he heated the baths of the barbarians, for eight months together, with the famed Alexandrian library's ineſtimable ſpoils, that no prophane book might obſtruct the triumphant progreſs of his holy Alcoran round the globe.

But why are originals ſo few? not becauſe the writer's harveſt is over, the great reapers of antiquity having left nothing to be gleaned after them; nor becauſe the human mind's teeming time is paſt, or becauſe it is incapable of putting forth unprecedented births; but becauſe illuſtrious examples *engroſs*, *prejudice*, and *intimidate*. They *engroſs* our attention, and ſo prevent a due inſpection of ourſelves; they *prejudice* our judgment in favour of their abilities, and ſo leſſen the ſenſe of our own; and they *intimidate* us with the ſplendor of their renown, and thus under diffidence bury our ſtrength. Nature's impoſſibilities, and thoſe of diffidence, lie wide aſunder.

After all, the firſt ancients had not merit in being *originals*: they could *not* be *imitators*. Modern writers have a *choice* to make; and therefore have a merit in their power. They may ſoar in the regions of *liberty*, or move in the ſoft fetters of eaſy *imitation*; and *imitation* has as many plauſible reaſons to urge, as *pleaſure* had to offer to Hercules. Hercules made the choice of an hero, and *ſo* became immortal.

Yet let not aſſertors of claſſic excellence imagine, that we deny the tribute it ſo well deſerves. He that admires not ancient authors, betrays a ſecret he would conceal, and tells the world, that he does not underſtand them. Let us be as far from neglecting, as from copying, their admirable compoſitions: ſacred be their rights, and inviolable their fame. Let our underſtanding feed on theirs; they afford the nobleſt nouriſhment: but let them nouriſh, and annihilate, our own. When we read, let our imagination kindle at their charms; when we write, let our judgment ſhut them out of our thoughts; treat even Homer himſelf, as his royal admirer was treated by the cynic; bid him ſtand aſide, nor ſhade our compoſition from the beams of our own genius; for nothing *original* can riſe, nothing immortal, can ripen, in any other ſun.

Muſt we, then, not imitate ancient authors? Imitate them, by all means; but imitate aright. He that imitates the divine Iliad, does not imitate Homer; but he who takes the ſame method, which Homer took, for arriving at a capacity of accompliſhing a work ſo great. Tread in his ſteps to the ſole fountain of immortality; drink where he drank, at the true *Helicon*, that is, at the breaſt of nature. Imitate; but imitate not the *compoſition*, but the *man*. For may not this paradox paſs into a maxim? *viz.* "The leſs we copy the renowned ancients, we ſhall reſemble them the more."

But poſſibly it may be replied, that we muſt either imitate Homer, or depart from nature. Not ſo: for ſuppoſe you was to change place, in time, with Homer; then, if you write naturally, you might as well charge Homer with an imitation of you. Can you be ſaid to imitate Homer for writing *ſo*, as you would have written if Homer had never been? As far as a regard to nature, and ſound ſenſe, will permit a departure from your great predeceſſors; ſo far, ambitiouſly, depart from them; the farther from them in *ſimilitude*, the nearer are you to them in *excellence*; you riſe by it into an *original*; become a noble collateral, not an humble deſcendant from them. Let us build our compoſitions with the ſpirit, and in the taſte of the ancients; but not with their materials: thus will they reſemble the ſtructures of Pericles at Athens, which Plutarch commends for having had an air of antiquity as ſoon as they were built. All eminence, and diſtinction, lies out of the beaten road; excurſion, and deviation, are neceſſary to find it; and the more remote your path from the highway, the more reputable; if, like poor Gulliver, you fall not into a ditch, in your way to glory.

What glory to come near, what glory to reach, what glory (preſumptuous thought!) to ſurpaſs our predeceſſors? And is that then in nature abſolutely impoſſible? or is it not rather contrary to nature to fail in it? Nature herſelf ſets the ladder, all wanting is our ambition to climb. For by the bounty of nature we are as ſtrong as our predeceſſors; and by the favour of time (which is but another round in nature's ſcale) we ſtand on higher ground. As to the *firſt*, were *they* more than men? or are *we* leſs? Are not our minds caſt in the ſame mould with thoſe before the flood? The flood affected matter: mind eſcaped. As to the *ſecond*; though we are moderns, the world is an ancient; more ancient far, than when they, whom we moſt admire, filled it with their fame. Have we not their beauties, as ſtars, to guide; their defects, as rocks, to be ſhunned; the judgment of ages on both, as a chart to conduct, and a ſure helm to ſteer us in our paſſage to greater perfection than theirs? And ſhall we be ſtopt in our rival pretenſions to fame by this juſt reproof?

Stat contra, dicitque tibi tua pagina, Fur *es.*
MART.

It is by a ſort of noble contagion, from a general familiarity with their writings, and not by any particular ſordid theft, that we can be the better for thoſe who went

went before us. Hope we, from plagiarifm, any dominion in literature; as that Rome rofe from a neft of thieves?

Rome was a powerful ally to many ftates; ancient authors are our powerful allies; but we muft take heed, that they do not fuccour till they inflave, after the manner of Rome. Too formidable an idea of their fuperiority, like a fpectre, would fright us out of a proper ufe of our wits; and dwarf our underftanding, by making a giant of theirs. Too great awe for them lays genius under reftraint, and denies it that free fcope, that full elbow-room, which is requifite for ftriking its moft mafterly ftrokes. Genius is a mafter-workman, learning is but an inftrument, and an inftrument, though moft valuable, yet not always indifpenfable. Heaven will not admit of a partner in the accomplifhment of fome favourite fpirits; but rejecting all human means, affumes the whole glory to itfelf. Have not fome, though not famed for erudition, *fo* written, as almoft to perfuade us, that they fhone brighter, and foared higher, for efcaping the boafted aid of that proud ally?

Nor is it ftrange; for what, for the moft part, mean we by genius, but the power of accomplifhing great things without the means generally reputed neceffary to that end? A *genius* differs from a *good underftanding*, as a magician from a good architect; *that* raifes his ftructure by means invifible; *this* by the fkilful ufe of common tools. Hence genius has ever been fuppofed to partake of fomething divine.

Learning, deftitute of this fuperior aid, is fond, and proud of what has coft it much pains; is a great lover of rules, and boafter of famed examples. As beauties lefs perfect, who owe half their charms to cautious art, learning inveighs againft natural unftudied graces, and fmall harmlefs inaccuracies, and fets rigid bounds to that liberty to which genius often owes its fupreme glory; but the no genius its frequent ruin. For unprefcribed beauties, and unexampled excellence, which are characteriftics of *genius*, lie without the pale of *learning*'s authorities, and laws; which pale, genius muft leap to come at them: but by that leap, if genius is wanting, we break our necks; we lofe that little credit, which poffibly we might have enjoyed before. For rules, like crutches, are a needful aid to the lame, though an impediment to the ftrong. A Homer cafts them away; and, like his Achilles,

Jura negat fibi nata, nihil non arrogat,

by native force of mind. There is fomething in poetry beyond profe-reafon; there are myfteries in it not to be explained, but admired; which render mere profe-men infidels to their divinity. And here may be offered a fecond paradox: *viz.* "*Genius* often then deferves moft to be praifed, when it is moft fure to be condemned; that is, when its excellence, from mounting high, to weak eyes is quite out of fight."

If we might fpeak farther of learning and genius, we would compare genius to virtue, and learning to riches. As riches are moft wanted where there is leaft virtue; fo learning where there is leaft genius. As virtue without much riches can give happinefs; fo genius without much learning can give renown. As it is faid in Terence, *pecuniam negligere interdum maximum eft lucrum;* fo to neglect of learning, genius fometimes owes its greater glory. Genius, therefore, leaves but the fecond place, among men of letters, to the learned. It is their merit, and ambition, to fling light on the works of genius, and point out its charms. We moft juftly reverence their informing radius for that favour; but we muft much more admire the radiant ftars pointed out by them.

A ftar of the firft magnitude among the moderns was Shakefpeare; among the ancients, Pindar; who, (as Voffius tells us) boafted of his no learning, calling himfelf the eagle, for his flight above it. And fuch genii as thefe may, indeed, have much reliance on their own native powers. For genius may be compared to the natural ftrength of the body; learning to the fuperinduced accountrements of arms: if the firft is equal to the propofed exploit, the latter rather encumbers, than affifts; rather retards, than promotes, the victory. *Sacer nobis ineft Deus*, fays Seneca. With regard to the moral world, *confcience*, with regard to the intellectual, *genius*, is that god within. Genius can fet us right in compofition, without the rules of the learned; as confcience fets us right in life, without the laws of the land: *this*, fingly, can make us good, as men: *that*, fingly, as writers, can, fometimes, make us great

As too great admirers of the fathers of the church have fometimes fet up their authority againft the true fenfe of fcripture; fo too great admirers of the claffical fathers have fometimes fet up their authority, or example, againft reafon.

Neve minor, neu fit quinto productior actu fabula.

So fays Horace, fo fays ancient example. But reafon has not fubfcribed. We know but one book that can juftify our implicit acquiefcence in it: and (by the way) on that book a noble difdain of undue deference to prior opinion has lately caft, and is ftill cafting, a new and ineftimable light.

But, fuperftition for our predeceffors fet afide, the claffics are for ever our rightful and revered mafters in *compofition*; and our underftandings bow before them. But when? When a mafter is wanted; which fometimes is not the cafe. Some are pupils of nature only, nor go farther to fchool. From fuch we reap often a double advantage; they not only rival the reputation of the great ancient authors, but alfo reduce the number of mean ones among the moderns. For when they enter on fubjects which have been in former hands, fuch is their fuperiority, that, like a tenth wave, they overwhelm, and bury in oblivion all that went before: and thus not only enrich and adorn, but remove a load, and leffen the labour, of the letter'd world.

"But, it may be faid, fince *originals* can arife from genius only, and fince genius is fo very rare, it is fcarce worth while to labour a point fo much, from which we can reafonably expect fo little." To fhow that genius is not fo very rare as you imagine, we fhall point out ftrong inftances of it, in a far diftant quarter from that mentioned above. The minds of the fchoolmen were almoft as much cloiftered as their bodies; they had but little learning, and few books; yet may the moft learned be ftruck with

with ſome aſtoniſhment at their ſo ſingular natural ſagacity, and moſt exquiſite edge of thought. Who would expect to find Pindar and Scotus, Shakeſpeare and Aquinas, of the ſame party? Both equally ſhew an *original*, unindebted, energy: the *vigor igneus*, and *cæleſtis origo*, burns in both; and leaves us in doubt whether genius is more evident in the ſublime flights and beauteous flowers of poetry, or in the profound penetrations, and marvelouſly keen and minute diſtinctions, called the thorns of the ſchools. There might have been more able conſuls called from the plough, than ever arrived at that honour: many a genius, probably, there has been, which could neither write nor read. So that genius, that ſupreme luſtre of literature, is leſs rare than is generally conceived.

By the praiſe of genius we detract not from learning; we detract not from the value of gold, by ſaying that diamond has greater ſtill. He who diſregards learning, ſhows that he wants its aid; and he that overvalues it, ſhows that its aid has done him harm. Over-valued indeed it cannot be, if genius as to *compoſition*, is valued more. Learning, we thank; genius, we revere; that gives us pleaſure, this gives us rapture; that informs, this inſpires; and is itſelf inſpired; for genius is from heaven, learning from man: *this* ſets us above the low, and illiterate; *that*, above the learned, and polite. Learning is borrowed knowledge; genius is knowledge innate, and quite our own. Therefore, as Bacon obſerves, it may take a nobler name, and be called wiſdom; in which ſenſe of wiſdom, ſome are born wiſe.

Having put in a caveat againſt the moſt fatal of errors, from the too great indulgence of genius, return we now to that too great ſuppreſſion of it, which is detrimental to compoſition; and endeavour to reſcue the writer, as well as the man. We have ſaid, that ſome are born wiſe; but they, like thoſe that are born rich, by neglecting the cultivation and produce of their own poſſeſſions, and by running in debt, may be beggared at laſt; and loſe their reputations, as younger brothers eſtates, not by being born with leſs abilities than the rich heir, but at too late an hour.

Many a great man has been loſt to himſelf, and the public, purely becauſe great ones were born before him. Hermias, in his collections on Homer's blindneſs, ſays, that Homer requeſting the gods to grant him a ſight of Achilles, that hero roſe, but in armour ſo bright, that it ſtruck Homer blind with the blaze. Let not the blaze of even Homer's muſe darken us to the diſcernment of our own powers; which may poſſibly ſet us above the rank of *imitators*; who, though moſt excellent, and even immortal, (as ſome of them are), yet are ſtill but *dii minorum gentium*, nor can expect the largeſt ſhare of incenſe, the greateſt profuſion of praiſe, on their ſecondary altars.

But farther ſtill: a ſpirit of *imitation* hath many ill effects; we ſhall confine ourſelves to three. *Firſt*, It deprives the liberal and politer arts of an advantage which the mechanic enjoy: in theſe, men are ever endeavouring to go beyond their predeceſſors; in the former, to follow them. And ſince copies ſurpaſs not their *originals*, as ſtreams riſe not higher than their ſpring, rarely ſo high; hence, while arts mechanic are in perpetual progreſs and increaſe, the liberal are in retrogradation and decay. *Theſe* reſemble pyramids, are broad at bottom, but leſſen exceedingly as they riſe; *thoſe* reſemble rivers, which, from a ſmall fountain head, are ſpreading ever wider and wider, as they run. Hence it is evident, that different portions of underſtanding are not (as ſome imagine) allotted to different periods of time; for we ſee, in the ſame period, underſtanding riſing in one ſet of artiſts, and declining in another. Therefore, *nature* ſtands abſolved, and our inferiority in compoſition muſt be charged on ourſelves.

Nay, ſo far are we from complying with a neceſſity which nature lays us under, that, *ſecondly*, by a ſpirit of imitation we counteract nature, and thwart her deſign. She brings us into the world all *originals*. No two faces, no two minds, are juſt alike; but all bear nature's evident mark of ſeparation on them. Born *originals*, how comes it to paſs that we die *copies?* That meddling ape *imitation*, as ſoon as we come to years of *indiſcretion*, (if we may ſo ſpeak), ſnatches the pen, and blots out nature's mark of ſeparation, cancels her kind intention, deſtroys all mental individuality; the letter'd world no longer conſiſts of ſingulars, it is a medly, a maſs; and a hundred books, at bottom, are but one. Why are monkies ſuch maſters of mimickry? why receive they ſuch a talent at imitation? Is it not as the Spartan ſlaves received a licenſe for ebriety, that their betters might be aſhamed of it?

The *third* fault to be found with a ſpirit of *imitation* is, that with great incongruity it makes us poor and proud: makes us think little, and write much; gives us huge folios, which are little better than more reputable cuſhions to promote our repoſe. Have not ſome ſevenfold volumes put us in mind of Ovid's ſevenfold channels of the Nile at the conflagration?

Oſtia ſeptem
Pulverulenta vacant ſeptem ſine flumine valles.

Such leaden labours are like Lycurgus's iron money, which was ſo much leſs in value than in bulk, that it required barns for ſtrong boxes, and a yoke of oxen to draw five hundred pounds.

But notwithſtanding theſe diſadvantages of *imitation*, imitation muſt be the lot (and often an honourable lot it is) of moſt writers. If there is a famine of *invention* in the land, like Joſeph's brethren, we muſt travel far for food; we muſt viſit the remote and rich ancients: but an inventive genius may ſafely ſtay at home; that, like the widow's cruſe, is divinely repleniſhed from within, and affords us a miraculous delight. Whether our own genius be ſuch or not, we diligently ſhould inquire, that we may not go a-begging with gold in our purſe. For there is a mine in man, which muſt be deeply dug ere we can conjecture its contents. Another often ſees that in us, which we ſee not ourſelves; and may there not be that in us which is unſeen by both? That there may, chance often diſcovers, either by a luckily choſen theme, or a mighty premium, or an abſolute neceſſity of exertion, or a noble ſtroke of emulation from another's glory; as that on Thucydides from hearing Herodotus repeat part of his hiſtory at the Olympic games. Had there been no Herodotus, there might have been no Thucydides, and the

world's admiration might have begun at Livy for excellence in that province of the pen. Demoſthenes had the ſame ſtimulation on hearing Calliſtratus; or Tully might have been the firſt of conſummate renown at the bar

Quite clear of the diſpute concerning ancient and modern learning, we ſpeak not of performance, but powers. The modern powers are equal to thoſe before them; modern performance in general is deplorably ſhort. How great are the names juſt mentioned? Yet who will daily affirm, that as great may not riſe up in ſome future, or even in the preſent age? Reaſons there are why talents may not *appear*, none why they may not *exiſt*, as much in one period as another. An evocation of vegetable fruits depends on rain, air, and ſun; an evocation of the fruits of genius no leſs depends on externals. What a marvellous crop bore it in Greece and Rome? And what a marvellous ſunſhine did it there enjoy? What encouragement from the nature of their governments, and the ſpirit of their people? Virgil and Horace owed their divine talents to Heaven; their immortal works to men; thank Mæcenas and Auguſtus for them. Had it not been for theſe, the genius of thoſe poets had lain buried in their aſhes. Athens expended on her theatre, painting, ſculpture, and architecture, a tax levied for the ſupport of a war. Cæſar dropt his papers when Tully ſpoke; and Philip trembled at the voice of Demoſthenes. And has there ariſen but one Tully, one Demoſthenes, in ſo long a courſe of years? The powerful eloquence of them both in one ſtream, ſhould never bear us down into the melancholy perſuaſion, that ſeveral have not been born, though they have not emerged. The ſun as much exiſts in a cloudy day, as in a clear; it is outward, accidental circumſtances that with regard to genius either in nation, or age,

Collectas fugat nubes, ſolemque reducit. Virg.

As great, perhaps greater than thoſe mentioned (preſumptuous as it may ſound) may, poſſibly, ariſe; for, who hath fathomed the mind of man? Its bounds are as unknown, as thoſe of the creation; ſince the birth of which, perhaps, not one has ſo far exerted, as not to leave his poſſibilities beyond his attainments, his powers beyond his exploits. Forming our judgments altogether by what *has* been done, without knowing, or at all inquiring, what poſſibly *might* have been done, we naturally enough fall into too mean an opinion of the human mind. If a ſketch of the divine Iliad before Homer wrote, had been given to mankind, by ſome ſuperior being, or otherwiſe, its execution would probably have appeared beyond the power of man. Now, to ſurpaſs it, we think impoſſible. As the firſt of theſe opinions would evidently have been a miſtake, why may not the ſecond be ſo too? Both are founded on the ſame bottom; on our ignorance of the poſſible dimenſions of the mind of man.

Nor are we only ignorant of the dimenſions of the human mind in general, but even of our own. That a man may be ſcarce leſs ignorant of his own powers, than an oyſter of its pearl, or a rock of its diamond; that he may poſſeſs dormant, unſuſpected abilities, till awakened by loud calls, or ſtung up by ſtriking emergencies; is evident from the ſudden eruption of ſome men out of perfect obſcurity, into public admiration, on the ſtrong impulſe of ſome animating occaſion; not more to the world's great ſurpriſe, than their own. Few authors of diſtinction but have experienced ſomething of this nature, at the firſt beamings of their yet unſuſpected genius on their hitherto dark compoſition. The writer ſtarts at it, as at a lucid meteor in the night; is much ſurpriſed; can ſcarce believe it true. During this happy confuſion, it may be ſaid to him, as to Eve at the lake,

What there thou ſeeſt, fair creature, is thyſelf.
Milton.

Genius, in this view, is like a dear friend in our company under diſguiſe; who, while we are lamenting his abſence, drops his maſk, ſtriking us at once with equal ſurpriſe and joy. This ſenſation, which we ſpeak of in a writer, might favour, and ſo promote, the fable of poetic inſpiration. A poet of a ſtrong imagination, and ſtronger vanity, on feeling it, might naturally enough realiſe the world's mere compliment, and think himſelf truly inſpired. Which is not improbable; for enthuſiaſm of all kinds do no leſs.

Since it is plain, that men may be ſtrangers to their own abilities; and by thinking meanly of them without juſt cauſe, may poſſibly loſe a name, perhaps a name immortal; we would find ſome means to prevent theſe evils. Whatever promotes virtue, promotes ſomething more, and carries its good influence beyond the *moral* man: to prevent theſe evils we borrow two golden rules from *ethics*, which are no leſs golden in *compoſition*, than in life. 1. *Know thyſelf*; 2. *Reverence thyſelf*.

1ſt, *Know thyſelf*. Of ourſelves it may be ſaid, as Martial ſays of a bad neighbour,

Nil tam prope, proculque nobis.

Therefore dive deep into thy boſom; learn the depth, extent, bias, and full ſort of thy mind; contract full intimacy with the ſtranger within thee; excite and cheriſh every ſpark of intellectual light and heat, however ſmothered under former negligence, or ſcattered through the dull, dark maſs of common thoughts; and collecting them into a body, let thy genius riſe (if a genius thou haſt) as the ſun from chaos; and if we ſhould then ſay, like an Indian, *Worſhip it*, (though too bold) yet ſhould we ſay little more than the ſecond rule enjoins, viz. *Reverence thyſelf.*

That is, let not great examples, or authorities, browbeat thy reaſon into too great a diffidence of thyſelf: thyſelf ſo reverence, as to prefer the native growth of thy own mind to the richeſt import from abroad; ſuch borrowed riches make us poor. The man who thus reverences himſelf, will ſoon find the world's reverence to follow his own. His works will ſtand diſtinguiſhed; his the ſole property of them; which property alone can confer the noble title of an *author*; that is, of one who, to ſpeak accurately, *thinks*, and *compoſes*; while other invaders of the preſs. how voluminous, and learned ſoever, with due reſpect be it ſpoken, only *read* and *write*.

This is the difference between thoſe two luminaries in literature, the well-accompliſhed ſcholar, and the divinely-inſpired enthuſiaſt; the firſt is, as the bright morning ſtar; the ſecond, as the riſing ſun. The writer who neglects thoſe two rules above will never ſtand alone; he

makes one of a group, and thinks in wretched unanimity with the throng. Incumbered with the notions of others, and impoverifhed by their abundance, he conceives not the leaft embryo of new thought; opens not the leaft vifta through the gloom of ordinary writers, into the bright walks of rare imagination, and fingular defign; while the true genius is croffing all public roads into frefh untrodden ground, he, up to the knees in antiquity, is treading the facred footfteps of great examples, with the blind veneration of a bigot faluting the papal toe; comfortably hoping full abfolution for the fins of his own underftanding, from the powerful charm of touching his idol's infallibility.

Such meannefs of mind, fuch proftration of our own powers, proceeds from too great admiration of others. Admiration has generally a degree of two very bad ingredients in it; of ignorance, and of fear; and does mifchief in compofition, and in life. Proud as the world is, there is more fuperiority in it given, than affumed: and its grandees of all kinds owe more of their elevation to the littlenefs of others minds, than to the greatnefs of their own. Were not proftrate fpirits their voluntary pedeftals, the figure they make among mankind would not ftand fo high. *Imitators* and *tranflators* are fomewhat of the pedeftal-kind, and fometimes rather raife their *original*'s reputation, by fhowing him to be by them inimitable, than their own. Homer has been tranflated into moft languages; Ælian tells us, that the Indians, (hopeful tutors!) have taught him to fpeak their tongue. What expect we from them? Not Homer's Achilles, but fomething, which, like Patroclus, affumes his name, and, at its peril, appears in his ftead; nor expect we Homer's Ulyffes glorioufly burfting out of his cloud into royal grandeur, but an Ulyffes under difguife, and a beggar to the laft. Such is that inimitable father of poetry, and oracle of all the wife, whom Lycurgus tranfcribed; and for an annual public recital of whofe works Solon enacted a law; that it is much to be feared, that his fo numerous tranflations are but as the publifhed teftimonials of fo many nations, and ages, that this author fo divine is untranflated ftill.

But here,

Cynthius aurem
Vellit,——— VIRG.

and demands juftice for his favourite, and ours. Great things he has done; but he might have done greater. What a fall is it from Homer's numbers, free as air, lofty and harmonious as the fpheres, into childifh fhackles, and tinkling founds! But, in his fall, he is ftill great;——

Nor appears
Lefs than archangel ruin'd, and the excefs
Of glory obfcur'd.—— MILT.

Had Milton never wrote, Pope had been lefs to blame: but when in Milton's genius, Homer, as it were, perfonally rofe to forbid Britons doing him that ignoble wrong; it is lefs pardonable, by that *effeminate* decoration, to put Achilles in petticoats a fecond time. How much nobler had it been, if his numbers had rolled on in full flow, through the various modulations of mafculine melody, into thofe grandeurs of folemn found, which are indifpenfibly demanded by the native dignity of heroic fong? How much nobler, if he had refifted the temptation of that Gothic dæmon, which modern poefy tafting, became mortal? O how unlike the deathlefs, divine harmony of three great names (how juftly joined!) of *Milton*, *Greece*, and *Rome?* His verfe, but for his little fpeck of mortality, in its extreme parts, as his hero had in his heel; like him, had been invulnerable, and immortal. But, unfortunately, *that* was undipt in Helicon; as *this* in Styx. Harmony as well as eloquence is effential to poefy; and a murder of his mufic is putting half Homer to death. *Blank* is a term of diminution; what we mean by blank verfe is, verfe unfallen, uncurft; verfe reclaimed, reinthroned in the true *language of the gods*; who never thundered, nor fuffered their Homer to thunder in rhime.

But fuppofing Pope's Iliad to have been perfect in its kind; yet it is a *tranflation* ftill; which differs as much from an *original*, as the moon from the fun.

But as nothing is more eafy than to write originally wrong; originals are not here recommended, but under the ftrong guard of the firft rule,—*Know thyfelf.* Lucian, who was an original, neglected not this rule, if we may judge by his reply to one who took fome freedom with him. He was at firft an apprentice to a ftatuary; and when he was reflected on as fuch, by being called *Prometheus*, he replied, "I am indeed the inventor of a new work, the model of which I owe to none; and, if I do not execute it well, I deferve to be torn by twelve vultures, inftead of one."

Bacon fays, "Men feek not to know their own ftock, and abilities; but fancy their poffeffions to be greater, and their abilities lefs, than they really are." Which is in effect faying, "That we ought to exert more than we do; and that, on exertion, our probability of fuccefs is greater than we conceive."

Nor have we Bacon's opinion only, but his affiftance too, in favour of originals. His mighty mind travelled round the intellectual world; and, with a more than eagle's eye, faw, and has pointed out, blank fpaces, or dark fpots in it, on which the human mind never fhone: fome of thefe have been enlightened fince; fome are benighted ftill.

Moreover, fo boundlefs are the bold excurfions of the human mind, that in the vaft void beyond real exiftence, it can call forth fhadowy beings, and unknown worlds, as numerous, as bright, and perhaps as lafting as the ftars; fuch quite-original beauties we may call paradifaical,

Natos fine femine flores. OVID.

When fuch an ample area for renowned adventure in *original* attempts lies before us, fhall we be as mere leaden pipes, conveying to the prefent age fmall ftreams of excellence from its grand refervoir in antiquity; and thofe too perhaps mudded in the pafs? Originals fhine like comets; have no peer in their path; are rivalled by none, and the gaze of all: all other compofitions (if they fhine at all) fhine in clufters; like the ftars in the galaxy; where, like bad neighbours, all fuffer from all; each particular being diminifhed, and almoft loft in the throng.

If thoughts of this nature prevailed; if ancients and moderns were no longer confidered as mafters and pupils, but

but as hard-matched rivals for renown; then moderns, by the longevity of their labours, might one day become ancients themselves: and old time, that best weigher of merits, to keep his balance even, might have the golden weight of an Augustan age in both his scales: or rather, our scale might descend: and that of antiquity (as a modern match for it strongly speaks) might *kick the beam*.

Why condemned Maro his admirable epic to the flames? Was it not because his discerning eye saw some length of perfection beyond it? And what he saw, may not others reach? And who bid fairer than our countrymen for that glory? Something new may be expected from Britons particularly; who seem not to be more severed from the rest of mankind by the surrounding sea, than by the current in their veins; and of whom little more appears to be required, in order to give us originals, than a consistency of character, and making their compositions of a piece with their lives. May our genius shine; and proclaim us in that noble view!

—minimâ contentos nocte Britannos. VIRG.

And so it does; for in polite composition, in natural and mathematical knowledge, we have great originals already: Bacon, Boyle, Newton, Shakespeare, Milton, have showed us, that all the winds cannot blow the British flag farther, than an original spirit can convey the British fame; their names go round the world; and what foreign genius strikes not as they pass? Why should not their posterity embark in the same bold bottom of new enterprise, and hope the same success? Hope it they may; or we must assert, either that those originals, which we already enjoy, were written by angels, or deny that we are men. As Simonides said to Pausanias, reason should say to the writer, "Remember thou art a man." And for man not to grasp at all which is laudable within his reach, is a dishonour to human nature, and a disobedience to the divine; for as Heaven does nothing in vain, its gift of talents implies an injunction of their use.

Johnson, in the serious drama, is as much an imitator as Shakespeare is an original. He was very learned, as Sampson was very strong, to his own hurt. Blind to the nature of tragedy, he pulled down all antiquity on his head, and buried himself under it; we see nothing of Johnson, nor indeed of his admired (but also murdered) ancients; for what shone in the historian is a cloud on the poet; and Catiline might have been a good play if Sallust had never written.

Dryden, destitute of Shakespeare's genius, had almost as much learning as Johnson, and, for the buskin, quite as little taste. He was a stranger to the pathos, and, by numbers, expression, sentiment, and every other dramatic cheat, strove to make amends for it; as if a saint could make amends for the want of conscience; a soldier, for the want of valour; or a vestal, of modesty. The noble nature of tragedy disclaims an equivalent; like virtue, it demands the heart; and Dryden had none to give. Let epic poets *think*, the tragedian's point is rather to *feel*; such distant things are a tragedian and a poet, that the latter indulged, destroys the former. Look on Barnwell, and Essex, and see how as to these distant characters Dryden excels, and is excelled. But the strongest demonstration of his no-taste for the buskin, are his tragedies fringed with rhyme; which, in epic poetry, is a sore disease; in the tragic, absolute death. To Dryden's enormity, Pope's was a light offence. As lacemen are foes to mourning, these two authors, rich in rhyme, were no great friends to those solemn ornaments, which the noble nature of their works required.

Must rhyme then, it may be said, be banished? It is to be wished the nature of our language could bear its entire expulsion; but our lesser poetry stands in need of a toleration for it; it raises that, but sinks the great; as spangles adorn children, but expose men.

Among the brightest of the moderns, Mr Addison must take his place. Who does not approach his character with great respect? They who refuse to close with the public in his praise, refuse at their peril. But, if men will be fond of their own opinions, some hazard must be run. He had, what Dryden and Johnson wanted, a warm, and feeling heart; but, being of a grave and bashful nature, through a philosophic reserve, and a sort of moral prudery, he concealed it, where he should have let loose all his fire, and have showed the most tender sensibility of heart. At his celebrated Cato, few tears are shed, but Cato's own; which indeed are truly great, but unaffecting, except to the noble few who love their country better than themselves. The bulk of mankind want virtue enough to be touched by them. His strength of genius has reared up one glorious image, more lofty, and truly golden, than that in the plain of Dura, for cool admiration to gaze at, and warm patriotism (how rare!) to worship; while those two throbbing pulses of the drama, by which alone it is shown to live, *terror* and *pity*, neglected through the whole, leave our unmolested hearts at perfect peace. Thus the poet, like his hero, through mistaken excellence, and virtue overstrained, becomes a sort of suicide; and that which is most dramatic in the drama, dies. All his charms of poetry are but as funeral flowers which adorn, all his noble sentiments but as rich spices which embalm, the tragedy deceased.

Socrates frequented the plays of Euripides; and, what living Socrates would decline the theatre, at the representation of Cato? Tully's assassins found him in his litter, reading the Medea of the Grecian poet, to prepare himself for death. Part of Cato might be read to the same end. In the weight and dignity of moral reflection, Addison resembles that poet, who was called the dramatic philosopher; and is himself, as he says of Cato, *ambitiously sententious*. But as to the singular talent so remarkable in Euripides, at melting down hearts into the tender streams of grief and pity, there the resemblance fails. His beauties sparkle, but do not warm; they sparkle as stars in a frosty night. There is, indeed, a constellation in his play; there is the philosopher, patriot, orator, and poet; but where is the tragedian? And, if that is wanting,

Cur in theatrum Cato severe venisti? MART.

2. *Of epic and dramatic Compositions.*

Tragedy and the epic poem differ little in substantials: in

in both the ſame ends are propoſed, *viz.* inſtruction and amuſement; and in both the ſame means are employed, *viz.* imitation of human actions. They differ in the manner only of imitating: epic poetry deals in narration; tragedy repreſents its facts as paſſing in our ſight: in the former, the poet introduces himſelf as an hiſtorian; in the latter, he preſents his actors, and never himſelf.

This difference, regarding form only, may be thought ſlight: but the effects it occaſions, are by no means ſo; for what we ſee, makes a ſtronger impreſſion than what we learn from others. A narrative poem is a ſtory told by another: facts and incidents paſſing upon the ſtage, come under our own obſervation; and are beſide much enlivened by action and geſture, expreſſive of many ſentiments beyond the reach of language.

A dramatic compoſition has another property, independent altogether of action; which is, that it makes a deeper impreſſion than narration; in the former, perſons expreſs their own ſentiments; in the latter, ſentiments are related at ſecond hand. For that reaſon, Ariſtotle, the father of critics, lays it down as a rule, That in an epic poem the author ought to take every opportunity to introduce his actors, and to confine the narrative part within the narroweſt bounds. Homer underſtood perfectly the advantage of this method; and his poems are both of them in a great meaſure dramatic. Lucan runs to the oppoſite extreme; and is guilty of a ſtill greater fault, in ſtuffing his *Pharſalia* with cold and languid reflections, the merit of which he aſſumes to himſelf, and deigns not to ſhare with his perſonages.

Ariſtotle, from the nature of the fable, divides tragedy into ſimple and complex: but it is of greater moment, with reſpect to dramatic as well as epic poetry, to found a diſtinction upon the different ends attained by ſuch compoſitions. A poem, whether dramatic or epic, that has nothing in view but to move the paſſions, and to exhibit pictures of virtue and vice, may be diſtinguiſhed by the name of *pathetic:* but where a ſtory is purpoſely contrived to illuſtrate ſome moral truth, by ſhowing that diſorderly paſſions naturally lead to external misfortunes, ſuch compoſition may be denominated *moral.* Beſides making a deeper impreſſion than can be done by any moral diſcourſe, it affords conviction equal to that of the moſt accurate reaſoning. To be ſatisfied of this, we need but reflect, that the natural connection which vice hath with miſery, and virtue with happineſs, may be illuſtrated by ſtating a fact as well as by urging an argument. Let us aſſume, for example, the following moral truths: That diſcord among the chiefs renders ineffectual all common meaſures; and that the conſequences of a ſlightly-founded quarrel, foſtered by pride and arrogance, are not leſs fatal than thoſe of the groſſeſt injury: theſe truths may be inculcated, by the quarrel between Agamemnon and Achilles at the ſiege of Troy. In this view, probable circumſtances muſt be invented, ſuch as furniſh an opportunity for the turbulent paſſions to exert themſelves in action: at the ſame time, no accidental nor unaccountable event ought to be admitted; for the neceſſary or probable connection between vice and miſery, is not learned from any events but what are naturally occaſioned by the characters and paſſions of the perſons repreſented, acting in ſuch and ſuch circumſtances. A real event of which we ſee not the cauſe, may be a leſſon to us; becauſe what hath happened may again happen: but this cannot be inferred from a ſtory that is known to be a fiction.

Many are the good effects of ſuch compoſitions. A pathetic compoſition, whether epic or dramatic, tends to a habit of virtue, by exciting us to do what is right, and reſtraining from what is wrong. Its frequent pictures of human woes produce, beſide, two effects extremely ſalutary: they improve our ſympathy, and at the ſame time fortify us in bearing our own misfortunes. A moral compoſition muſt obviouſly produce the ſame good effects, becauſe by being moral it doth not ceaſe to be pathetic: it enjoys beſide an excellence peculiar to itſelf; for it not only improves the heart, as above mentioned, but inſtructs the head by the moral it contains. For our part, we cannot imagine any entertainment more ſuited to a rational being, than a work thus happily illuſtrating ſome moral truth; where a number of perſons of different characters are engaged in an important action, ſome retarding, others promoting, the great cataſtrophe; and where there is dignity of ſtyle as well as of matter. A work of this kind has our ſympathy at command, and can put in motion the whole train of the ſocial affections: our curioſity is by turns excited and gratified; and our delight is conſummated at the cloſe, upon finding, from the characters and ſituations exhibited at the commencement, that every incident down to the final cataſtrophe is natural, and that the whole in conjunction make a regular chain of cauſes and effects.

Conſidering that an epic and a dramatic poem are the ſame in ſubſtance, and have the ſame aim or end, one would readily imagine, that ſubjects proper for the one muſt be equally proper for the other. But conſidering their difference as to form, there will be found reaſon to correct that conjecture, at leaſt in ſome degree. Many ſubjects may indeed be treated with equal advantage in either form; but the ſubjects are ſtill more numerous for which they are not equally qualified; and there are ſubjects proper for the one and not at all for the other. To give ſome ſlight notion of the difference, as there is no room here for enlarging upon every article, we obſerve, that dialogue is the beſt qualified for expreſſing ſetiments, and narrative for diſplaying facts. Heroiſm, magnanimity, undaunted courage, and the whole tribe of the elevated virtues, figure beſt in action: tender paſſions, and the whole tribe of ſympathetic affections, figure beſt in ſentiment: what we feel is the moſt remarkable in the latter; what we perform is the moſt remarkable in the former. It clearly follows, that tender paſſions are more peculiarly the province of tragedy, grand and heroic actions of epic poetry.

The ſubject beſt fitted for tragedy is a ſtory where a man has himſelf been the cauſe of his misfortune. But this man muſt neither be deeply guilty, nor altogether innocent: the misfortune muſt be occaſioned by a fault incident to human nature, and therefore venial. Misfortunes of this kind call forth the ſocial affections, and warmly intereſt the ſpectator. An accidental misfortune, if not extremely ſingular, doth not greatly move

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our pity: the perſon who ſuffers, being innocent, is freed from the greateſt of all torments, that anguiſh of mind which is occaſioned by remorſe.

An atrocious criminal, on the other hand, who brings misfortunes upon himſelf, excites little pity, for a different reaſon: his remorſe, it is true, aggravates his diſtreſs, and ſwells the firſt emotions of pity; but then our hatred of him as a criminal blending with pity, blunts its edge conſiderably. Misfortunes that are not innocent, nor highly criminal, partake the advantages of each extreme: they are attended with remorſe to embitter the diſtreſs, which raiſes our pity to a great height; and the ſlight indignation we have at a venial fault, detracts not ſenſibly from our pity. For this reaſon, the happieſt of all ſubjects for raiſing pity, is where a man of integrity falls into a great misfortune by doing an action that is innocent, but which by ſome ſingular means he conceives to be criminal: his remorſe aggravates his diſtreſs; and our compaſſion, unreſtrained by indignation, riſes to its higheſt pitch. Pity comes thus to be the ruling paſſion of a pathetic tragedy; and by proper repreſentation, may be raiſed to a height ſcarce exceeded by any thing felt in real life. A moral tragedy takes in a larger field; for, beſide exerciſing our pity, it raiſes another paſſion, ſelfiſh indeed, but which deſerves to be cheriſhed equally with the ſocial affections. The paſſion we have in view is fear or terror; for when a misfortune is the natural conſequence of ſome wrong bias in the temper, every ſpectator who is conſcious of ſuch a wrong bias in his own temper, takes the alarm, and dreads his falling into the ſame misfortune: and it is by this emotion of fear or terror, frequently reiterated in a variety of moral tragedies, that the ſpectators are put upon their guard againſt the diſorders of paſſion.

The commentators upon Ariſtotle, and other critics, have been much gravelled about the account given of tragedy by this author: "That by means of pity and terror, it refines or purifies in us all ſorts of paſſion." But no one who has a clear conception of the end and effects of a good tragedy, can have any difficulty about Ariſtotle's meaning: our pity is engaged for the perſons repreſented; and our terror is upon our own account. Pity indeed is here made to ſtand for all the ſympathetic emotions, becauſe of theſe it is the capital. There can be no doubt, that our ſympathetic emotions are refined or improved by daily exerciſe; and in what manner our other paſſions are refined by terror, we have juſt now ſaid.

With reſpect to ſubjects of this kind, it may indeed be a doubtful queſtion, whether the concluſion ought not always to be fortunate. Where a perſon of integrity is repreſented as ſuffering to the end under misfortunes purely accidental, we depart diſcontented, and with ſome obſcure ſenſe of injuſtice: for ſeldom is man ſo ſubmiſſive to providence, as not to revolt againſt the tyranny and vexations of blind chance; he will be inclined to ſay, This ought not to be. We give for an example the Romeo and Juliet of Shakeſpeare, where the fatal cataſtrophe occaſioned by Friar Laurence's coming to the monument a minute too late. We are vexed at the unlucky chance, and go away diſſatisfied. Such impreſſions, which ought not to be cheriſhed, are a ſufficient reaſon for excluding ſtories of that kind from the theatre. The misfortunes of a virtuous perſon, ariſing from neceſſary cauſes, or from a chain of unavoidable circumſtances, will be conſidered in a different light: chance affords always a gloomy proſpect, and in every inſtance gives an impreſſion of anarchy and miſrule: a regular chain, on the contrary, of cauſes and effects, directed by the general laws of nature, never fails to ſuggeſt the hand of Providence; to which we ſubmit without reſentment, being conſcious that ſubmiſſion is our duty. For that reaſon, we are not diſguſted with the diſtreſſes of Voltaire's Mariamne, though redoubled on her till the moment of her death, without the leaſt fault or failing on her part: her misfortunes are owing to a cauſe extremely natural, and not unfrequent, the jealouſy of a barbarous huſband. The fate of Deſdemona in the Moor of Venice, affects us in the ſame manner. We are not ſo eaſily reconciled to the fate of Cordelia in King Lear: the cauſes of her misfortune are by no means ſo evident, as to exclude the gloomy notion of chance. In ſhort, a perfect character ſuffering under misfortunes, is qualified for being the ſubject of a pathetic tragedy, provided chance be excluded. Nor is a perfect character altogether inconſiſtent with a moral tragedy: it may ſucceſsfully be introduced as an under-part, ſuppoſing the chief place to be filled with an imperfect character from which a moral can be drawn. This is the caſe of Deſdemona and Mariamne juſt now mentioned; and it is the caſe of Monimia and Belvidera, in Otway's two tragedies, the Orphan, and Venice Preſerved.

Fable operates on our paſſions, by repreſenting its events as paſſing in our ſight, and by deluding us into a conviction of reality. Hence, in epic and dramatic compoſitions, it is of importance to employ means of every ſort that may promote the deluſion, ſuch as the borrowing from hiſtory ſome noted event, with the addition of circumſtances that may anſwer the author's purpoſe: the principal facts are known to be true; and we are diſpoſed to extend our belief to every circumſtance. But in chuſing a ſubject that makes a figure in hiſtory, greater precaution is neceſſary than where the whole is a fiction. In the latter caſe there is full ſcope for invention: the author is under no reſtraint other than that the characters and incidents be juſt copies of nature. But where the ſtory is founded on truth, no circumſtances muſt be added, but ſuch as connect naturally with what are known to be true; hiſtory may be ſupplied, but muſt not be contradicted: further, the ſubject choſen muſt be diſtant in time, or at leaſt in place; for the familiarity of perſons and events nearly connected with us, ought by all means to be avoided. Familiarity ought more eſpecially to be avoided in an epic poem, the peculiar character of which is dignity and elevation: modern manners make but a poor figure in ſuch a poem.

After Voltaire, no writer, it is probable, will think of rearing an epic poem upon a recent event in the hiſtory of his own country. But an event of this kind is perhaps not altogether unqualified for tragedy: it was admitted in Greece; and Shakeſpear has employed it ſucceſsfully

cessfully in several of his pieces. One advantage it possesses above fiction, that of more readily engaging our belief, which tends above any other particular to raise our sympathy. The scene of comedy is generally laid at home: familiarity is no objection; and we are peculiarly sensible of the ridicule of our own manners.

After a proper subject is chosen, the dividing it into parts requires some art. The conclusion of a book in an epic poem, or of an act in a play, cannot be altogether arbitrary; nor be intended for so slight a purpose as to make the parts of equal length. The supposed pause at the end of every book, and the real pause at the end of every act, ought always to coincide with some pause in the action. In this respect, a dramatic or epic poem ought to resemble a sentence or period in language, divided into members that are distinguished from each other by proper pauses; or it ought to resemble a piece of music, having a full close at the end, preceded by imperfect closes that contribute to the melody. Every act in a dramatic poem ought therefore to close with some incident that makes a pause in the action; for otherwise there can be no pretext for interrupting the representation: it would be absurd to break off in the very heat of action; against which every one would exclaim: the absurdity still remains, though the action relents, if it be not actually suspended for some time. This rule is also applicable to an epic poem: though there, a deviation from the rule is less remarkable; because it is in the reader's power to hide the absurdity, by proceeding instantly to another book. The first book of the Paradise Lost ends without any regular close, perfect or imperfect: it breaks off abruptly, where Satan, seated on his throne, is prepared to make a speech to the convocated host of the fallen angels; and the second book begins with the speech. Milton seems to have copied the Æneid, of which the two first books are divided much in the same manner. Neither is there any proper pause at the end of the fifth book of the Æneid. There is no proper pause at the end of the seventh book of Paradise Lost, nor at the end of the eleventh.

This branch of the subject shall be closed with a general rule, That action being the fundamental part of every composition whether epic or dramatic, the sentiments and tone of language ought to be subservient to the action, so as in every respect to appear natural, and proper for the occasion. The application of this rule to our modern plays, would reduce the bulk of them to a skeleton.

After carrying on together epic and dramatic compositions, we proceed to handle them separately, and to mention circumstances peculiar to each, beginning with the epic kind. In a theatrical entertainment, which employs both the eye and the ear, it would be a gross absurdity to introduce upon the stage superior beings in a visible shape. There is not place for this objection in an epic poem; and Boileau, with many other critics, declares strongly for this sort of machinery in an epic poem. But waving authority, which is apt to impose upon the judgment, let us draw what light we can from reason. This matter is but indistinctly handled by critics: the poetical privilege of animating insensible objects for enlivening a description, is very different from what is termed *machinery*, where deities, angels, devils, or other supernatural powers, are introduced as real personages, mixing in the action, and contributing to the catastrophe; and yet these two things are constantly jumbled together in the reasoning. The former is founded on a natural principle: but can the latter claim the same authority? so far from it, that nothing can be more unnatural. Its effects, at the same time, are deplorable. First, it gives an air of fiction to the whole; and prevents that impression of reality which is requisite to interest our affections, and to move our passions: this of itself is sufficient to explode machinery, whatever entertainment it may afford to readers of a fantastic taste or irregular imagination. And, next, were it possible, by disguising the fiction, to delude us into a notion of reality, an insuperable objection would still remain, which is, that the aim or end of an epic poem can never be attained in any perfection where machinery is introduced; for an evident reason, that virtuous emotions cannot be raised successfully but by the actions of those who are endued with passions and affections like our own, that is, by human actions: and as for moral instruction, it is clear, that none can be drawn from beings who act not upon the same principles with us. A fable in Æsop's manner is no objection to this reasoning: his lions, bulls, and goats, are truly men under disguise: they act and feel in every respect as human beings; and the moral we draw is founded on that supposition. Homer, it is true, introduces the gods into his fable: but he was authorised to take that liberty by the religion of his country; it being an article in the Grecian creed, that the gods often interpose visibly and bodily in human affairs. We must however observe, that Homer's deities do no honour to his poems: fictions that transgress the bounds of nature, seldom have a good effect: they may inflame the imagination for a moment, but will not be relished by any person of a correct taste. Let us add, that of whatever use such fictions may be to a mean genius, an able writer has much finer materials of Nature's production, for elevating his subject, and making it interesting.

The marvellous is indeed so much promoted by machinery, that it is not wonderful to find it embraced by the bulk of writers, and perhaps of readers. If indulged at all, it is generally indulged to excess. Homer introduces his deities with no greater ceremony than his mortals; and Virgil has still less moderation: a pilot spent with watching cannot fall asleep and drop into the sea by natural means: one bed cannot hold the two lovers, Æneas and Dido, without the immediate interposition of superior powers. The ridiculous in such fictions must appear, even through the thickest vail of gravity and solemnity.

Angels and devils serve equally with the Heathen deities, as materials for figurative language, perhaps better among Christians, because we believe in them, and not in the Heathen deities. But every one is sensible, as well as Boileau, that the invisible powers in our creed make a much worse figure as actors in a modern poem, than the invisible powers in the Heathen creed did in ancient times. The reason seems to be what follows. The Heathen deities, in the opinion of their votaries, were

were beings elevated one ſtep only above mankind, actuated by the ſame paſſions, and directed by the ſame motives; therefore not altogether improper to mix with men in an important action. In our creed, ſuperior beings are placed at ſuch a mighty diſtance from us, and are of a nature ſo different, that with no propriety can they appear with us upon the ſame ſtage: man is a creature ſo much inferior, that he loſes all dignity when ſet in oppoſition.

There can be no doubt, that an hiſtorical poem admits the embelliſhment of allegory, as well as of metaphor, ſimile, or other figure. Moral truth, in particular, is finely illuſtrated in the allegorical manner: it amuſes the fancy to find abſtract terms, by a ſort of magic, converted into active beings; and it is delightful to trace a general propoſition in a pictured event. But allegorical beings ſhould be confined within their own ſphere, and never be admitted to mix in the principal action, nor to co-operate in retarding or advancing the cataſtrophe; which would have a ſtill worſe effect than inviſible powers, and we are ready to aſſign the reaſon. The impreſſion of real exiſtence, eſſential to an epic poem, is inconſiſtent with that figurative exiſtence which is eſſential to an allegory; and therefore no method can be more effectual to prevent the impreſſion of reality, than to introduce allegorical beings co-operating with thoſe whom we conceive to be really exiſting. The love-epiſode in the Henriade, inſufferable by the diſcordant mixture of allegory with real life, is copied from that of Rinaldo and Armida in the *Gieruſalemme liberata*, which hath no merit to intitle it to be copied. An allegorical object, ſuch as Fame in the Æneid, and the Temple of Love in the Henriade, may find place in a deſcription: but to introduce Diſcord as a real perſonage, imploring the aſſiſtance of Love as another real perſonage, to enervate the courage of the hero, is making theſe figurative beings act beyond ther ſphere, and creating a ſtrange jumble of truth and fiction.

What is the true notion of an epiſode? or how is it to be diſtinguiſhed from the principal action? Every incident that promotes or retards the cataſtrophe, muſt be a part of the principal action. This clears the nature of an epiſode; which may be defined, "An incident connected with the principal action, but contributing neither to advance nor retard it." The deſcent of Æneas into hell doth not advance nor retard the cataſtrophe; and therefore is an epiſode. The ſtory of Niſus and Euryalus, producing an alteration in the affairs of the contending parties, is a part of the principal action. The family-ſcene in the ſixth book of the Iliad is of the ſame nature: by Hector's retiring from the field of battle to viſit his wife, the Grecians had liberty to breathe, and even to preſs upon the Trojans. Such being the nature of an epiſode, the unavoidable effect of it muſt be, to break in upon the unity of action; and therefore it ought never to be indulged, unleſs to unbend the mind after the fatigue of a long narration. This purpoſe of an epiſode demands the following conditions: it ought to be well connected with the principal action: it ought to be lively and intereſting: it ought to be ſhort: and a time ought to be choſen when the principal action relents.

Next, upon the peculiarities of a dramatic poem. And the firſt we ſhall mention is a double plot; one of which muſt be of the nature of an epiſode in an epic poem; for it would diſtract the ſpectator, inſtead of entertaining him, if he were forced to attend, at the ſame time, to two capital plots equally intereſting. And even ſuppoſing it an under-plot, of the nature of an epiſode, it ſeldom hath a good effect in tragedy, of which ſimplicity is a chief property; for an intereſting ſubject that engages our warmeſt affections, occupies our whole attention, and leaves no room for any ſeparate concern. Variety is more tolerable in comedy, which pretends only to amuſe, without totally occupying the mind. But even here to make a double plot agreeable, is no ſlight effort of art: the under plot ought not to vary greatly in its tone from the principal; for diſcordant paſſions are unpleaſant when jumbled together; which, by the way, is an inſuperable objection to tragi-comedy. Upon this account, we blame the Provoked Huſband: all the ſcenes that bring the family of the Wrongheads into action, being ludicrous and farcical, agree very ill with the principal ſcenes, diſplaying ſevere and bitter expoſtulations between lord Townly and his lady. The ſame objection touches not the double plot of the Careleſs Huſband; the different ſubjects being ſweetly connected, and having only ſo much variety as to reſemble ſhades of colours harmoniouſly mixed. But this is not all. The under plot ought to be connected with that which is principal, ſo much at leaſt as to employ the ſame perſons: the under-plot ought to occupy the intervals or pauſes of the principal action; and both ought to be concluded together. This is the caſe of the Merry Wives of Windſor.

Violent action ought never to be repreſented on the ſtage. While the dialogue runs on, a thouſand particulars concur to delude us into an impreſſion of reality, genuine ſentiments, paſſionate language, and perſuaſive geſture: the ſpectator once engaged, is willing to be deceived, loſes ſight of himſelf, and without ſcruple enjoys the ſpectacle as a reality. From this abſent ſtate, he is rouſed by violent action: he wakes as from a pleaſing dream, and gathering his ſenſes about him, finds all to be a fiction.

The French critics join with Horace in excluding from the ſtage the ſhedding blood; but they have overlooked the moſt ſubſtantial objection, that above-mentioned, urging only that it is barbarous, and ſhocking to a polite audience. But the Greeks had no notion of ſuch delicacy, or rather effeminacy; witneſs the murder of Clytemneſtra by her ſon Oreſtes, paſſing behind the ſcene, as repreſented by Sophocles: her voice is heard calling out for mercy, bitter expoſtulations on his part, loud ſhrieks upon her being ſtabbed, and then a deep ſilence. We appeal to every perſon of feeling, whether this ſcene be not more horrible, than if the deed had been committed in ſight of the ſpectators upon a ſudden guſt of paſſion. If Corneille, in repreſenting the affair between Horatius and his ſiſter upon which murder enſues behind the ſcene, had

had no other view but to remove from the ſpectators a ſhocking action, he certainly was in a capital miſtake: for murder in cold blood, which in ſome meaſure was the caſe as repreſented, is more ſhocking to a polite audience, even where the concluſive ſtab is not ſeen, than the ſame act performed in their preſence, when it is occaſioned by violent and unpremeditated paſſion, as ſuddenly repented of as committed. We heartily agree with Addiſon, that no part of this incident ought to have been repreſented, but reſerved for a narrative, with every alleviating circumſtance in favour of the hero. This is the only method to avoid the difficulties that unqualify this incident for repreſentation, a deliberate murder on the one hand, and on the other a violent action performed on the ſtage, which muſt rouſe the ſpectator from his dream of reality.

A few words upon the dialogue, which ought to be ſo conducted as to be a true repreſentation of nature. Every ſingle ſpeech, ſhort or long, ought to ariſe from what is ſaid by the former ſpeaker, and furniſh matter for what comes after, till the end of the ſcene. In this view, the whole ſpeeches, from firſt to laſt, repreſent ſo many links, all connected together in one regular chain. No author, ancient or modern, poſſeſſes the art of dialogue equal to Shakeſpeare. Dryden in this particular may juſtly be placed as his oppoſite: he frequently introduces three or four perſons ſpeaking upon the ſame ſubject, each throwing out his own ſentiments ſeparately, without regarding what is ſaid by the reſt; take for an example the firſt ſcene of Aurenzebe: ſometimes he makes a number club in relating an event, not to a ſtranger, ſuppoſed ignorant of it, but to one another, for the ſake merely of ſpeaking: of which notable ſort of dialogue, we have a ſpecimen in the firſt ſcene of the firſt part of the Conqueſt of Granada. In the ſecond part of the ſame tragedy, ſcene ſecond, the king, Abenamar, and Zulema, make their ſeparate obſervations, like ſo many ſoliloquies, upon the fluctuating temper of the mob: a dialogue ſo uncouth, puts one in mind of two ſhepherds in a paſtoral, excited by a prize to pronounce verſes alternately, each in praiſe of his own miſtreſs.

The bandying ſentiments in this manner, beſide an unnatural air, has another bad effect: it ſtays the courſe of the action, becauſe it is not productive of any conſequence. In Congreve's comedies, the action is often ſuſpended to make way for a play of wit.

No fault is more common among writers, than to prolong a ſpeech after the impatience of the perſon to whom it is addreſſed ought to prompt him or her to break in. Conſider only how the impatient actor is to behave in the mean time. To expreſs his impatience in violent action without interrupting, would be unnatural; and yet to diſſemble his impatience by appearing cool where he ought to be highly inflamed, would be no leſs unnatural.

Rhyme being unnatural and diſguſtful in dialogue, is happily baniſhed from our theatre: the only wonder is, that it ever found admittance, eſpecially among a people accuſtomed to the more manly freedom of Shakeſpeare's dialogue. By baniſhing rhyme, we have gained ſo much as never once to dream that there can be any further improvement. And yet, however ſuitable blank verſe may be to elevated characters and warm paſſions, it muſt appear improper and affected in the mouths of the lower ſort. Why then ſhould it be a rule, that every ſcene in tragedy muſt be in blank verſe? Shakeſpeare, with great judgment, has followed a different rule; which is, to intermix proſe with verſe, and only to employ the latter where the importance or dignity of the ſubject requires it. Familiar thoughts and ordinary facts ought to be expreſſed in plain language; and if it appear not ridiculous to hear a footman deliver a ſimple meſſage in blank verſe, a vail muſt be drawn over the ridiculous appearance by the force of cuſtom. In ſhort, that variety of characters and of ſituations, which is the life of a play, requires not only a ſuitable variety in the ſentiments, but alſo in the diction.

Composition, in painting, conſiſts of two parts, invention and diſpoſition; the firſt whereof is the choice of the objects which are to enter into the compoſition of the ſubject the painter intends to execute, and is either ſimply hiſtorical or allegorical.

Composition, in commerce, a contract between an inſolvent debtor and his creditors, whereby the latter accept of a part of the debt in compenſation for the whole, and give a general acquittance accordingly.

Composition, in printing, commonly termed compoſing, the arranging of ſeveral types, or letters, in the compoſing-ſtick, in order to form a line; and of ſeveral lines ranged in order in the galley, to make a page; and of ſeveral pages, to make a form. See Printing.

COMPOST, in huſbandry and gardening, ſeveral ſorts of ſoils, or earthy matter, mixed together, in order to make a manure, for aſſiſting the natural earth in the work of vegetation, by way of amendment or improvement. See Agriculture.

COMPOSTELLA, the capital of Galicia, in Spain, remarkable for the devotion paid there by pilgrims from all countries to the relics of St James.

COMPOUND, in a general ſenſe, an appellation given to whatever is compoſed, or made up of different things: thus we ſay, a compound word, compound ſound, compound taſte, compound force, *&c.*

Compound-interest. See Interest.

Compound numbers, thoſe which may be divided by ſome other number beſides unity, without leaving any remainder: ſuch are 18, 20, *&c.* the firſt being meaſured by the numbers 2, 6, or 9; and the ſecond by the numbers 2, 4, 5, 10.

COMPREHENSION, in logic, the ſame with apprehenſion.

COMPRESSION, the act of preſſing or ſqueezing ſome matter, ſo as to ſet its parts nearer to each other, and make it poſſeſs leſs ſpace.

COMPRINT, among bookſellers, ſignifies a ſurreptitious printing of another's copy, in order to gain thereby, which is expreſsly contrary to ſtatute 14 Car. II.

COMPROMISE, a treaty, or contract, whereby two contending

contending parties eſtabliſh one or more arbitrators, to judge of and terminate their difference in an amicable way.

COMPUNCTION, in theology, an inward grief of mind, for having offended God.

COMPUTATION, in a general ſenſe, the manner of eſtimating time, weights, meaſure, moneys, or quantities of any kind.

CONARION, or CONOIDES, a name for the pineal gland. See Vol. I. p. 286.

CONATUS, a term frequently uſed in philoſophy and mathematics, defined by ſome to be a quantity of motion, not capable of being expreſſed by any time, or length; as the *conatus recedendi ab axe motus*, is the endeavour which a body, moved circularly, makes to recede, or fly off from the centre or axis of its motion. See MECHANICS.

CONCATENATION, a term chiefly uſed in ſpeaking of the mutual dependence of ſecond cauſes upon each other.

CONCAVE, an appellation uſed in ſpeaking of the inner ſurface of hollow bodies, but more eſpecially of ſpherical ones.

CONCAVE GLASSES, ſuch as are ground hollow, and are uſually of a ſpherical figure, though they may be of any other, as parabolical, *&c.* All objects ſeen through concave glaſſes, appear erect and diminiſhed. See OPTICS.

CONCENTRATION, in general, ſignifies the bringing things nearer a center. Hence the particles of ſalt, in ſea-water, are ſaid to be concentrated; that is, brought nearer each other, by evaporating the watery part. See CHEMISTRY.

CONCENTRIC, in mathematics, ſomething that has the ſame common center with another: it ſtands in oppoſition to excentric.

CONCEPTION, among phyſicians, *&c.* denotes the firſt formation of an embryo in the womb of its parent, who from that time becomes pregnant. See GENERATION.

CONCEPTION, in logic. See APPREHENSION.

CONCEPTION, in geography, a city of Chili, in South America, ſituated on the Pacific Ocean, in 79° W. long. and 37° S. lat.

CONCEPTION is alſo the capital of the province of Veragua, in Mexico, about 100 miles weſt of Porto Bello: W. long. 83°, and N. lat. 10°.

CONCERT, or CONCERTO, in muſic, a number or company of muſicians, playing or ſinging the ſame piece of muſic or ſong at the ſame time. See MUSIC.

CONCERTATO intimates the piece of muſic to be compoſed in ſuch a manner, as that all the parts may have their recitativos, be it for two, three, four, or more voices or inſtruments.

CONCERTO GROSSI, the grand chorus of a concert, or thoſe places where all the ſeveral parts perform or play together.

CONCHA, in zoology, a ſynonime of the MYTILUS, SOLEN, *&c.* See theſe articles.

CONCHA, in anatomy. See Vol. I. p. 297.

CONCHOID, in geometry, the name of a curve, given it by its inventor Nicomedes. See FLUXIONS.

CONCHYLIA, a general name for all kinds of petrified ſhells, as limpets, cochlea, nautili, conchæ, lepades, *&c.*

CONCINNOUS *intervals*, in muſic, are ſuch as are fit for muſic, next to, and in combination with concords; being neither very agreeable, nor diſagreeable in themſelves, but having a good effect, as by their oppoſition they heighten the more eſſential principles of pleaſure; or as by their mixture and combination with them, they produce a variety neceſſary to our being better pleaſed.

CONCINNOUS *ſyſtem*, in muſic. A ſyſtem is ſaid to be concinnous, or divided concinnouſly, when its parts, conſidered as ſimple intervals, are concinnous; and are beſides placed in ſuch an order between the extremes, as that the ſucceſſion of ſounds, from one extreme to the other, may have an agreeable effect.

CONCLAVE, the place in which the cardinals of the Romiſh church meet, and are ſhut up, in order to the election of a pope.

The conclave is a range of ſmall cells, ten feet ſquare, made of wainſcot: theſe are numbered, and drawn for by lot. They ſtand in a line along the galleries and hall of the Vatican, with a ſmall ſpace between each. Every cell has the arms of the cardinal over it. The conclave is not fixed to any one determinate place, for the conſtitutions of the church allow the cardinals to make choice of ſuch a place for the conclave as they think moſt convenient; yet it is generally held in the Vatican.

The conclave is very ſtrictly guarded by troops: neither the cardinals, nor any perſon ſhut up in the conclave, are ſpoke to, but at the hours allowed of, and then in Italian or Latin; even the proviſions for the conclave are examined, that no letters be conveyed by that means from the miniſters of foreign powers, or other perſons who may have an intereſt in the election of the pontiff.

CONCLAVE is alſo uſed for the aſſembly, or meeting, of the cardinals ſhut up, for the election of a pope.

CONCLUSION, in logic, the conſequence or judgment, drawn from what was aſſerted in the premiſſes; or the previous judgments in reaſoning, gained from combining the extreme ideas between themſelves.

CONCOCTION, in medicine, the change which the food undergoes in the ſtomach, *&c.* to become chyle. See CHYLE.

CONCOMITANT, ſomething that accompanies or goes along with another.

CONCORD, in grammar, that part of conſtruction called ſyntax, in which the words of a ſentence agree; that is, in which nouns are put in the ſame gender, number, and caſe; and verbs in the ſame number and perſon with nouns and pronouns.

CONCORD, in muſic, the relation of two ſounds that are always agreeable to the ear, whether applied in ſucceſſion or conſonance. See MUSIC.

CONCORDANCE, a ſort of dictionary of the Bible, explaining

explaining the words thereof in alphabetical order, with the ſeveral books, chapters, and verſes quoted, in which they are contained.

CONCORDIA, in geography, a town of the dutchy of Mantua in Italy, about fifteen miles ſouth-eaſt of the city of Mantua: E. long. 11° 20′, and N. lat. 45°.

CONCRETE, in the ſchool-philoſophy, an aſſemblage or compound.

Concrete, in natural philoſophy and chemiſtry, ſignifies a body made up of different principles, or any mixed body: thus ſoap is a factitious concrete, or a body mixed together by art; and antimony is a natural concrete, or a mixed body, compounded in the bowels of the earth.

CONCRETION, the uniting together ſeveral ſmall particles of a natural body into ſenſible maſſes, or concretes, whereby it becomes ſo and ſo figured and determined, and is endued with ſuch and ſuch properties.

Concretion is alſo the act whereby ſoft bodies are rendered hard; or an inſenſible motion of the particles of a fluid or a ſoft body, whereby they come to a conſiſtence. It is indifferently uſed for induration, condenſation, congelation, and coagulation.

CONCUBINAGE, denotes ſometimes a criminal or prohibited commerce between the ſexes; in which ſenſe it comprehends adultery, inceſt, and ſimple fornication: but, in a more limited ſenſe, it ſignifies the cohabitation of a man and a woman in the way of marriage, without having paſſed the ceremony thereof.

CONCUBINE, a woman whom a man takes to cohabit with in the manner of a wife, without being authoriſed thereto by a legal marriage.

CONCUPISCENCE, according to divines, an irregular appetite, or luſt after carnal things, inherent in the nature of man ever ſince the fall.

CONDAMIN, in botany. See Cinchona.

CONDE, a town of the French Netherlands, in the province of Hainault, ſituated on the river Scheld, about twelve miles weſt of Mons: E. long. 3° 40′, N. lat. 50° 35′.

CONDENSATION, the act whereby a body is rendered more denſe, compact, and heavy.

CONDENSER, a pneumatic engine, or ſyringe, whereby an uncommon quantity of air may be crouded into a given ſpace; ſo that ſometimes ten atmoſpheres, or ten times as much air as there is at the ſame time, in the ſame ſpace, without the engine, may be thrown in by means of it, and its egreſs prevented by valves properly diſpoſed. See Pneumatics.

CONDITION, in the civil law, a clauſe of obligation ſtipulated as an article of a treaty or contract; or in a donation of teſtament, legacy, &c. in which laſt caſe a donee does not loſe his donative, if it be charged with any diſhoneſt or impoſſible conditions.

CONDITIONALS, ſomething not abſolute but ſubject to conditions.

CONDOM, the capital of the Condomois, in the province of Gaſcony, in France, about ſixty miles ſouth-eaſt of Bourdeaux. It is a biſhop's ſee, and ſituated in 20′ E. long. and 44° 5′ N. lat.

CONDORMIENTES, in church hiſtory, religious ſectaries, who hold their name from lying all together, men and women, young and old. They aroſe in the thirteenth century near Cologne, where they are ſaid to have worſhipped an image of Lucifer, and to have received anſwers and oracles from him.

CONDUCTOR, in ſurgery, an inſtrument which ſerves to conduct the knife in the operation of cutting for the ſtone, and in laying up ſinuſes and fiſtulas. See Surgery.

CONDUIT, a canal or pipe for the conveyance of water, or other fluid.

There are ſeveral ſubterraneous conduits through which the waters paſs that form ſprings. Artificial conduits for water are made of lead, ſtone, caſt-iron, potter's earth, timber, &c.

CONDYLOMA, in medicine, a tubercle or callous eminence which ariſes in the folds of the anus, or rather a ſwelling or hardening of the wrinkles of that part.

CONDYLUS, a name given by anatomiſts to a knot in any of the joints, formed by the epiphyſis of a bone.

CONE, in geometry, a ſolid figure, having a circle for its baſe, and its top terminated in a point or vertex. See Conic Sections.

Cone *of rays*, in optics, includes all the ſeveral rays which fall from any radiant point on the ſurface of a glaſs. See Optics.

CONESSI, a ſort of bark of a tree which grows on the Coromandel coaſt in the Eaſt-Indies. It is recommended in a letter to Dr Monro, in the Medical Eſſays, as a ſpecific in diarrhœas. It is to be pounded into a fine powder, and made into an electuary with ſyrup of oranges; and the bark ſhould be freſh, and the electuary new made every day, or ſecond day, otherwiſe it loſes its auſtere but grateful bitterneſs on the palate, and its proper effects on the inteſtines.

CONFECTION, in pharmacy, ſignifies in general any thing prepared with ſugar: in particular, it imports ſomething preſerved, eſpecially dry ſubſtances. It alſo ſignifies a liquid or ſoft electuary, of which there are various ſorts directed in diſpenſatories.

CONFECTS, a denomination given to fruits, flowers, herbs, roots, &c. when boiled or prepared with ſugar or honey, to diſpoſe them to keep, and render them more agreeable to the taſte.

CONFERVA, in botany, a genus of the cryptogamia algæ claſs, conſiſting of oblong, capillary filaments; without any joints. There are twenty-one ſpecies.

CONFESSION, in a legal ſenſe, an acknowledgment of ſome truth, though in prejudice of the perſon that makes the declaration.

Confession, among divines, the verbal acknowledgement which a Chriſtian makes of his ſins.

Among the Jews it was a cuſtom, on the annual feaſt of expiation, for the high-prieſt to make confeſſion of ſins to God in the name of the whole people: beſides this general confeſſion, the Jews were enjoined, if their ſins were a breach of the firſt table of the law, to make confeſſion of them to God; but violations offered the ſecond table, were to be acknowledged to their brethren. The confeſſions of the primitive Chri-

ſtians were all voluntary, and not impoſed on them by any laws of the church; yet private confeſſion was not only allowed, but encouraged.

The Romiſh church requires confeſſion not only as a duty, but has advanced it to the dignity of a ſacrament: this confeſſion is made to the prieſt, and is private and auricular; and the prieſt is not to reveal them under pain of the higheſt puniſhment.

CONFESSION *of faith*, a liſt of the ſeveral articles of belief in any church.

CONFESSIONAL, or CONFESSIONARY, a place in churches, under the great altar, where the bodies of deceaſed ſaints, martyrs, and confeſſors, were depoſited.

CONFESSOR, in the Romiſh church, a prieſt who is impowered to receive the confeſſion of penitents, and to give them abſolution.

CONFIGURATION, the outward figure which bounds bodies, and gives them their external appearance; being that which, in a great meaſure, conſtitutes the ſpecific difference between bodies.

CONFIRMATION *by a ſuperior*. See SCOTS LAW, title, *Tranſmiſſion of rights by confirmation*.

CONFIRMATION *of a teſtament*. See SCOTS LAW, title, *Succeſſion in moveables*.

CONFIRMATION, in theology, the ceremony of laying on of hands, for the conveyance of the Holy Ghoſt.

The antiquity of this ceremony is, by all ancient writers, carried as high as the apoſtles, and founded upon their example and practice. In the primitive church, it uſed to be given to Chriſtians immediately after baptiſm, if the biſhop happened to be preſent at the ſolemnity. Among the Greeks, and throughout the Eaſt, it ſtill accompanies baptiſm: but the Romaniſts make it a diſtinct independent ſacrament. Seven years is the ſtated time for confirmation: however, they are ſometimes confirmed before, and ſometimes after that age. The perſon to be confirmed has a god father and god mother appointed him, as in baptiſm. The order of confirmation in the church of England, does not determine the preciſe age of the perſons to be confirmed.

CONFISCATION, in law, the adjudication of goods or effects to the public treaſury; as the bodies and effects of criminals, traitors, *&c.*

CONFLAGRATION, the general burning of a city, or other conſiderable place.

This word is commonly applied to that grand period or cataſtrophe of our world, when the face of nature is to be changed by fire, as formerly it was by water.

CONFLUENT, among phyſicians, *&c.* an appellation given to that kind of ſmall-pox wherein the puſtules run into each other. See MEDICINE.

CONFORMATION, the particular conſiſtence and texture of the parts of any body, and their diſpoſition to compoſe a whole.

CONFORMATION, in medicine, that make and conſtruction of the human body, which is peculiar to every individual.

CONFORMITY, among ſchoolmen, the relation of agreement between one thing and another; as that between any thing and the diviſion thereof, the object and the underſtanding, *&c.*

CONFUSION, in Scots law, is a method of extinguiſhing and ſuſpending obligations. See SCOTS LAW, title, *Extinction of obligations*.

CONGE' *d'lire*, in eccleſiaſtical polity, the king's permiſſion royal to a dean and chapter in the time of a vacancy, to chuſe a biſhop; or to an abbey, or priory, of his own foundation, to chuſe their abbot or prior.

The king of England, as ſovereign patron of all archbiſhoprics, biſhoprics, and other eccleſiaſtical benefices, had of ancient time free appointment of all eccleſiaſtical dignities, whenſoever they chanced to be void; inveſting them firſt *per bacculum & annulum*, and afterwards by his letters-patent; and in courſe of time he made the election over to others, under certain forms and limitations, as that they ſhould at every vacation, before they chuſe, demand the king's congé d'lire, and after the election crave his royal aſſent, *&c.*

CONGE', in architecture, a mould in form of a quarter round or a cavetto, which ſerves to ſeparate two members from one another, ſuch as that which joins the ſhaft of the column to the cincture, called alſo apophyge.

CONGES are alſo rings or ferrels formerly uſed in the extremities of wooden pillars, to keep them from ſplitting, afterwards imitated in ſtone-work.

CONGELATION, freezing, or ſuch a change produced by cold in a fluid body, that it quits its former ſtate, and becomes congealed. See FREEZING.

CONGER, in zoology. See MURÆNA.

CONGERIES, a conſtellation or aggregate of ſeveral particles or bodies united into one maſs.

CONGIUS, a liquid meaſure of the ancient Romans, containing the eighth part of the amphora, or the fourth of the urna, or ſix ſextarii. The congius in Engliſh meaſure contains 2,070 676 ſolid inches; that is, ſeven pints, 4,942 ſolid inches.

CONGLOBATE *gland*, in anatomy. See Vol. I. p. 263.

CONGLOMERATE *gland*, in anatomy. See Vol. I. p. 265. *bottom*.

CONGLUTINATION, the gluing or faſtening any two bodies together by the intromiſſion of a third, whoſe parts are unctuous and tenacious, in the nature of glue. See GLUE.

CONGO, a large country on the weſtern coaſt of Africa, between 10° and 20° E. long. and between the equator and 18° S. lat. comprehending the countries of Loango, Angola, and Benguella. It is bounded by the kingdom of Benin on the north; by Mataman, a part of Caffraria, on the ſouth; and by the Atlantic ocean, on the weſt; and is ſometimes called the lower Guinea.

CONGREGATION, an aſſembly of ſeveral eccleſiaſtics united, ſo as to conſtitute one body; as an aſſembly of cardinals, in the conſtitution of the pope's court, met for the diſpatch of ſome particular buſineſs.

Theſe aſſemblies, being ſixteen in number, are diſtributed

ftributed into feveral chambers, after the manner of our offices and courts: the firft whereof is the pope's congregation, whofe bufinefs it is to prepare the moft difficult beneficiary matters to be afterward debated in the confiftory: the fecond is the congregation of the holy office, or the inquifition: the third is the congregation *de propaganda fide:* the fourth is the congregation for explaining the council of Trent: the fifth is the congregation of the index, deputed to examine into pernicious and heretical books: the fixth is the congregation of immunities, eftablifhed to obviate the difficulties that arife in the judgments of fuch fuits as are carried on againft churchmen: the feventh is the congregation of bifhops and regulars: the eighth is the congregation for the examination of bifhops, *&c.* It is alfo ufed for a company or fociety of religious, cantoned out of any order, fo as to make a fubdivifion of the order itfelf; as the congregation of Cluny, *&c.* among the Benedictines. It is likewife ufed for affemblies of pious perfons, in manner of fraternities.

CONGREGATIONALISTS, in church-hiftory, a fect of proteftants who reject all church-government, except that of a fingle congregation.

CONGRESS, in political affairs, an affembly of commiffioners, envoys, deputies, *&c.* from feveral courts meeting to concert matters for their common good.

CONGRESS, in a judicial fenfe, the trial made by appointment of a judge, before furgeons and matrons, in order to prove whether or no a man be impotent, before fentence is paffed for the diffolution of a marriage, folicited upon fuch a complaint.

CONGRUITY, a fuitablenefs or relation of agreement between things.

The terms *congruity* and *propriety* are not applicable to any fingle object: they imply a plurality, and obvioufly fignify a particular relation between different objects. Thus we fay currently, that a decent garb is fuitable or proper for a judge; modeft behaviour for a young woman, and a lofty ftyle for an epic poem: and, on the other hand, that it is unfuitable or incongruous to fee a little woman funk in an overgrown farthingale, a coat richly embroidered covering coarfe and dirty linen, a mean fubject in an elevated ftyle, an elevated fubject in a mean ftyle, a firft minifter darning his wife's ftocking, or a reverend prelate in lawn fleeves dancing a hornpipe.

The perception we have of this relation, which feems peculiar to man, cannot proceed from any other caufe, but from a *fenfe* of congruity or propriety; for, fuppofing us deftitute of that fenfe, the terms would be to us unintelligible.

It is a matter of experience, that congruity or propriety, where-ever perceived, is agreeable; and that incongruity or impropriety, where-ever perceived, is difagreeable. The only difficulty is, to afcertain what are the particular objects that in conjunction fuggefts thefe relations; for there are many objects that do not: the fea, for example, viewed in conjunction with a picture, or a man viewed in conjunction with a mountain, fuggeft not either congruity or incongruity. It feems natural to infer, what will be found true by induction, that we never perceive congruity nor incongruity but among things that are connected together by fome relation; fuch as a man and his actions, a principal and its acceffories, a fubject and its ornaments. We are indeed fo framed by nature, as among things fo connected, to require a certain fuitablenefs or correfpondence, termed *congruity* or *propriety*; and to be difpleafed when we find the oppofite relation of *incongruity* or *impropriety.*

If things connected be the fubject of congruity, it is reafonable beforehand to expect, that a degree of congruity fhould be required proportioned to the degree of the connection. And upon examination we find this to hold in fact: where the relation is intimate, as between a caufe and its effect, a whole and its parts, we require the ftricteft congruity; but where the relation is flight, or accidental, as among things jumbled together in the fame place, we require little or no congruity: the ftricteft propriety is required in behaviour and manner of living; becaufe a man is connected with thefe by the relation of caufe and effect: the relation between an edifice and the ground it ftands upon, is of the moft intimate kind, and therefore the fituation of a great houfe ought to be lofty; its relation to neighbouring hills, rivers, plains, being that of propinquity only, demands but a fmall fhare of congruity: among members of the fame club, the congruity ought to be confiderable, as well as among things placed for fhow in the fame niche: among paffengers in a ftage-coach, we require very little congruity; and lefs ftill at a public fpectacle.

Congruity is fo nearly allied to beauty, as commonly to be held a fpecies of it; and yet they differ fo effentially, as never to coincide: beauty, like colour, is placed upon a fingle fubject; congruity upon a plurality: further, a thing beautiful in itfelf, may, with relation to other things, produce the ftrongeft fenfe of incongruity.

Congruity and propriety are commonly reckoned fynonymous terms; but they are diftinguifhable; and the precife meaning of each muft be afcertained. Congruity is the genus, of which propriety is a fpecies; for we call nothing *propriety*, but that congruity or fuitablenefs, which ought to fubfift between fenfible beings and their thoughts, words, and actions.

In order to give a full view of thefe fecondary relations, we fhall trace them through fome of the moft confiderable primary relations. The relation of a part to the whole, being extremely intimate, demands the utmoft degree of congruity; even the flighteft deviation is difguftful.

Examples of congruity and incongruity are furnifhed in plenty by the relation between a fubject and its ornaments. A literary performance intended merely for amufement, is fufceptible of much ornament, as well as a mufic room, or a play-houfe; for in gaiety, the mind hath a peculiar relifh for fhow and decoration. The moft gorgeous apparel, however improper in tragedy, is not unfuitable to opera-actors: the truth is, an opera, in its prefent form, is a mighty fine thing; but as it deviates from nature in its capital circumftances, we look not for nature

nor

nor propriety in thoſe which are acceſſory. On the other hand, a ſerious and important ſubject admits not much ornament; nor a ſubject that of itſelf is extremely beautiful: and a ſubject that fills the mind with its loftineſs and grandeur, appears beſt in a dreſs altogether plain.

To a perſon of a mean appearance, gorgeous apparel is unſuitable; which, beſides the incongruity, has a bad effect; for by conſtraſt it ſhows the meanneſs of appearance in the ſtrongeſt light. Sweetneſs of look and manner, requires ſimplicity of dreſs joined with the greateſt elegance. A ſtately and majeſtic air requires ſumptuous apparel, which ought not to be gaudy, nor crouded with little ornaments. A woman of conſummate beauty can bear to be highly adorned, and yet ſhows beſt in a plain dreſs:

——————— For lovelineſs
Needs not the foreign aid of ornament,
But is when unadorn'd, adorn'd the moſt.

Thomſon's Autumn, 208.

Congruity regulates not only the quantity of ornament, but alſo the kind. The ornaments that embelliſh a dancing-room ought to be all of them gay. No picture is proper for a church, but what has religion for its ſubject. All the ornaments upon a ſhield ought to relate to war; and Virgil, with great judgment, confines the carvings upon the ſhield of Æneas to the military hiſtory of the Romans: but this beauty is overlooked by Homer; for the bulk of the ſculpture upon the ſhield of Achilles, is of the arts of peace in general, and of joy and feſtivity in particular: the author of Telemachus betrays the ſame inattention, in deſcribing the ſhield of that young hero.

In judging of propriety with regard to ornaments, we muſt attend, not only to the nature of the ſubject that is to be adorned, but alſo to the circumſtances in which it is placed: the ornaments that are proper for a ball, will appear not altogether ſo decent at public worſhip; and the ſame perſon ought to dreſs differently for a marriage-feaſt and for a burial.

Nothing is more intimately related to a man, than his ſentiments, words, and actions; and therefore we require here the ſtricteſt conformity. When we find what we thus require, we have a lively ſenſe of propriety: when we find the contrary, our ſenſe of impropriety is not leſs lively. Hence the univerſal diſtaſte of affectation, which conſiſts in making a ſhew of greater delicacy and refinement than is ſuited either to the character or circumſtances of the perſon.

Congruity and propriety, where-ever perceived, appear agreeable; and every agreeable object produceth in the mind a pleaſant emotion: incongruity and impropriety, on the other hand, are diſagreeable; and of courſe produce painful emotions. Theſe emotions, whether pleaſant or painful, ſometimes vaniſh without any conſequence; but more frequently occaſion other emotions, which we proceed to exemplify.

When any ſlight incongruity is perceived, in an accidental combination of perſons or things, as of paſſengers in a ſtage-coach, or of individuals dining at an ordinary; the painful emotion of incongruity, after a momentary exiſtence, vaniſheth without producing any effect. But this is not the caſe of propriety and impropriety: voluntary acts, whether words or deeds, are imputed to the author; when proper, we reward him with our eſteem; when improper, we puniſh him with our contempt. Let us ſuppoſe, for example, a generous action ſuited to the character of the author, which raiſes in him and in every ſpectator the pleaſant emotion of propriety: this emotion generates in the author both ſelf-eſteem and joy; the former when he conſiders his relation to the action, and the latter when he conſiders the good opinion that others will entertain of him: the ſame emotion of propriety produceth in the ſpectators eſteem for the author of the action; and when they think of themſelves, it alſo produceth, by means of contraſt, an emotion of humility. To diſcover the effects of an unſuitable action, we muſt invert each of theſe circumſtances: the painful emotion of impropriety generates in the author of the action both humility and ſhame; the former when he conſiders his relation to the action, and the latter when he conſiders what others will think of him: the ſame emotion of impropriety produceth in the ſpectators contempt for the author of the action; and it alſo produceth, by means of contraſt, when they think of themſelves, an emotion of ſelf-eſteem. Here then are many different emotions, derived from the ſame action conſidered in different views by different perſons; a machine provided with many ſprings, and not a little complicated. Propriety of action, it would ſeem, is a chief favourite of nature, when ſuch care and ſolicitude is beſtowed upon it. It is not left to our own choice; but, like juſtice, is required at our hands; and, like juſtice, is inforced by natural rewards and puniſhments: a man cannot, with impunity, do any thing unbecoming or improper; he ſuffers the chaſtiſement of contempt inflicted by others, and of ſhame inflicted by himſelf. An apparatus ſo complicated, and ſo ſingular, ought to rouſe our attention: for nature doth nothing in vain; and we may conclude with great certainty, that this curious branch of the human conſtitution is intended for ſome valuable purpoſe.

A groſs impropriety is puniſhed with contempt and indignation, which are vented againſt the offender by correſponding external expreſſions: nor is even the ſlighteſt impropriety ſuffered to paſs without ſome degree of contempt. But there are improprieties, of the ſlighter kind, that provoke laughter; of which we have examples without end, in the blunders and abſurdities of our own ſpecies: ſuch improprieties receive a different puniſhment, as will appear by what follows. The emotions of contempt and of laughter occaſioned by an impropriety of this kind, uniting intimately in the mind of the ſpectator, are expreſſed externally by a peculiar ſort of laugh, termed *a laugh of deriſion* or *ſcorn*. An impropriety that thus moves not only contempt but laughter, is diſtinguiſhed by the epithet of *ridiculous*; and a laugh of deriſion or ſcorn is the puniſhment provided for it by nature. Nor ought it to eſcape obſervation, that we are ſo fond of inflicting this puniſhment, as ſometimes to exert it even againſt creatures of an inferior ſpecies: witneſs a turkycock ſwelling with pride, and ſtrutting with diſplayed feathers; a ridiculous object, which in a gay mood is apt to provoke a laugh of deriſion.

We

We muſt not expect, that theſe different improprieties are ſeparated by diſtinct boundaries: for of improprieties, from the ſlighteſt to the moſt groſs, from the moſt riſible to the moſt ſerious, there are degrees without end. Hence it is, that in viewing ſome unbecoming actions, too riſible for anger, and too ſerious for deriſion, the ſpectator feels a ſort of mixt emotion, partaking both of deriſion and of anger; which accounts for an expreſſion, common with reſpect to the impropriety of ſome actions, That we know not whether to laugh or be angry.

It cannot fail to be obſerved, that in the caſe of a riſible impropriety, which is always ſlight, the contempt we have for the offender is extremely faint, though deriſion, its gratification, is extremely pleaſant. This diſproportion between a paſſion and its gratification, ſeems not conformable to the analogy of nature. In looking about for a ſolution, we muſt reflect upon what is laid down above, that an improper action not only moves our contempt for the author, but alſo, by means of contraſt, ſwells the good opinion we have of ourſelves. This contributes, more than any other article, to the pleaſure we have in ridiculing follies and abſurdities; and accordingly, it is well known, that they who put the greateſt value upon themſelves are the moſt prone to laugh at others. Pride, which is a vivid paſſion, pleaſant in itſelf, and not leſs ſo in its gratification, would ſingly be ſufficient to account for the pleaſure of ridicule, without borrowing any aid from contempt. Hence appears the reaſon of a noted obſervation, That we are the moſt diſpoſed to ridicule the blunders and abſurdities of others, when we are in high ſpirits; for in high ſpirits, ſelf-conceit diſplays itſelf with more than ordinary vigour.

With regard to the final cauſes of congruity and impropriety; one, regarding congruity, is pretty obvious, that the ſenſe of congruity, as one principle of the fine arts, contributes in a remarkable degree to our entertainment. Congruity, indeed, with reſpect to quantity, coincides with proportion: when the parts of a building are nicely adjuſted to each other, it may be ſaid indifferently, that it is agreeable by the congruity of its parts, or by the proportion of its parts. But propriety, which regards voluntary agents only, can never be the ſame with proportion: a very long noſe is diſproportioned, but cannot be termed *improper*. In ſome inſtances, it is true, impropriety coincides with diſproportion in the ſame ſubject, but never in the ſame reſpect; for example, a very little man buckled to a long toledo: conſidering the man and the ſword with reſpect to ſize, we perceive a diſproportion; conſidering the ſword as the choice of the man, we perceive an impropriety.

The ſenſe of impropriety with reſpect to miſtakes, blunders, and abſurdities, is happily contrived for the good of mankind. In the ſpectators, it is productive of mirth and laughter, excellent recreation in an interval from buſineſs. But this is a trifle in reſpect of what follows. It is painful to be the ſubject of ridicule; and to puniſh with ridicule the man who is guilty of an abſurdity, tends to put him more upon his guard in time coming. Thus even the moſt innocent blunder is not committed with impunity; becauſe, were errors licenſed where they do no hurt, inattention would grow into a habit, and be the occaſion of much hurt.

The final cauſe of propriety as to moral duties, is of all the moſt illuſtrious. To have a juſt notion of it, the moral duties that reſpect others muſt be diſtinguiſhed from thoſe that reſpect ourſelves. Fidelity, gratitude, and the forbearing injury, are examples of the firſt ſort; temperance, modeſty, firmneſs of mind, are examples of the other: the former are made duties by the ſenſe of juſtice; the latter by the ſenſe of propriety. Here is a final cauſe of the ſenſe of propriety, that muſt rouſe our attention. It is undoubtedly the intereſt of every man, to ſuit his behaviour to the dignity of his nature, and to the ſtation allotted him by Providence; for ſuch rational conduct contributes in every reſpect to happineſs, by preſerving health, by procuring plenty, by gaining the eſteem of others, and, which of all is the greateſt bleſſing, by gaining a juſtly-founded ſelf-eſteem. But in a matter ſo eſſential to our well-being, even ſelf-intereſt is not relied on: the powerful authority of duty is ſuperadded to the motive of intereſt. The God of nature, in all things eſſential to our happineſs, hath obſerved one uniform method: to keep us ſteady in our conduct, he hath fortified us with natural laws and principles, which prevent many aberrations, that would daily happen were we totally ſurrendered to ſo fallible a guide as is human reaſon. Propriety cannot rightly be conſidered in another light, than as the natural law that regulates our conduct with reſpect to ourſelves; as juſtice is the natural law that regulates our conduct with reſpect to others. We call propriety a law, not leſs than juſtice; becauſe both are equally rules of conduct that ought to be obeyed: propriety includes this obligation; for to ſay an action is proper, is, in other words, to ſay, that it *ought* to be performed; and to ſay it is improper, is, in other words, to ſay that it *ought* to be forborn. It is this very character of *ought* and *ſhould* that makes juſtice a law to us; and the ſame character is applicable to propriety, though perhaps more faintly than to juſtice: but the difference is in degree only, not in kind; and we ought, without heſitation or reluctance, to ſubmit equally to the government of both.

But it muſt, in the next place, be obſerved, that to the ſenſe of propriety, as well as of juſtice, are annexed the ſanctions of rewards and puniſhments; which evidently prove the one to be a law as well as the other. The ſatisfaction a man hath in doing his duty, joined with the eſteem and good will of others, is the reward that belongs to both equally. The puniſhments alſo, though not the ſame, are nearly allied; and differ in degree more than in quality. Diſobedience to the law of juſtice, is puniſhed with remorſe; diſobedience to the law of propriety, with ſhame, which is remorſe in a lower degree. Every tranſgreſſion of the law of juſtice raiſes indignation in the beholder; and ſo doth every flagrant tranſgreſſion of the law of propriety. Slighter improprieties receive a milder puniſhment: they are always rebuked with ſome degree of contempt, and frequently with deriſion. In general, it is true, that the rewards and puniſhments annexed to the ſenſe of propriety, are ſlighter

ſlighter in degree than thoſe annexed to the ſenſe of juſtice: which is wiſely ordered, becauſe duty to others is ſtill more eſſential to ſociety, than duty to ourſelves; for ſociety could not ſubſt a moment, were individuals not protected from the headſtrong and turbulent paſſion of their neighbours.

CONI, a ſtrong town of Piedmont in Italy, ſituated upon the river Stura, thirty two miles ſouth of Turin, in 7° 30′ E. long. and 44° 25′ N. lat.

CONIC SECTIONS.

CONIC SECTIONS are curve lines formed by the interſections of a cone and plane.

If a cone be cut by a plane through the vertex, the ſection will be a triangle ABC, Plate LXVII. fig. 1.

If a cone be cut by a plane parallel to its baſe, the ſection will be a circle. If it be cut by a plane DEF, fig. 1. in ſuch a direction, that the ſide AC of a triangle paſſing through the vertex, and having its baſe BC perpendicular to EF, may be parallel to DP, the ſection is a parabola; if it be cut by a plane DR, fig. 2. meeting AC, the ſection is an ellipſe; and if it be cut by a plane DMO, fig. 3. which would meet AC extended beyond A, it is an hyperbola.

If any line HG, fig. 1. be drawn in a parabola perpendicular to DP, the ſquare of HG will be to the ſquare of EP, as DG to DP; for let LHK be a ſection parallel to the baſe, and therefore a circle, the rectangle LGK, will be equal to the ſquare of HG, and the rectangle BPC equal to the ſquare of EP; therefore theſe ſquares will be to each other as their rectangles; that is, as BP to LG, that is DP to DG.

Deſcription of Conic Sections on a Plane.

PARABOLA.

"Let AB, fig. 4. be any right line, and C any point "without it, and DKF a ruler, which let be placed "in ſame plane in which the right line and point are, "in ſuch a manner that one ſide of it, as DK, be applied "to the right line AB, and the other ſide KF coincide "with the point C; and at F, the extremity of the ſide "KF, let be fixed one end of the thread FNC, whoſe "length is equal to KF, and the other extremity of it "at the point C, and let part of the thread, as FG, be "brought cloſe to the ſide KF by a ſmall pin G; then "let the ſquare DKF be moved from B towards A, ſo "that all the while its ſide DK be applied cloſe to the "line BA, and in the mean time the thread being ex"tended will always be applied to the ſide KF, being "ſtopt from going from it by means of the ſmall pin; "and by the motion of the ſmall pin N there will be de"ſcribed a certain curve, which is called a *ſemi para"bola*.

"And if the ſquare be brought to its firſt given poſi"tion, and in the ſame manner be moved along the line "AB, from B towards H, the other ſemi-parabola will "be deſcribed."

The line AB is called the directrix; C, the focus; any line perpendicular to AB, a diameter; the point where it meets the curve, its vertex; and four times the diſtance of the vertex from the directrix, its latus rectum, or parameter.

ELLIPSE.

"If any two points, as A and B, fig. 5. be taken in "any plane, and in them are fixed the extremities of a "thread, whoſe length is greater than the diſtance be"tween the points, and the thread extended by means "of a ſmall pin C, and if the pin be moved round from "any point until it return to the place from whence it "began to move, the thread being extended during the "whole time of the revolution, the figure which the "ſmall pin by this revolution deſcribes is called an *El"lipſe*."

The points AB are called the foci; D, the centre; EF, the tranſverſe axis; GH, the leſſer axis; and any other line paſſing through D, a diameter.

HYPERBOLA.

"If to the point A, fig. 6. in any plane, one end of the "rule AB be placed, in ſuch a manner, that about that "point, as a center, it may freely move; and if to the "other end B, of the rule AB, be fixed the extremity "of the thread BDC, whoſe length is ſmaller than the "rule AB, and the other end of the thread being fixed "in the point C, coinciding with the ſide of the rule "AB, which is in the ſame plane with the given point "A; and let part of the thread, as BD, be brought "cloſe to the ſide of the rule AB, by means of a ſmall "pin D; then let the rule be moved about the point A, "from C towards T, the thread all the while being ex"tended, and the remaining part coinciding with the "ſide of the rule being ſtopt from going from it by "means of the ſmall pin, and by the motion of the ſmall "pin D, a certain figure is deſcribed which is called "the *ſemi-hyperbola*."

The other ſemi-hyperbola is deſcribed in the ſame way, and the oppoſite HKF, by fixing the ruler to C, and the thread to A, and deſcribing it in the ſame manner. A and C are called foci; the point G, which biſects AC, the center; KE, the traſverſe axis; a line drawn through the center meeting the hyperbolas, a tranſverſe diameter; a line drawn through the center, perpendicular to the tranſverſe axis, and cut off by the circle MN, whoſe center is E, and radius equal to CG, is called the ſecond axis.

If a line be drawn through the vertex E, equal and parallel to the ſecond axis GP and GO be joined, they are called aſſymptotes. Any line drawn through the center, not meeting the hyperbolas, and equal in length to the part

part of a tangent parallel to it, and intercepted betwixt the aſſymptotes, is called a ſecond diameter.

An ordinate to any ſection is a line biſected by a diameter and the abſciſſa, the part of the diameter cut off by the ordinate.

Conjugate diameters in the ellipſe and hyperbola are ſuch as mutually biſect lines parallel to the other; and a third proportional to two conjugate diameters is called the latus rectum of that diameter, which is the firſt in the proportion.

In the parabola, the lines drawn from any point to the focus are equal to perpendiculars to the directrix; being both equal to the part of the thread ſeparated from the ruler.

In the ellipſe, the two lines drawn from any point in the curve to the foci are equal to each other, being equal to the length of the thread; they are alſo equal to the tranſverſe axis. In the hyperbola the difference of the lines drawn from any point to the foci is equal, being equal to the difference of the lengths of the ruler and thread, and is equal to the tranſverſe axis.

From theſe fundamental properties all the others are derived.

The ellipſe returns into itſelf. The parabola and hyperbola may be extended without limit.

Every line perpendicular to the directrix of a parabola meets it in one point, and falls afterwards within it; and every line drawn from the focus meets it in one point, and falls afterwards without it. And every line that paſſes through a parabola, not perpendicular to the directrix, will meet it again, but only once.

Every line paſſing through the center of an ellipſe is biſected by it; the tranſverſe axis is the greateſt of all theſe lines; the leſſer axis the leaſt; and theſe nearer the tranſverſe axis greater than thoſe more remote.

In the hyperbola, every line paſſing through the center is biſected by the oppoſite hyperbola, and the tranſverſe axis is the leaſt of all theſe lines; alſo the ſecond axis is the leaſt of all the ſecond diameters. Every line drawn from the center within the angle contained by the aſſymptotes, meets it once, and falls afterwards within it; and every line drawn through the center without that angle never meets it; and a line which cuts one of the aſſymptotes, and cuts the other extended beyond the center, will meet both the oppoſite hyperbolas in one point.

If a line G M, fig. 4. be drawn from a point in a parabola perpendicular to the axis, it will be an ordinate to the axis, and its ſquare will be equal to the rectangle under the abſciſſa MI and latus rectum; for, becauſe GMC is a right angle, GM^q is equal to the difference of GC^q and CM^q; but GC is equal to GE, which is equal to MB; therefore GM^q is equal to $BM^q—CM^q$; which, becauſe CI and IB are equal, is (8 *Euc.* 2.) equal to four times the rectangle under MI and IB, or equal to the rectangle under MI and the *latus rectum*.

Hence it follows, that if different ordinates be drawn to the axis, their ſquares being each equal to the rectangle under the abſciſſa and latus rectum, will be to each other in the proportion of the abſciſſas, which is the ſame property as was ſhewn before to take place in the parabola cut from the cone, and proves thoſe curves to be the ſame.

This property is extended alſo to the ordinates of other diameters, whoſe ſquares are equal to the rectangle under the abſciſſas and parameters of their reſpective diameters.

In the ellipſe, the ſquare of the ordinate is to the rectangle under the ſegments of the diameter, as the ſquare of the diameter parallel to the ordinate to the ſquare of the diameter to which it is drawn, or as the firſt diameter to its latus rectum; that is, LK^q (fig. 5.) is to EKF as EF^q to GH^q.

In the hyperbola, the ſquare of the ordinate is to the rectangle contained under the ſegments of the diameters betwixt its vertices, as the ſquare of the diameter parallel to the ordinate to the ſquare of the diameter to which it is drawn, or as the firſt diameter to its *latus rectum*; that is, SX^q is to EXK as MN^q to KE^q.

Or if an ordinate be drawn to a ſecond diameter, its ſquare will be to the ſum of the ſquares of the ſecond diameter, and of the line intercepted betwixt the ordinate and centre, in the ſame proportion; that is, RZ^q (fig. 6.) is to ZG^q added to GM^q, as KE^q to MN^q. Theſe are the moſt important properties of the conic ſections: and, by means of theſe, it is demonſtrated, that the figures are the ſame deſcribed on a plane as cut from the cone; which we have demonſtrated in the caſe of the parabola.

Equations of the Conic Sections

Are derived from the above properties. The equation of any curve, is an algebraic expreſſion, which denotes the relation betwixt the ordinate and abſciſſa; the abſciſſa being equal to x, and the ordinate equal to y.

If p be the parameter of a parabola, then $y^2=px$; which is an equation for all parabolas.

If a be the diameter of an ellipſe, p its parameter; then $y^2 : ax-xx :: p : a$; and $y^2=\frac{p}{a}\times\overline{ax-xx}$; an equation for all ellipſes.

If a be a tranſeverſe diameter of a hyperbola, p its parameter; then $y^2 : ax+xx :: p : a$, and $y^2=\frac{p}{a}\times\overline{ax+xx}$.

If a be a ſecond diameter of an hyperbola, then $y^2 = aa+xx :: p : a$; and $y^2=\frac{p}{a}\times aa+xx$; which are equations for all hyperbolas.

As all theſe equations are expreſſed by the ſecond powers of x and y, all conic ſections are curves of the ſecond order; and converſely, the locus of every quadratic equation is a conic ſection, and is a parabola, ellipſe, or hyperbola, according as the form of the equation correſponds with the above ones, or with ſome other deduced from lines drawn in a different manner with reſpect to the ſection.

General Properties of Conic Sections.

A Tangent to a parabola biſects the angle contained by the lines drawn to the focus and directrix; in an ellipſe

ellipse and hyperbola, it bisects the angle contained by the lines drawn to the foci.

In all the sections, lines parallel to the tangent are ordinates to the diameter passing through the point of contact; and in the ellipse and hyperbola, the diameters parallel to the tangent, and those passing through the points of contact, are mutually conjugate to each other. If an ordinate be drawn from a point to a diameter and a tangent from the same point which meets the diameter produced; in the parabola the part of the diameter betwixt the ordinate and tangent will be bisected in the vertex; and in the ellipse and hyperbola, the semi-diameter will be a mean proportion betwixt the segments of the diameter betwixt the center and ordinate, and betwixt the centre and tangent.

The parallelogram formed by tangents drawn through the vertices of any conjugate diameters, in the same ellipse or hyperbola, will be equal to each other.

Properties peculiar to the Hyperbola.

As the hyperbola has some curious properties arising from its assymptotes, which appear at first view almost incredible, we shall briefly demonstrate them.

1. The hyperbola and its assymptotes never meet: if not, let them meet in S, fig. 6.; then by the property of the curve the rectangle KXE is to SX^q as GE^q to GM^q or EP^q; that is, as GX^q to SX^q; wherefore, KXE will be equal to the square of GX; but the rectangle KXE, together with the square of GE, is also equal to the square of GX; which is absurd.

2. If a line be drawn through a hyperbola parallel to its second axis, the rectangle, by the segments of that line, betwixt the point in the hyperbola and the assymptotes, will be equal to the square of the second axis.

For, if SZ, fig. 6. be drawn perpendicular to the second axis, by the property of the curve, the square of MG, that is, the square of PE, is to the square of GE, as the squares of ZG and the square of MG together, to the square of SZ or GX: and the squares of RX and GX are in the same proportion, because the triangles RXG, PEG are equiangular; therefore the squares ZG and MG are equal to the square of RX; from which taking the equal squares of SX and ZG, there remains the rectangle RSV, equal to the square of MG.

3. Hence, if right lines be drawn parallel to the second axis, cutting an hyperbola and its assymptotes, the rectangles contained betwixt the hyperbola and points where the lines cut the assymptotes will be equal to each other; for they are severally equal to the square of the second axis.

4. If from any points, d and S, in a hyperbola, there be drawn lines parallel to the assymptotes da SQ and Sb dc, the rectangle under da and dc will be equal to the rectangle under QS and Sb; also the parallelograms da, Gc, and SQGb, which are equiangular, and consequently proportional to the rectangles, are equal.

For draw YW RV parallel to the second axis, the rectangle YdW is equal to the rectangle RSV; wherefore, WD is to SV as RS is to dY. But because the triangles RQS, AYD, and GSV cdW, are equiangular, Wd is to SV as cd to Sb, and RS is to DY as SQ to da; wherefore, dc is to Sb as SQ to da: and the rectangle dc, da, is equal to the rectangle QS, Sb.

5. The assymptotes always approach nearer the hyperbola.

For, because the rectangle under SQ and Sb, or QG, is equal to the rectangle under da and dc, or AG, and QG is greater than aG; therefore ad is greater than QS.

6. The assymptotes come nearer the hyperbola than any assignable distance.

Let X be any small line. Take any point, as d, in the hyperbola, and draw da, dc, parallel to the assymptotes; and as X is to da, so let aG be to GQ. Draw QS parallel to ad, meeting the hyperbola in S, then QS will be equal to X. For the rectangle SQG will be equal to the rectangle daG; and consequently SQ is to da as AG to GQ.

If any point be taken in the assymptote below Q, it can easily be shown that its distance is less than the line X.

Areas contained by Conic Sections.

THE area of a parabola is equal to $\frac{2}{3}$ the area of a circumscribed paralellogram.

The area of an ellipse is equal to the area of a circle whose diameter is a mean proportional betwixt its greater and lesser axes.

If two lines, ad and QS, be drawn parallel to one of the assymptotes of an hyperbola, the space aQSd, bounded by these parallel lines, the assymptotes and the hyperbola will be equal to the logarithm of aQ, whose module is ad, supposing aG equal to unity.

Curvature of Conic Sections.

THE curvature of any conic section, at the vertices of its axis, is equal to the curvature of a circle whose diameter is equal to the parameter of its axis.

If a tangent be drawn from any other point of a conic section, the curvature of the section in that point will be equal to the curvature of a circle to which the same line is a tangent, and which cuts off from the diameter of the section, drawn through the point, a part equal to its parameter.

Uses of Conic Sections.

ANY body, projected from the surface of the earth, describes a parabola, to which the direction wherein it is projected is a tangent; and the distance of the directrix is equal to the height from which a body must fall to acquire the velocity wherewith it is projected: hence the properties of the parabola are the foundation of gunnery.

All bodies acted on by a central force, which decreases as the square of the distances increases, and impressed with any projectile motion, making any angle with the direction of the central force, must describe conic sections, having the central force in one of the foci, and will

Plate LXVII.

Fig. 1.

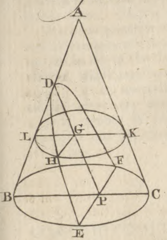


Fig. 2.

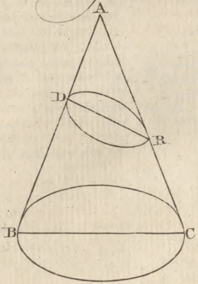


Fig. 3.

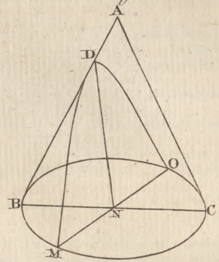


Fig. 4.

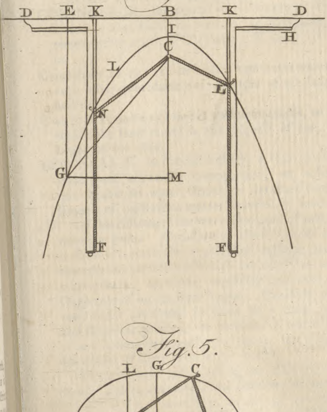


Fig. 6.

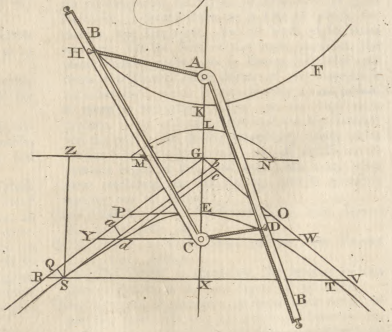
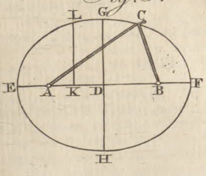


Fig. 5.



A. B. Sc.

will deſcribe parabolas, ellipſes, and hyperbolas, according to the proportion betwixt the central and projectile force. This is proved by direct demonſtration.

The great principle of gravitation acts in this manner; and all the heavenly bodies deſcribe conic ſections having the ſun in one of the foci; the orbits of the planets are ellipſes, whoſe tranſverſe and leſſer diameters are nearly equal; it is uncertain whether the comets deſcribe ellipſes with very unequal axes, and ſo return after a great number of years; or whether they deſcribe parabolas and hyperbolas, in which caſe they will never return.

Uſes of Conic Sections in the Solution of Geometrical Problems.

Many problems can be ſolved by conic ſections that cannot be ſolved by right lines and circles. The following theorems, which follow from the ſimpler properties of the ſections, will give a ſpecimen of this.

A point equally diſtant from a given point and a given line, is ſituated in a given parabola.

A point, the ſum of whoſe diſtances from two given points is given, is ſituated in a given ellipſe.

A point, the difference of whoſe diſtances from two given points is given, is ſituated in a given hyperbola.

CONICTHYODONTES, or Plectronitæ, in natural hiſtory, one of the three names the foſſile teeth of fiſhes are known by.

CONIFEROUS trees, ſuch as bear hard, dry ſeed-veſſels, of a conical figure, conſiſting of ſeveral woody parts, being moſtly ſcaly, adhering cloſely together, and ſeparating when ripe.

Of this ſort is the cedar of Lebanon, fir, *&c.*

CONINGSECK, the capital of a county of the ſame name, in the circle of Swabia, in Germany, about twenty miles north of Conſtance: E. long 9° 23′, N. lat. 47° 50′.

Conjoint degrees, in muſic, two notes which follow each other immediately in the order of the ſcale, as *ut* and *re*.

Conjoint tetrachords, two tetrachords, or fourths, where the ſame chord is the higheſt of one, and the loweſt of the other.

CONISSALÆ, in natural hiſtory, a claſs of foſſils, naturally and eſſentially compounded, not inflammable, nor ſoluble in water, found in detached maſſes, and formed of cryſtalline matter debaſed by earth.

Of this claſs there are two orders, and of each of theſe only one genus. Coniſſalæ of the firſt order are found in form of a naturally regular and uniform powder, all the genuine particles of which are nearly of one determinate ſhape, appearing regularly concreted, and not fragments of others once larger. Coniſſalæ of the ſecond order are found in form of a rude, irregular, and ſhapeleſs powder, the particles of which are never of any determinate particular figure, but ſeem broken fragments of ſome once larger maſſes.

To the former genus belong the different kinds of ſand; and to the latter, the ſaburræ, or gritts.

CONJUGATE diameter, or *axis of an ellipſis*, the ſhorteſt of the two diameters, or that biſecting the tranſverſe axis.

Conjugate hyperbolas. See Conicsections.

CONJUGATION, in grammar, a regular diſtribution of the ſeveral inflexions of verbs in their different voices, moods, tenſes, numbers and perſons, ſo as to diſtinguiſh them from one another.

The Latins have four conjugations, diſtinguiſhed by the terminations of the infinitive āre, ēre, ĕre, and īre.

The Engliſh have ſcarce any natural inflexions, deriving all their variations from additional particles, pronouns, *&c.* whence there is ſcarce any ſuch thing as ſtrict conjugations in that language.

CONIUM, in botany, a genus of the pentandria digynia claſs of plants. The fruit is globular, crenated on each ſide, and has five ſtriæ or ſtreaks. There are three ſpecies, only one of which, *viz.* the conium maculatum, or hemlock, is a native of Britain. Within theſe few years paſt Dr Stork publiſhed a treatiſe recommending the extract of hemlock to be given internally, in ſeveral doſes, as a kind of ſpecific for cancers, the king's-evil, and all kinds of ſchirrous tumours. On the faith of this ſingle phyſician, the whole medical practitioners in Europe doſed their patients who laboured under diſeaſes of the above kinds with hemlock, which is unqueſtionbly a rank poiſon, if taken to any extent. After two or three years practice, it was at length diſcovered that the hemlock was not poſſeſſed of thoſe extraordinary virtues which Dr Stork had attributed to it; and of courſe its reputation began to ſink, and now, like many other great medicines, has had its day, and is gradually wearing out of practice.

CONJUNCT *rights*. See Scots Law, title, *Succeſſion in heritable rights*.

CONJUNCT, or Confident perſons. See Scots Law, title, *Actions*.

CONJUNCTION, in aſtronomy, the meeting of two ſtars or planets, in the ſame degree of the zodiac.

Conjunction, in grammar, an undeclinable word, or particle, which ſerves to join words and ſentences together, and thereby ſhews their relation or dependence one upon another.

CONJUNCTIVA, in anatomy. See Vol. I. p. 291.

CONNAUGHT, the moſt weſterly province of Ireland.

CONNARUS, in botany, a genus of the monodelphia decandria claſs. It has but one ſtylus; the ſtigma is ſimple; and the capſule has two valves, and contains one ſeed. There is but one ſpecies, *viz.* the monocarpus, a native of India.

CONNECTICUT, a Britiſh colony of North America, bounded by the Maſſachuſet colony on the north-eaſt; by the ſea, on the ſouth; and by New York, on the weſt;

west; being about 100 miles in length, and 80 in breadth.

CONNECTION, or CONNEXION, the relation or dependence of one thing upon another.

CONNECTION, or CONTINUITY, in the drama, consists in the joining of the several scenes together.

The connection is said to be observed, when the scenes of an act succeed one another immediately, and are so joined as that the stage is never left empty.

CONNOISSEUR, a French word much used of late in English, to signify a person well versed in any thing: whence it is used for a critic, or a person who is a thorough judge of any subject.

CONNOR, a city of Ireland, in the county of Antrim, and province of Ulster, situated about six miles north of Antrim, in 6° 30′ W. long. and 54° 50′ N. lat.

CONOCARPODENDRON, in botany. See PROTEA.

CONOCARPUS, the BUTTON-TREE, in botany, a genus of the pentandria monogynia class. The corolla consists of four petals; the seeds are naked, solitary, and below the flower; and the flowers are aggregated. There are three species, all natives of the Indies.

CONOID, in geometry, a solid body, generated by the revolution of a conic section about its axis. See CONIC SECTIONS.

CONOIDES, in anatomy, a gland found in the third ventricle of the brain, called *pinealis*, from its resemblance to a pine-apple.

CONQUEST. See SCOTS LAW, title, *Succession in heritable rights*.

CONSANGUINITY, the relation subsisting between persons of the same blood, or who are sprung from the same root.

CONSANGUINITY and AFFINITY, degrees of, forbidden in marriage; see SCOTS LAW, title, *Marriage*. Consanguinity or affinity, an objection against a judge; see title, *Jurisdiction and judges*: Against a witness; see title, *Probation*.

CONSCIENCE, a secret testimony of the soul, whereby it gives its approbation to things that are naturally good, and condemns those that are evil. See MORALS.

CONSCRIPT, in Roman antiquity, an appellation given to the senators of Rome, who were called conscript-fathers on account of their names being entered all in one register.

CONSECRATION, the act of devoting any thing to the service and worship of God.

In England, churches have been always consecrated with particular ceremonies, the form of which was left to the discretion of the bishop.

CONSENT, in a general sense, denotes much the same with assent. See ASSENT.

CONSENT *of parts*, in the animal œconomy. See SYMPATHY.

CONSEQENCE, in logic, the conclusion, or what results from reason or argument.

CONSERVATOR, an officer ordained for the security and preservation of the privileges of some cities and communities. having a commission to judge of and determine the differences among them.

CONSERVATORY, a term sometimes used for a green-house, or ice-house.

CONSERVE, in pharmacy, a form of medicine, contrived to preserve the flowers, herbs, roots, pills, or fruits, of several simples, as near as possible to what they are when fresh gathered.

Conserves are made by beating up the thing to be preserved, with sugar, *viz.* a triple quantity thereof to those that are most moist, and a double quantity to those that are least so.

CONSIGNATION of money; see SCOTS LAW, title, *Obligations and contracts in general*: Of redemption-money; see title, *Redeemable rights*.

CONSISTENCE, in physics, that state of a body wherein its component particles are so connected or entangled among themselves, as not to separate or recede from each other. It differs from continuity in this, that it implies a regard to motion or rest, which continuity does not, it being sufficient to denominate a thing continuous that its parts are contiguous to each other.

CONSISTORIAL, or COMMISSARY COURT. See SCOTS LAW, title, *Ecclesiastical persons*.

CONSISTORY, at Rome, is an ecclesiastical assembly held in the presence of the pope, for the reception of princes or their ambassadors, for the canonization of saints, for the promotion of cardinals, and other important affairs.

CONSOLE, in architecture, an ornament cut upon the key of an arch, which has a projecture, and, on occasion, serves to support little corniches, figures, busts, and vases. See ARCHITECTURE.

CONSOLIDA, in botany. See AJUGA.

CONSOLIDATION, in medicine, the action of uniting broken bones, or the lips of wounds, by means of conglutinating medicines.

CONSONANCE, in music, is ordinarily used in the same sense with concord, *viz.* for the union or agreement of two sounds produced at the same time, the one grave and the other acute; which mingling in the air in a certain proportion, occasion an accord agreeable to the ear. See MUSIC.

CONSONANT, a letter that cannot be sounded without some single or double vowel before or after it, as b, c, d, *&c.*

CONSPIRACY, in law, signifies an agreement between two or more, falsely to indict, or procure to be indicted, an innocent person, of felony.

CONSPIRATORS are, by statute, defined to be such as bind themselves by oath, covenant, or other alliance, to assist one another falsely and maliciously to indict persons, or falsely to maintain pleas.

Conspirators in treason are those that plot against the king and the government.

CONSTABLE, Lord High Constable, an ancient officer of the crowns both of England and France, whose authority was so very extensive, that the office has been laid aside in both kingdoms, except upon particular occasions,

casions, ſuch as the king's coronation. The conſtable of France had his perſon privileged, and, during the king's minority, was named next to the princes of the blood. The army obeyed him next the king: he managed all that belonged to war, either for puniſhment of delinquents, diſtribution of booty, ſurrender of places, *&c.* The juriſdiction and functions of this office are now in the mareſchals of France.

The function of the conſtable of England conſiſted in the care of the common peace of the land, in deeds of arms and matters of war. By a law of Richard II. the conſtable of England has the determination of things concerning wars and blazonry of arms, which cannot be diſcuſſed by the common law. The firſt conſtable was created by the Conqueror: the office continued hereditary till the thirteenth of Henry VIII. when it was laid aſide, as being ſo powerful as to become troubleſome to the king. We have alſo conſtables denominated from particular places, as conſtable of the Tower, of Dover caſtle, of Windſor-caſtle, of the caſtle of Caernarvon, and many other of the caſtles of Wales, whoſe office is the ſame with that of the caſtellani, or governors of caſtles.

CONSTABLE *of Scotland.* See SCOTS LAW, title, *Of inferior judges.*

CONSTABLES *to juſtices of the peace,* in Scots law, are the proper officers for executing their orders. They have powers to ſuppreſs tumults, and to apprehend delinquents and thoſe who can give no good account of themſelves, and carry them to the next juſtice.

CONSTANCE, a city of Swabia, in Germany, ſituated on the weſtern ſhore of a lake to which it gives name, in 9° 12′ E. lon. and 47° 37′ N. lat.

It is the ſee of a biſhop, who is a prince of the German empire.

CONSTANTINA, the capital of a province of the ſame name, in the kingdom of Algiers, in Africa: E. long. 7°, and N. lat. 35° 30′.

CONSTANTINOPLE, the metropolis of the Turkiſh empire, called by the Turks themſelves Stamboul, and by many Europeans the Port, being one of the beſt harbours in Europe: E. long. 29° 15′, and N. lat. 41° 30′.

It is built on the weſtern ſhore of the Boſphorus, in the form of a triangle; the ſeraglio, or palace, occupying that angle which runs out between the Propontis and harbour; and underneath the palace are the gardens, which extend to the water-ſide.

CONSTELLATION, in aſtronomy. See Vol. I. p. 486.

CONSTIPATION, in medicine, a hardneſs of the belly, with great coſtiveneſs.

CONSTITUENT PART, in phyſiology, an eſſential part in the compoſition of any thing, differing little from what is otherwiſe called element or principle.

CONSTITUTION, in matters of policy, ſignifies the form of government eſtabliſhed in any country or kingdom.

CONSTITUTION alſo denotes an ordinance, deciſion, regulation, or law, made by authority of any ſuperior, eccleſiaſtical or civil.

Apoſtolical CONSTITUTIONS, a collection of regulations attributed to the apoſtles, and ſuppoſed to have been collected by St Clement, whoſe name they likewiſe bear.

It is the general opinion, however, that they are ſpurious, and that St Clement had no hand in them. They appeared firſt in the IVth age, but have been much changed and corrupted ſince that time. They are divided into eight books, conſiſting of a great number of rules and precepts, relating to the duties of Chriſtians, and particularly the ceremonies and diſcipline of the church. Mr Whiſton, in oppoſition to the general opinion, aſſerts them to be a part of the ſacred writings, dictated by the apoſtles in their meetings, and wrote down from their own mouth by St Clement, and intended as a ſupplement to the New Teſtament, or rather as a ſyſtem of Chriſtian faith and polity. The reaſon why the Conſtitutions are ſuſpected by the orthodox, and, perhaps, the reaſon alſo why their genuineneſs is defended by Mr Whiſton, is, that they ſeem to favour Arianiſm.

CONSTITUTION, in a phyſical ſenſe, ſignifies the particular temperature of the body.

CONSTRICTOR, an appellation given to ſeveral muſcles on account of their conſtringing or cloſing ſome of the orifices of the body. See ANATOMY.

CONSTRUCTION *of equations,* in Algebra. See ALGEBRA.

CONSTRUCTION, in grammar, the connecting the words of a ſentence according to the rules of the language.

CONSUALIA, in Roman antiquity, a feſtival inſtituted by Romulus, who, at the time of the rape of the Sabine virgins, found an altar under ground dedicated to the god Conſus, that is, Neptune. They were introduced with a magnificent cavalcade; and during the celebration, the horſes and aſſes were crowned with flowers, and a mule was ſacrificed to that god.

CONSUBSTANTIATION, a tenet of the Lutheran church with regard to the manner of the change made in the bread and wine in the euchriſt.

The divines of that profeſſion maintain, that after conſecration, the body and blood of our Saviour are ſubſtantially preſent, together with the ſubſtance of the bread and wine, which is called conſubſtantiation, or impanation.

CONSUL, the chief magiſtrate of the Roman commonwealth. They were two in number, choſen every year in the Campus Martius, by the people aſſembled in the comitia centuriata. In the firſt times of the commonwealth, no man could pretend to this dignity, but ſuch as were of a patrician family; but afterwards the people obtained, that one of the conſuls ſhould be choſen from among them. A conſul was commonly choſen at forty-three years of age, but this was not always obſerved: beſides, it was requiſite he ſhould have exerciſed other offices, as that of quæſtor, ædile, and prætor: and yet this condition was no better obſerved than the firſt; for Pompey had never been prætor nor quæſtor when he obtained the conſulſhip. Their authority and power was of very great extent, ſo long as the commonwealth ſubſiſted. They were the

the head of the ſenate: they commanded the armies, and were ſupreme judges of the differences between the citizens; but as they had made ſome abuſe of this power, it was allowed by the Valerian law for the party aggrieved to appeal from their tribunal to the people, eſpecially in caſes where the life of a citizen was concerned. Under the emperors, conſul was little more than an honourable title, and at laſt it became abſolutely extinct in the time of Juſtinian. From the eſtabliſhment of the republic to the conſulate of Baſil, that is, from the year of Rome 244, to the year of Rome 1294, the years are accounted by the conſuls; but after that period, the time was computed by the years of the emperors reigns and the indictions.

CONSUL, at preſent, is an officer eſtabliſhed by virtue of a commiſſion from the king and other princes, in all foreign countries of any conſiderable trade, to facilitate and diſpatch buſineſs, and protect the merchants of the nation. The conſuls are to keep up a correſpondence with the miniſters of England reſiding in the courts whereon their conſulate depends. They are to ſupport the commerce and the intereſt of the nation; to diſpoſe of the ſums given and the preſents made to the lords and principals of places, to obtain their protection, and prevent the inſults of the natives on the merchants of the nation.

CONSUMMATION, the end or completion of the work. Thus we ſay, the conſummation of all things, meaning the world.

CONSUMPTION, in medicine, a word of very extenſive ſignification, implies all diſorders that bring any decay or waſte upon the conſtitution; but is moſt uſed for the phthiſis pulmonalis. See MEDICINE.

CONTACT, is when one line, plane, or body, is made to touch another, and the parts that do thus touch, are called the points or places of contact.

CONTAGION, in phyſic, the communicating a diſeaſe from one body to another. In ſome diſeaſes it is only effected by an immediate contact or touch, as the venom of the pox; in others, it is conveyed by infected cloaths, as the itch; and in others, it is tranſmitted through the air at a conſiderable diſtance, by means of ſteams or effluvia expiring from the ſick, as in the plague and other peſtilential diſorders, in which caſe the air is ſaid to be contagious.

CONTEMPLATION, an act of the mind, whereby it applies itſelf to conſider and reflect upon the works of God, nature, *&c.*

CONTEMPORARY, a perſon or thing that exiſted in the ſame age with another. Thus, Socrates, Plato, and Ariſtophanes, were contemporaries.

CONTENT, in geometry, the area or quantity of matter or ſpace included in certain bounds. See GEOMETRY.

CONTESSA, a port-town of Turkey, in Europe, in the province of Macedonia, ſituated on a bay of the Archipelago, about 200 miles weſt of Conſtantinople: E. long. 25°, and N. lat. 41°.

CONTEXT, among divines and critics, that part of ſcripture or of a writing that precedes and follows the text.

CONTI, a town of Picardy in France, about fifteen miles ſouth-weſt of Amiens: E. long. 2° 20′, N. lat. 49° 40′.

CONTIGUITY, in geometry, is when the ſurface of one body touches that of another.

CONTINENT, in general, an appellation given to things continued without interruption; in which ſenſe we ſay, continent fever, *&c.*

CONTINENT, in geography, a great extent of land not interrupted by ſeas, in contradiſtinction to iſland and peninſula, *&c.* See GEOGRAPHY.

CONTINGENT, ſomething caſual or unuſual. Hence future contingent, denotes a conditional event which may or may not happen, according as circumſtances fall out.

CONTINGENTS are ſometimes uſed by mathematicians in the ſame ſenſe as tangent. See TANGENT.

CONTINUED *proportion*, in arithmetic, is that where the conſequent of the firſt ratio is the ſame with the antecedent of the ſecond; as 4 : 8 :: 8 : 16, in contradiſtinction to diſcrete proportion.

CONTINUITY, is defined by ſome ſchoolmen the immediate coheſion of parts in the ſame quantum; by others, a mode of body, whereby its extremities become one; and by others, a ſtate of body reſulting from the mutual implication of its parts. There are two kinds of continuity, mathematical and phyſical. The firſt is merely imaginary, ſince it ſuppoſes real or phyſical parts where there are none.

Phyſical continuity is that ſtate of two or more particles, in which their parts are ſo mutually implicated as to conſtitute one uninterrupted quantity or continuum.

CONTINUO, in muſic, ſignifies the thorough baſs, as baſſo continuo is the continual or thorough baſs, which is ſometimes marked in muſic books by the letters B. C.

CONTORSION, in medicine, has many ſignifications. 1. It denotes the iliac paſſion. 2. An incomplete diſlocation, when a bone is in part, but not entirely, forced from its articulation. 3. A diſlocation of the vertebræ of the back ſide-ways, or a crookedneſs of theſe vertebræ. And, 4. A diſorder of the head, in which it is drawn towards one ſide, either by a ſpaſmodic contraction of the muſcles on the ſame ſide, or a palſy of the antagoniſt muſcles on the other.

CONTOUR, in painting, the out-line, or that which defines a figure.

A great part of the ſkill of the painter lies in managing the contours well. Contour, with the Italian painters, ſignifies the lineaments of the face.

CONTOURNE, in heraldry, is uſed when a beaſt is repreſented ſtanding or running with its face to the ſiniſter ſide of the eſcutcheon, they being always ſuppoſed to look to the right, if not otherwiſe expreſſed.

CONTOURNIATED, a term among antiquaries applied to medals, the edges of which appear as if turned in a lath. This ſort of work ſeems to have had its origin in Greece, and to have been deſigned to perpetuate the memories of great men, particularly thoſe who had bore away the prize at the ſolemn games. Such

are

are thofe remaining of Homer, Solon, Euclid, Pythagoras, Socrates, and feveral athletæ.

CONTRABAND, in commerce, a prohibited commodity, or merchandife bought or fold, imported or exported, in prejudice to the laws and ordinances of a ftate, or the public prohibitions of the fovereign. Contraband goods are not only liable to confifcation themfelves, but alfo fubject all other allowed merchandife found with them in the fame box, bale or parcel, together with the horfes, waggons, *&c.* which conduct them. There are contrabands likewife, which, befides the forfeiture of the goods, are attended with feveral penalties and difabilities.

CONTRACT, in a general fenfe, a mutual confent of two or more parties, who voluntarily promife and oblige themfelves to do fomething, pay a certain fum, or the like. All donations, exchanges, leafes, *&c.* are fo many different contracts.

CONTRACTILE *force*, that property or power inherent in certain bodies, whereby, when extended, they are enabled to draw themfelves up again to their former dimenfions

CONTRACTION, in grammar, is the reducing of two fyllables into one, as *can't* for *cannot*, *fhould'ft* for *fhouldeft*, *&c.*

CONTRACTION, in phyfics. the diminifhing the extent or dimenfions of a body, or the caufing its parts to approach nearer to each other, in which fenfe it ftands oppofed to dilatation or expanfion.

CONTRA-FISSURE, in furgery, a kind of fracture, or fiffure, in the cranium, which fometimes happens on the fide oppofite to that which received the blow; or, at leaft, at fome diftance from it. See SURGERY.

CONTRARIETY, an oppofition between two things, which imports their being contrary to one another; and confifts in this, that one of the terms implies a negation of the other, either mediately or immediately; fo that contrariety may be faid to be the contraft, or oppofition of two things, one of which imports the abfence of the other, as love and hatred.

CONTRARY, a pofitive oppofite, which, fubfifting by turns in the fame fubject with its oppofite, is as remote from it as poffible, expells it, and is mutually expelled by it. Blacknefs and whitenefs, cold and heat, are fuch contraries.

CONTRAST. See RESEMBLANCE.

CONTRATE-*wheel*, in watch-work, that next to the crown, the teeth and hoop whereof lie contrary to thofe of the other wheels, from whence it takes its name. See WATCH-MAKING.

CONTRAVALLATION, or *the line* CONTRAVALLATION, in fortification, a trench guarded with a parapet, and ufually cut round about a place by the befiegers, to fecure themfelves on that fide, and to ftop the fallies of the garrifon. See FORTIFICATION.

CONTRAVENTION, in law, a man's failing to difcharge his word, obligation, duty, or the laws or cuftoms of the place.

CONTRAYERVA, in botany. See DORSTENIA.

CONTRE, in heraldry, an appellation given to feveral bearings, on account of their cutting the fhield contrary and oppofite ways: thus we meet with contre-bend, contre-chevron, contre-pale, *&c.* when there are two ordinaries of the fame nature oppofite to each other, fo as colour may be oppofed to metal, and metal to colour. See COUNTER.

CONTRITION, in theology, a forrow for our fins, refulting from the reflexion of having offended God, from the fole confideration of his goodnefs, without any regard to the punifhment due to the trefpafs, and attended with a fincere refolution of reforming them.

CONTROL is properly a double regifter kept of acts, iffues, *&c.* of the officers or commiffioners in the revenue, army, *&c.* in order to perceive the true ftate thereof, and to certify the truth, and the due keeping of the acts fubject to the enregifterment.

CONTROLLER, an officer appointed to control or overfee the accounts of other officers, and, on occafion, to certify whether or no things have been controlled or examined.

In Britain we have feveral officers of this name, as controller of the king's houfe, controller of the navy, controller of the cuftoms, controller of the mint, *&c.*

CONTROLLER *of the hanaper*, an officer that attends the lord chancellor daily, in term and in feal-time, to take all things fealed in leathern bags from the clerks of the hanaper, and to make the number and effect thereof, and enter them in a book, with all the duties belonging to the king and other officers for the fame, and fo charge the clerk of the hanaper with them.

CONTROLLER *of the pipe*, an officer of the exchequer, that makes out a fummons twice every year, to levy the farms and debts of the pipe. See PIPE, and EXCHEQUER.

CONTROLLERS *of the pells*, two officers of the exchequer, who are the chamberlain's clerks, and keep a control of the pell of receipts, and goings out.

CONTUSION, in medicine and furgery, any hurt of the body that is inflicted by a blunt inftrument. See SURGERY.

CONVALLARIA, or LILLY *of the* VALLEY, in botany, a genus of the hexandria monogynia clafs. The corolla is divided into fix fegments; and the berry is fpotted, and has three cells. The fpecies are eight, three of which are natives of Britain, *viz.* the majalis, or may-lily; the multiflora, or folomon's-feal; and the polygonatum, or fweet-fmelling folomon's-feal.

CONVENT, in church-hiftory. See MONASTERY.

CONVENTICLE, a private affembly or meeting, for the exercife of religion. The word was firft attributed as an appellation of reproach to the religious affemblies of Wickliffe, in this nation, in the reigns of Edward III. and Richard II. There were feveral ftatutes made in former reigns, for the fuppreffion of conventicles; but, by 1 William and Mary, it is ordered, that diffenters may affemble for the performance of religious worfhip, provided their doors be not locked, barred, or bolted.

CONVENTION, a treaty, contract, or agreement between two or more parties.

CONVENTION is alfo a name given to an extraordinary affembly of parliament, or the eftates of the realm, held without

without the king's writ; as was the convention of eſtates, who, upon the retreat of king James II. came to a concluſion that he had abdicated the throne, and that the right of ſucceſſion devolved to king William and queen Mary; whereupon their aſſembly expired as a convention, and was converted into a parliament.

CONVERGING, or CONVERGENT *lines*, in geometry, are ſuch as continually approach nearer one another, or whoſe diſtances become ſtill leſs and leſs. Theſe are oppoſed to divergent lines, the diſtances of which become continually greater: thoſe lines which converge one way, diverge the other.

CONVERGING *rays*, in optics, thoſe rays that, iſſuing from divers points of an object, incline towards another, till, at laſt, they meet and croſs, and then become diverging rays. See OPTICS.

CONVERSE, in mathematics. One propoſition is called the converſe of another, when, after a concluſion is drawn from ſomething ſuppoſed in the converſe propoſition, that concluſion is ſuppoſed; and then, that which in the other was ſuppoſed, is now drawn as a concluſion from it: thus, when two ſides of a triangle are equal, the angles under theſe ſides are equal; and, on the converſe, if theſe angles are equal, the two ſides are equal.

CONVERSION, in a moral ſenſe, implies a repentance for a temper and conduct unworthy our nature, and unbecoming our obligations to its Author, and a reſolution to act a wiſer and a better part for the future.

CONVERSION, in war, a military motion whereby the front of a battalion is turned where the flank was, in caſe the battalion is attacked in the flank.

CONVERSION *of equations*, in algebra. See Vol. I. p. 104.

CONVEX, an appellation given to the exterior ſurface of gibbous or globular bodies, in oppoſition to the hollow inner ſurface of ſuch bodies, which is called concave: thus we ſay, a convex frieze, lens, mirror, ſuperficies, *&c.*

CONVEXITY, that configuration or ſhape of a body, on account of which it is denominated convex.

CONVEYANCE, in law, a deed or inſtrument that paſſes land, *&c.* from one perſon to another.

CONVICT, in common law, a perſon that is found guilty of an offence by the verdict of a jury.

CONVICTION, in theology, expreſſes the firſt degree of repentance, wherein the ſinner becomes ſenſible of his guilt, of the evil nature of ſin, and of the danger of his own ways.

CONVOCATION, an aſſembly of the clergy of England, by their repreſentatives, to conſult of eccleſiaſtical matters. It is held during the ſeſſion of parliament, and conſiſts of an upper and a lower houſe. In the upper ſit the biſhops, and in the lower the inferior clergy, who are repreſented by their proctors, conſiſting of all the deans and archdeacons, of one proctor for every chapter, and two for the clergy of every dioceſe, in all one hundred and forty-three divines, *viz.* twenty-two deans, fifty-three archdeacons, twenty-four prebendaries, and forty-four proctors of the dioceſan clergy. The lower houſe chuſes its prolocutor, whoſe buſineſs it is to take care that the members attend, to collect their debates and votes, and to carry their reſolutions to the upper houſe. The convocation is ſummoned by the king's writ, directed to the archbiſhop of each province, requiring him to ſummon all biſhops, deans, archdeacons, *&c.*

The power of the convocation is limited by a ſtatute of Henry VIII. They are not to make any canons or eccleſiaſtical laws, without the king's licence; nor, when permitted to make any, can they put them in execution, but under ſeveral reſtrictions. They have the examining and cenſuring all heretical and ſchiſmatical books and perſons, *&c.* but there lies an appeal to the king in chancery, or to his delegates. The clergy in convocation, and their ſervants, have the ſame privileges as members of parliament.

CONVOLUTION, a winding motion, proper to the trunks of ſome plants, as the convolvulus, or bindweed; the claſpers of vines, bryony, *&c.*

CONVOLVULUS, or BIND-WEED, in botany, a genus of the pentandria monogynia claſs. The corolla is bell-ſhaped, and plaited; it has two ſtigmata; and the capſule is bilocular, each cell containing two ſeeds. There are forty-three ſpecies, only three of which are natives of Britain, *viz.* the arvenſis, or ſmall bindweed; the ſepium, or great bind-weed; and the ſoldanella, or ſea bind-weed.

CONVOY, in marine affairs, one or more ſhips of war, employed to accompany and protect merchant ſhips, and prevent their being inſulted by pirates, or the enemies of the ſtate in time of war.

CONVOY, in military matters, a body of men that guard any ſupply of men, money, ammunition, or proviſions, conveyed by land into a town, army, or the like, in time of war.

CONVULSION, in medicine, a preternatural and violent contraction of the membranous and muſcular parts of the body. See MEDICINE.

CONWAY, a market-town of Carnarvonſhire in North Wales, ſituated near the mouth of a river of the ſame name, fifteen miles weſt of St Aſaph: W. long. 3° 50′, and N. lat. 53° 20′.

CONYZA, or FLEA-BANE, in botany, a genus of the ſyngeneſia polygamia ſuperflua claſs. The receptacle is naked; the pappus is ſimple; the calix is roundiſh and imbricated; and the rays of the corolla are divided into three ſegments. There are nineteen ſpecies, only one of which is a native of Britain, *viz.* the ſquarroſa, or plowman's ſpikenard.

CONZA, a town of the kingdom of Naples in Italy, ſituated on the farther Principate, on the river Offanto, fifty miles ſouth-eaſt of the city of Naples: E. long. 16°, N. lat. 41°. It is the ſee of an archbiſhop.

COOPER, in geography, the name of a river in Carolina in North America.

COOPER, on board a ſhip, he that looks to the caſks, and all other veſſels for beer, water, or any other liquor. He has a mate under him.

CO-ORDINATE, ſomething of equal order, rank, or degree with another. See ORDER.

COPAIBA

COPAIBA, or *balsam of* Copaiba, a liquid resinous juice, flowing from incisions made in the trunk of the fera, a large tree which grows in the Spanish West Indies, and is used as a corroborating and detergent medicine.

COPAL, in the materia medica, a resin obtained from several sorts of large trees in New Spain. It is brought to us in irregular lumps; but it has never come into use as a medicine, and is rarely to be met with in the shops.

COPENHAGEN, the capital of the kingdom of Denmark, situated on the eastern shore of the island of Zealand, upon a fine bay of the Baltic sea, not far from the strait called the Sound: E. long. 13°, and N. lat. 55° 30′.

COPERNICAN, in general, something belonging to Copernicus. Hence,

Copernican *system* or *hypothesis*, that system of the world, wherein the sun is supposed to rest in the centre, and the planets, with the earth, to move in ellipses round him. See Vol. I. p. 434.

COPERNICUS, the name of an astronomical instrument, invented by Mr Whiston, to exhibit the motion and phænomena of the planets, both primary and secondary. It is built upon the Copernican system, and for that reason called by his name.

COPHTS, Cophti, or Copts, a name given to such of the Christians of Egypt as are of the sect of Jacobites.

The Cophts have a patriarch, who is styled the patriarch of Alexandria, having eleven or twelve bishops under him, but no archbishop. The rest of the clergy, whether secular or regular, are of the order of St Anthony, St Paul, and St Macarius, each of whom have their monasteries. The Cophts have seven sacraments, *viz.* baptism, the eucharist, confirmation, ordination, faith, fasting, and prayer.

COPHTIC, or Coptic *language*, is that spoke by the Cophts, being the ancient language of the Egyptians, intermixed with the Greek, and the characters of it being those of the Greek.

The ancient Coptic is now a dead language, to be met with no where but in books, and those only translations of the scriptures, and of ecclesiastical offices, or others that have a relation thereto; the language now used over all the country being that of the Arabic.

COPPEL, Copel, or Cuppel, a chemical vessel made of earth, pretty thick, and of the form of a platter or dish.

COPPELLING, or Cupelling, in chemistry, is the putting metallic substances into a coppel, or covered vessel, made of bone ashes, and set in a naked fire, to try what gold or silver they will afford. See p. 114.

COPPER constitutes a distinct genus of metals, being next to iron in specific gravity, but lighter than gold, silver, or lead. See p. 80.

COPPERAS, a name given to the factitious green vitriol. See Chemistry.

The English copperas is made at Deptford, in the following manner, from pyritæ. See Pyritæ.

A heap of these stones, two or three foot thick, is laid in a bed well rammed; where being turned once in six months, in five or six years, by the action of the air and rain, they begin to dissolve, and yield a liquor which is received in pits, and thence conveyed into a cistern, in a boiling-house. The liquor at length being pumped out of the cistern into a leaden boiler, and a quantity of iron added thereto, in two or three days the boiling is compleated; care having been taken all along to supply it with fresh quantities of iron, and to restore the boiling, whenever it seems to abate. When boiled sufficiently, it is drawn off into a cooler, with sticks across, where it is left 14 or 15 days to shoot. The uses of copperas are numerous. It is the chief ingredient in the dying of wool, cloths, and hats, black; in making ink, in tanning and dressing leather, *&c.* and from hence is prepared oil of vitriol, and a kind of Spanish brown for painters. In medicine it is rarely prescribed under the name of copperas, but it is a true salt of iron, and often prescribed under that name, and used instead of the genuine preparation; our chemists in general giving themselves no further trouble about the making of that salt, than to dissolve and purify the common copperas, and shoot it again into crystals.

COPPICE, or Copse, a little wood, consisting of under-woods, or such as may be raised either by sowing or planting.

COPULATION, the act of generation, or the congress of the male and female, otherwise called coition. See Generation.

COPY-HOLD, a tenure for which a tenant has nothing to shew but the copy of the rolls made by the steward of the lords court.

It is called a base tenure, because the tenant holds the land at the will of the lord. However, it is not simply at the will of the lord, but according to the custom of the manor by which such estate is descendible, and the tenants heirs may inherit it; and a copyholder, so long as he does his services, and does not break the custom, cannot be ejected by the lord; and if he be, he shall have trespass against him.

Copy-holder, one who is admitted tenant of lands or tenements within a manor, which time out of mind, by use and custom of the manor, have been demisable and demised to such as will take them in fee-simple or fee-tale, for life, years, or at will, according to the custom of the manor by copy of court-roll; but is generally where the tenant has such estate either in fee or for three lives.

COQUIMBO, a port-town of Chili, in South America, situated at the mouth of a river of the same name, which discharges itself into the pacific ocean: W. long 75° 10′, and N. lat. 30.°

COR caroli, in astronomy, an extraconstellated star in the northern hemisphere, situated between the coma berenices, and ursa major, so called by Dr Halley in honour of king Charles.

Cor hydræ, a fixed star of the first magnitude, in the constellation of hydra.

Cor leonis, or Regulus, in aſtronomy, a fixed ſtar of the firſt magnitude in the conſtellation leo.

CORACO-BRACHIALIS, in anatomy. See Vol. I. p. 196.

CORACOIDES, in anatomy. See Vol. I. p. 177.

CORACOMANTES, in antiquity, perſons who foretold events from their obſervations on crows.

CORACO-RADIALIS, in anatomy. See Vol. I. p. 197.

CORALLINA, or Coral, in zoology, a genus belonging to the order of vermes zoophyta. The trunk is radicated, jointed, and calcarious. The ſpecies are eight, diſtinguiſhed by the form of their branches, and are found in the ocean adhering to ſtones, bones, ſhells, *&c.* The corals were formerly believed to be vegetable ſubſtances hardened by the air; but are generally believed to be compoſed of a congeries of animals, which are even endued with the faculty of moving ſpontaneouſly. Linnæus's order of zoophyta is compoſed of animals of this kind, as the ſpongia, ſertularia, *&c.* See Natural History.

CORALLODENDRON, in botany. See Erythrina.

Coral *fiſhery*. Red coral is found in the Mediterranean, on the ſhores of Provence, from Cape de la Couronne to that of St Tropez; about the iſles of Majorca and Minorca; on the ſouth of Sicily; on the coaſts of Africa; and, laſtly, in the Ethiopic ocean, about cape Negro. The divers ſay, that the little branches are found only in the caverns whoſe ſituation is parallel to the earth's ſurface, and open to the ſouth. The manner of fiſhing being nearly the ſame wherever coral is found, it will ſuffice to inſtance the method uſed at the baſtion of France, under the direction of the company eſtabliſhed at Marſeilles for that fiſhery. Seven or eight men go in a boat commanded by the patron or proprietor, and when the net is thrown by the caſter, the reſt work the veſſel, and help to draw the net in. The net is compoſed of two rafters of wood tied croſs-wiſe, with leads fixed to them: to theſe they faſten a quantity of hemp twiſted looſely round, and intermingled with ſome large netting. This inſtrument is let down where they think there is coral, and pulled up again, when the coral is ſtrongly intangled in the hemp and netting. For this purpoſe, ſix boats are ſometimes required; and if in hauling in, the rope happens to break, the fiſhermen run the hazard of being loſt. Before the fiſhers go to ſee, they agree for the price of the coral, which is ſometimes more, ſometimes leſs a pound; and they engage, on pain of corporal puniſhment, that neither they nor their crew ſhall embezzle any, but deliver the whole to the proprietors. When the fiſhery is ended, which amounts one year with another to twenty-five quintals for each boat, it is divided into thirteen parts, of which the proprietor hath four, the caſters two, and the other ſix men one each, the thirteenth belongs to the company for payment of the boat furniſhed them.

CORAN, or Alcoran. See Alcoran.

CORAX, in ornithology, the trivial name of a ſpecies of corvus. See CORVUS.

CORBAN, a ſcripture term of an offering which had life, in oppoſition to the minchab which had no life.

Corban is alſo a ceremony which the Mahometans perform at the foot of mount Ararat, in Arabia, near Mecca. It conſiſts in killing a great number of ſheep, and diſtributing them among the poor.

CORBEILS, in fortification. See Basket.

CORBEL, in architecture, a repreſentation of a baſket, ſometimes ſeen on the heads of th caryatides.

CORBY, a town of Germany, thirty miles eaſt of Paderborn, in Weſtphalia: Eaſt long. 9° 20′, N. lat. 51° 40′.

CORCHORUS, Jews-sallad, in botany, a genus of the polyandria monogynia claſs. The corolla conſiſts of five petals; the calix is deciduous, and conſiſts of five leaves; and the capſule has many cells and valves. The ſpecies are ſix, none of them natives of Britain.

Cord *of wood*, a certain quantity of wood for burning, ſo called becauſe formerly meaſured with a cord. The dimenſions of a ſtatute cord of wood are eight feet long, four feet high, and four feet broad.

Cord-wood, is new wood, and ſuch as, when brought by water, comes on board a veſſel, in oppoſition to that which is floated.

CORDAGE, a term uſed, in general, for all ſorts of cord, whether ſmall, middling, or great. See Rope.

CORDATED, an appellation frequently given by naturaliſts to things ſomewhat reſembling a heart.

CORDED, in heraldry. A croſs corded ſome authors take for a croſs wound or wrenched about with cords. See Cabled-cross.

Others, with more probability, take it for a croſs made of two pieces of cord.

CORDELERAS, mountains of ſouth America, otherwiſe called Andes. See Andes.

CORDELIER, in church-hiſtory, a Franciſcan or religious of the order of St Francis.

CORDIA, in botany, a genus of the pentandria monogynia claſs. The corolla is tunnel-ſhaped, and has but one petal; the ſtylus is dichotomous; and the fruit is a bilocular drupa. The ſpecies are five, none of them natives of Britain.

CORDIAL, in medicine, whatever raiſes the ſpirits, and gives them a ſudden ſtrength and chearfulneſs, as wine, ſpirits, the effluvia of flowers, fruit, and many other ſubſtances.

CORDON, in fortification, a row of ſtones, made round on the outſide, and ſet between the wall of the fortreſs which lies aſlope, and the parapet which ſtands perpendicular, after ſuch a manner, that this difference may not be offenſive to the eye: whence the cordons ſerve only as an ornament, ranging round about the place, being only uſed in fortification of ſtone-work. For in thoſe made with earth, the void ſpace is filled up with pointed ſtakes.

CORDOUA, Cordova, a city of Andaluſia, in Spain,

ſituated on the river Guadalquivir, ſeventy-two miles north-eaſt of Seville, and ſeventy-five north of Malaga: W. long. 4° 45′, and N. lat. 37° 45′.

COREA, an iſland or peninſula on the north-eaſt coaſt of China, between 36° and 42° N. lat.

CORDWAINERS a term whereby ſhoemakers are denominated in ſtatutes. By a ſtatute of Jac. I. the maſter and wardens of the cordwainers company, *&c.* are to appoint ſearchers and triers of leather; and no leather is to be ſold before ſearched, ſealed, *&c.*

CORDYLINA, in botany. See YUCCA.

CORDYLUS, the trivial name of a ſpecies of Lacerta. See LACERTA.

COREGONUS, in ichthyology, a ſynonime of a ſpecies of Salmo. See SALMO.

COREIA, in antiquity, a feſtival in honour of Proſerpine.

COREOPSIS, in botany, a genus of the ſyngeneſia polygamia fruſtranea claſs. The receptacle is paleaceous, the pappus has two double horns; the calix is erect, and conſiſts of many leaves. There are eleven ſpecies, none of them natives of Britain.

CORFE-CASTLE, a borough-town of Dorſetſhire, about twelve miles eaſt of Dorcheſter, near the ſea: W. long. 2° 10′, and N. lat. 50° 36′. It ſends two members to Parliament.

CORFU, an iſland ſubject to the Venetians, ſituated in the Mediterranean, near the entrance of the gulph of Venice.

CORFU is alſo the capital of the above iſland: E. long. 20° 40′, and N. lat. 39° 40′

CORIA, a city of Eſtremadura, in Spain, thirty-five miles north of Alcantara: W. long 6° 40′, and N. lat. 39° 55′. It is a biſhop's ſee.

CORIANDRUM, in botany, a genus of the pentandria digynia claſs. The corolla is radiated; the involucrum univerſale conſiſts of one leaf, and the partiale is dimidiated; and the fruit is ſpherical. The ſpecies are two, only one of which, *viz.* the ſativum, or coriander, is a native of Britain. The ſeeds are uſed as a ſtomachic.

CORIARIA, MYRTLE-SUMACH, in botany, a genus of the diœcia decandria claſs. The calix of both male and female conſiſts of five leaves, and the corolla of each has five petals. The antheræ are divided into two parts: The female has five ſtyli, and five ſeeds. The ſpecies are two, none of them natives of Britain.

CORINDUM, in botany. See CARDIOSPERMUM.

CORINTH, a city of European Turky, ſituated near the iſthmus into the Morea, about fifty miles weſt of Athens, in 23° E. long. and 37° 30′ N. lat.

CORINTHIAN ORDER, in architecture. See Vol. I. p. 352.

CORIS, in botany, a genus of the pentandria monogynia claſs. The corolla has but one irregular leaf; the calix is prickly, and the capſule has five valves. There is but one ſpecies, a native of Montpelier.

CORISPERMUM, in botany, a genus of the monandria digynia claſs of plants, whoſe corolla conſiſts of two compreſſed, crooked, pointed petals, equal in ſize, and placed oppoſite one another: its fruit is a roundiſh capſule, compreſſed, bilocular, and having a furrowed edge; the ſeeds are of an oblong figure, and ſtand ſingle. There are two ſpecies, none of them natives of Britain.

CORK, or CORK-TREE, in botany. See QUERCUS.

CORK, or CORKING *of a ſaddle*, the pieces to which the bolſters are made faſt; ſo called as having formerly been made of cork.

CORK, in geography, the capital of a county of the ſame name, in Ireland, and province of Munſter, ſituated on the river Lee, about fifty miles ſouth of Limerick: W. long. 8° 25′, and N. lat. 51° 40′.

CORMANDEL-COAST, comprehends the eaſtern coaſt of the hither India, bounded by Golconda on the north, the bay of Bengal on the eaſt, Madura on the ſouth, and Biſnagar on the weſt: it lies between 10° and 20° N. lat.

CORMORANT, in ornithology. See TANTALUS.

CORN, in country affairs, the grain or ſeeds of plants, ſeparated from the ſpica, or ear, and uſed for making bread.

There are ſeveral ſpecies of corn, ſuch as wheat, rye and barley, millet and rice, oats, maize and lentils, peaſe, and a number of other kinds, each of which has its uſefulneſs and propriety. Corn is very different from fruits, with reſpect to the manner of its preſervation; and is capable of being preſerved in public granaries, for preſſing occaſions, and of being kept for ſeveral centuries.

The firſt method is to let it remain in the ſpike; the only expedient for conveying it to the iſlands and provinces of America. The inhabitants of thoſe countries ſave it in the ear, and raiſe it to maturity by that precaution: but this method of preſerving it, is attended with ſeveral inconveniencies among us; corn is apt to rot or ſprout, if any the leaſt moiſture is in the heap; the rats likewiſe infeſt it, and our want of ſtraw alſo obliges us to ſeparate the grain from the ear. The ſecond is to turn and winnow it frequently; or to pour it through a trough or mill-hopper, from one floor to another; being thus moved and aired every fifteen days, for the firſt ſix months, it will require leſs labour for the future, if lodged in a dry place: but if, through neglect, mites ſhould be allowed to ſlide into the heap, they will ſoon reduce the corn to a heap of duſt: this muſt be avoided by moving the corn anew, and rubbing the places adjacent with oils and herbs, whoſe ſtrong odour may chace them away; for which garlic and dwarf-elder are very effectual: they may likewiſe be expoſed to the open ſun, which immediately kills them. When the corn has been preſerved from all impurities for the ſpace of two years, and has exhaled all its fires, it may be kept for fifty or even a hundred years, by lodging it in pits, covered with ſtrong planks, cloſely joined together: but the ſafer way is to cover the heap with quick-lime, which ſhould be diſſolved by ſprinkling it over with a ſmall quantity of water; this cauſes the grains to ſhoot to the

the depth of two or three fingers, aud incloſes them with an incruſtation, through which neither air nor inſects can penetrate.

Corn not exceeding the under-mentioned prices have the following bounties *per* quarter, *viz.*

	Price *per* qr. l.	s.	Bounty *per* qr. s.	d.
Wheat	2	8	5	0
Rye	1	12	3	6
Barley and Malt	1	4	2	6
Oat-meal	0	15	2	6

In France corn of the growth of the kingdom is reckoned a contraband commodity.

CORN-MILL, a water-engine for grinding of corn. See MECHANICS.

CORN, in medicine and ſurgery, a hard tubercle like a flat wart, growing in ſeveral parts of the feet, eſpecially upon the joints of the toes. See MEDICINE.

CORNACHINE-*powder*, the ſame with what is ſometimes called the earl of Warwick's powder, and *pulvis de tribus*. It is prepared thus: Take four ounces of ſcammony; calcined hartſhorn prepared, three ounces; grind them together into a powder. It is given as a purge.

CORNAGE, an ancient tenure, the ſervice whereof was to blow a horn when any invaſion of the Scots was perceived.

This tenure was very frequent in the northern counties near the Picts wall.

CORNEA *tunica*, in anatomy. See Vol. I. p. 289.

CORNEL-*tree*, in botany. See CORNUS.

CORNELIAN. See CARNELIAN.

CORNER, in a general ſenſe, the ſame with angle. See ANGLE.

CORNET, in the military art of the ancients, an inſtrument much in the nature of a trumpet, which when it only ſounded, the enſigns were to march alone, without the ſoldiers; whereas, when the trumpet only ſounded, the ſoldiers were to move without the enſigns. The cornets and buccinæ ſounded the charge and retreat, and the cornets and trumpets ſounded during the courſe of the battle.

CORNET, in the military art of the moderns, the third commiſſion-officer in a troop of horſe or dragoons.

This is a very honourable poſt: he commands in the lieutenant's abſence; his principal duty being to carry the ſtandard, near the middle of the firſt rank of the ſquadron.

CORNEUS, the name by which Linnæus calls a kind of tin-ore, found in black columns, with irregular ſides, and terminating in priſms.

CORNICHE, CORNISH, or CORNICE, in architecture. See ARCHITECTURE.

CORNICHE is alſo uſed, in general, for all little projectures in maſonry or joinery, even where there are no columns, as the corniche of a chimney, beaufet, &c.

CORNICHE-*ring*, of a piece of ordnance, is that next from the muzzle-ring, backward.

CORNICULARIUS, in Roman antiquity, an officer of the army, appointed to aſſiſt the military tribune in quality of lieutenant.

CORNIX, in ornithology, the trivial name of a ſpecies of corvus. See CORVUS.

CORNU. See HORN.

CORNU *ammonis*, in natural hiſtory, foſſile ſhells, called alſo ſerpent-ſtones, or ſnake-ſtones.

They are found of all ſizes, from the breadth of a ſixpence, to more than two feet in diameter; ſome of them rounded, others greatly compreſſed, and lodged in different ſtrata of ſtones and clays; ſome again are ſmooth, and others ridged in different manners, their ſtriæ and ridges being either ſtraight, irregularly crooked, or undulated.

CORNU *cervi*. See HARTSHORN.

CORNUCOPIA, or HORN OF PLENTY, among painters, &c. is repreſented under the figure of a large horn, out of which iſſue fruits, flowers, &c. Upon medals the cornucopia is given to all deities, genii, and heroes, to mark the felicity and abundance of all the wealth procured by the goodneſs of the former, or the care and valour of the latter.

CORNUCOPIÆ, in botany, a genus of the triandria digynia claſs. The involucrum conſiſts of one tunnel-ſhaped crenated leaf, containing many flowers; and the calices are double-valved. There is but one ſpecies, *viz.* the cucullatum, a native of Smyrna.

CORNUS, or CORNEL-TREE, in botany, a genus of the tetrandria monogynia claſs. The involucrum conſiſts moſtly of four leaves; the petals are four, and above the fruit, which is a bilocular gluma. There are five ſpecies, none of them natives of Britain.

CORNUTIA, in botany, a genus of the didynamia angioſpermia claſs. The calix has five teeth; the ſtamina are longer than the corolla; the ſtylus is very long; and the berry contains but one ſeed.

CORNWAL, the moſt weſterly county of England, which gives the title of duke to the prince of Wales. It ſends forty-four members to parliament.

COROLLA, among botaniſts, the moſt conſpicuous part of a flower, ſurrounding the organs of generation, and compoſed of one or more flower-leaves, moſt commonly called petals, to diſtinguiſh them from the leaves of the plant; according as there is one, two, or three of theſe petals, the corolla is ſaid to be monopetalous, dipetalous, tripetalous, &c.

COROLLARY is a conſequence drawn from ſomething already advanced or demonſtrated.

COROLLULA, a term uſed by botaniſts, to expreſs the little partial flowers, which together make up the compound ones.

CORONA, among anatomiſts, denotes that edge of the glans penis where the preputium begins. See ANATOMY.

CORONA, among botaniſts. See PAPPUS.

CORONA BOREALIS, the NORTHERN CROWN, in aſtronomy. See Vol. I. p. 486.

CORONA *imperialis*, in zoology, a ſynonime of a ſpecies of conus. See CONUS.

CORONA *imperialis*, in botany. See FRITILLARIA.

CORONA

Corona *folis*, in botany. See Helianthus.

Coronæ *jus*. See Jus.

CORONAL, in anatomy. See Vol. I. p. 152.

CORONALE *os*, in anatomy, the fame with the os frontis. See Vol. I. p. 152.

CORONARIA, in botany. See Agrostema.

CORONARY *veffels*, in anatomy. See Anatomy, Part III. and IV.

CORONEOLA, in botany. See Lysimachia.

CORONER, an ancient officer of this kingdom, fo called becaufe he is wholly employed for the king and crown.

The office of coroners efpecially concerns the pleas of the crown; and they are confervators of the peace in the county where elected, being ufually two for each county. Their authority is judicial and minifterial: judicial, where a perfon comes to a violent death; to take and enter appeals of murder, pronounce judgment on outlawries, *&c.* and to inquire into the lands, goods, and efcape of murders, treafure trove, wreck of the fea, deodands, *&c.* The minifterial power is when coroners execute the king's writs, on exception taken to the fheriff, as being party in a fuit, of kin to either of the parties, or on the default of the fheriff, *&c.* The authority of the coroner does not terminate on the demife of the king, as that of judges, *&c.* does, who act by the king's commiffion. On default of fheriffs, coroners are to impannel juries, and to return iffues on juries not appearing, *&c.*

CORONET. See Crown.

Coronet, or Cronet *of a horfe*, the loweft part of the poftern, which runs round the coffin, and is diftinguifhed by the hair joining and covering the upper part of the hoof.

CORONILLA, in botany, a genus of the diadelphia decandria clafs. The calix is bilabiated, and the vexillum is hardly longer than the alæ. There are 11 fpecies, none of them natives of Britain.

CORONOPUS, in botany. See Plantago.

CORPORA *cavernofa*, in anatomy. See Vol. I. p. 272.

Corpora *olivaria*, in anatomy. See Vol. I. p. 287.

Corpora *pyramidalia*, in anatomy. See Vol. I. p. 287.

Corpora *ftriata*. in anatomy. See Vol. I. p. 286.

CORPORAL, an inferior officer under a ferjeant, in a company of foot, who has charge over one of the divifions, places and relieves centinels, and keeps good order in the corps de garde: he alfo receives the word from the inferior rounds, which paffes by his corps de garde. This officer carries a fufee, and is commonly an old foldier: there are generally three corporals in each company.

Corporal *of a fhip*, an officer who has the charge of fetting and relieving the watches and centries, and who fees that the foldiers and failors keep their arms neat and clean: he teaches them how to ufe their arms, and has a mate under him.

CORPORATION, a body politic, or incorporate, fo called, becaufe the perfons or members are joined into one body, and are qualified to take and grant, *&c.*

Corporations are either fpiritual or temporal: fpiritual, as bifhops, deans, archdeacons, parfons, vicars, *&c.* Temporal, as mayor, commonalty, bailiff, burgeffes, *&c.* And fome corporations are of a mixed nature, compofed of fpiritual and temporal perfons, fuch as heads of colleges and hofpitals, *&c.* All corporations are faid to be ecclefiaftical or lay: ecclefiaftical are either regular, as abbeys, priories, chapters, *&c.* or fecular, as bifhoprics, deanries, archdeaconries, *&c.* lay, as thofe of cities, towns, companies, or communities of commerce, *&c.*

CORPOREAL, thofe qualities which denominate a body. See Quality, Body, and Incorporeal.

CORPULENCY, in medicine, the ftate of a perfon too much loaded with flefh or fat.

CORPUS *callofum*, in anatomy. See Vol. I. p. 285.

Corpus *cavernofum*, in anatomy. See Vol. I. p. 272.

Corpus *reticulare*. See Reticulare.

Corpus *Chrifti*, a feftival of the church, kept on the next Thurfday after Trinity-funday, inftituted in honour of the euchariſt; to which alfo one of the colleges in Oxford is dedicated.

CORPUSCLE, in phyfics, a minute particle, or phyfical atom, being fuch as a natural body is made up of. By this word is not meant the elementary particles, nor the hypoftatical principles of chemifts; but fuch particles, whether of a fimple or compound nature, whofe parts will not be diffolved nor diffipated by ordinary degrees of heat.

CORPUSCULAR *philofophy*, that way of philofophifing which endeavours to explain things, and to account for the phenomena of nature by the motion, figure, reft, pofition, *&c.* of the corpufcles, or the minute particles of matter.

Mr Boyle fums up the chief principles of the corpufcular hypothefis, which now flourifhes under the mechanical philofophy, in thefe particulars:

1. They fuppofe that there is but one catholic or univerfal matter, which is an extended, impenetrable, and divifible fubftance, common to all bodies, and capable of all forms. 2. That this matter, in order to form the vaft variety of natural bodies, muft have motion in fome or all its affignable parts; and that this motion was given to matter by God the Creator of all things, and has all manner of directions and tendencies. 3. Matter muft alfo be actually divided into parts, and each of thefe primitive particles, fragments, or atoms of matter, muft have its proper magnitude or fize, as alfo its peculiar figure or fhape. 4. They fuppofe alfo, that thefe differently fized and fhaped particles may have as different orders and pofitions, whereof great variety may arife in the compofition of bodies.

CORRECTION, in printing, the pointing out or difcovering the faults in a printed fheet, in order to be amended by the compofitor before it be printed off. See Printing.

CORRECTOR, in general, denotes fomething that mends the faults or bad qualities of others.

Corrector *of the ftaple*, a clerk belonging to the ftaple, whofe bufinefs is to write down and record the bargains that merchants make there.

Corrector,

CORRECTOR, in medicine and pharmacy, an ingredient in a compofition, which guards againft or abates the force of another.

CORRELATIVE, fomething oppofed to another in a certain relation. Thus, father and fon are correlatives. Light and darknefs, motion and reft, are correlative and oppofite terms.

CORRIGIOLA, in botany. See ILLECEBRUM.

CORROBORANTS, or CORROBORATIVE *medicines*. See STRENGTHENERS.

CORROSION, in a general fenfe, the action of gnawing away, by degrees, the continuity of the parts of bodies.

CORROSION, in chemiftry, an action of bodies, by means of proper menftruums, that produces new combinations, and a change of their form, without converting them to fluidity. See CHEMISTRY.

CORRUGATOR, in anatomy. See Vol I. p. 291.

CORROSIVES, in furgery, are medicines which corrode whatever part of the body they are applied to: fuch are burnt alum, white precipitate of mercury, white vitriol, red precipitate of mercury, butter of antimony, lapis infernalis, *&c.*

CORRUPTION, the deftruction, extinction, or, at leaft, ceffation for a time, of the proper mode of exiftence of any natural body. See PUTREFACTION.

CORRUPTION *of blood*, in law, an infection accruing to a man's ftate, attainted of felony and treafon, and to his iffue; for as he lofes all to the prince, *&c.* his iffue cannot be heirs to him, or to any other anceftor by him: and if he were noble, his heirs are rendered ignoble.

CORSA, in architecture. See PLAT-*band*.

CORSAIR, a pirate, or perfon who fcours the fea for plunder, with an armed veffel, without commiffion from any prince or power. A corfair differs from a privateer, in that the latter acts under a commiffion, and only attacks the veffels of thofe at war with the ftate whence he had his commiffion.

CORSELET, a little cuirafs; or, according to others, an armour or coat made to cover the whole body, anciently worn by the pike-men, ufually placed in the front and flanks of the battle, for the better refifting the enemy's affaults, and guarding the foldiers placed behind them.

CORSICA, an ifland in the Mediterranean, between 8° and 10° E. long. and between 41° and 43° N. lat. about one hundred miles fouth of Genoa, and fubject to that republic; though the natives for many years difputed their right. This ifland is now in the hands of the French, after a glorious ftruggle for liberty under general Paoli.

CORTEX, or CORTEX *Peruvianus*. See CINCHONA.

CORTEX *cerebri*. See Vol. p. 285.

CORTONA, a city of Tufcany, in Italy, about thirty-five miles fouth-eaft of Sienna: E. long. 13°, and N. lat. 43° 15′.

CORTUSA, in botany, a genus of the pentandria monogynia clafs. The corolla is rotated, with an open limbus; and the capfule has two valves. There are two fpecies, none of them natives of Britain.

CORUNNA, or GROYNE, a port-town of Gallicia in Spain, fituated on a fine bay of the Atlantic ocean, about thirty-two miles north of Compoftella: W. long. 9°, and N. lat. 43°.

CORUS, in Jewifh antiquity. See HOMER.

CORUS, in our old writers, denotes eight bufhels, or a quarter.

CORUS is alfo a wind, fo called by the Jews, rifing in the fummer in the weft; and is that at prefent called the north-eaft-wind.

CORUSCATION, a glittering, or gleam of light iffuing from any thing It is chiefly ufed for a flafh of lightening darting from the clouds in time of thunder.

CORVUS, the RAVEN, or CROW-kind, in ornithology, a genus of birds, of the order of picæ, the diftinguifhing characteriftics of which are thefe: The beak is convex and cultrated; the noftrils are covered with briftly feathers; the tongue is forked and cartilaginous; and the feet are of the walking kind. The fpecies are nineteen, *viz.* 1. The hottentottus, is of a greenifh black colour, with long myftaches, and an equal tail. It is found at the Cape of Good Hope. 2. The corax, or raven of Englifh authors, is black, with a blueifh back, and a roundifh tail. It is a native of Europe, and feeds upon carrion: it is much given to theft, and may be taught to utter articulate founds. 3. The corone, or carrion-crow, is of a black blueifh colour, with the prime wing-feathers fharp, and a round tail: it lives upon carrion and fruits, and is a native of Europe. 4. The frugilegus, or rook, is black, with an afh-coloured forehead, and a roundifh tail. The rooks affemble in flocks, and infeft the corn-fields: many of them fleep together in the fame tree, by which means they are eafily taken. 5. The cornix, or royfton-crow, is afh-coloured, with the throat, wings, and tail black. It feeds upon worms, fnails, frogs, caterpillars, *&c.* 6. The monedula, or jack-daw, is of a dufky colour, with a hoary hind-head; and the wings, tail, and forehead black. It is a native of Europe. They flock together in winter, fleep, and build their nefts in old turrets and walls. 7. The glandularius, or jay, has blueifh wings, with tranfverfe black and white lines; and the body is variegated with an iron-colour. It is a native of Europe, and feeds upon nuts, corn, and fometimes fmall birds. 8. The criftatus, or blue-crefted jay, has the covert feathers of the wings marked with tranfverfe black lines, a blueifh body, and a black collar. It is a native of North America. 9. The cayanus, is of a violet colour above, and white below, with a black front and throat, and the point of the tail white: the feathers of the hind head are erect and rigid. It is a native of Cayenne. 10. The caryocatactes, is brown, and fpotted with white; the wings and tail are black; the prime tail-feathers are white at the points, but the intermediate ones have a worn appearance. It is a native of Europe, and feeds upon nuts. 11. The balicaffius is of a greenifh black colour, with a forked tail.

It is found on the Philippine iſles. 12. The afer, is of a violet blackiſh colour, and has a wedge-like tail. It is a native of Africa. 13. The pica, or magpye, is variegated with black and white, and its tail is ſhaped like a wedge. They build their neſts in trees in a very artificial manner; the outſide conſiſts of thorns both above and below, leaving only a hole for their entrance. They lay five or ſix eggs, which are pale and ſpotted: they feed upon ſmall birds, *&c.* and carefully lay up ſuperfluous food till they become hungry again. They may be learned to talk pretty diſtinctly. 14. The ſenegalenſis, is of a blackiſh violet colour, with black legs, and a wedge-ſhaped tail. It is a native of Senegal. 15. The brachyurus, is green below, with yellow lines on the head, and white ſpots on the wings. It is found in the Molucca iſles. 16. The canadenſis, is of a duſky colour, with a yellow forehead, and white below: it has a roundiſh tail, and is a native of Canada. 17. The pyrrhocorax, is blackiſh, with a yellow beak, and black legs. 18. The graculus, is of a blackiſh violet colour, with a yellow back and legs. 19. The eremita, is greeniſh, with a yellowiſh head, a ſmall creſt on the back part of the head, and a red beak and legs. The three laſt are natives of Switzerland.

CORVUS, the RAVEN, in aſtronomy. See Vol. I. p. 487.

CORVUS, in Roman antiquity, a military engine, or rather gallery, moveable at pleaſure by means of pullies, chiefly uſed in boarding the enemy's ſhips, to cover the men.

CORYBANTES, in antiquity, prieſts of the goddeſs Cybele, who, inſpired with a ſacred fury, danced up and down, toſſing their heads, and beating on cymbals or brazen drums. They inhabited mount Ida, in the iſland of Crete, where they nouriſhed the infant Jupiter, keeping a continual rattling with their cymbals, that his father Saturn, who had reſolved to devour all his male offspring, might not hear the child's cries.

CORYBANTICA, in Grecian antiquity, a feſtival kept in honour of the Corybantes.

CORYCOMACHIA, among the ancients, was a ſort of exerciſe in which they puſhed forwards a ball, ſuſpended from the ceiling, and at its return either caught it with their hands, or ſuffered it to meet their body. Oribaſius informs us it was recommended for extenuating too groſs bodies.

CORYDALIS, in botany. See FUMARIA.

CORYLUS, the HAZLE, in botany, a genus of the monoecia polyandria claſs. The calix of the male conſiſts of one trifid leaf, and contains but one flower; it has no corolla, but eight ſtamina: the calix of the female conſiſts of two lacerated leaves; it has no corolla; the ſtyli are two; and the nut is oval. There are two ſpecies, *viz.* the avellana, a native of Britain; and the colurna, a native of Bizantium.

CORYMBIUM, in botany, a genus of plants belonging to the ſyngeneſia monogynia claſs. The calix conſiſts of two leaves ſhaped like a priſm, and containing one flower; the corolla has but one regular petal; and the fruit contains one downy ſeed. There is but one ſpecies, a native of Africa.

CORYMBUS, in botany. See Vol. I. p. 637.

CORYPHA, in botany, a genus belonging to the order of palmæ flabellifoliæ. The corolla conſiſts of three petals; it has ſix ſtamina, and one piſtillum; and the fruit is a drupa containing one ſeed. There is but one ſpecies, a native of India.

CORYPHÆNA, in ichthyology, a genus belonging to the order of thoracici. The head is declined and truncated; the branchioſtege membrane has ſix rays; and the back fin runs the whole length of the back. There are twelve ſpecies, moſt of them found in foreign ſeas.

CORYZA, in medicine, a catarrh of the noſe. See CATARRH.

CORZOLA, or CURSCOLA, an iſland in the gulf of Venice, divided from Raguſa in Dalmatia, by a narrow ſtrait: E. long. 18°, and N. lat. 42° 35′.

COS, the WHET-STONE, in natural hiſtory, a genus of vitreſcent ſtones, conſiſting of fragments of an indeterminate figure, ſub-opaque, and granulated.

Of this genus there are ſeveral ſpecies, ſome conſiſting of rougher, and others of ſmoother, or even of altogether impalpable particles; and uſed not only for whet-ſtones, but alſo for mill-ſtones, and other the like purpoſes.

CO-SECANT, in geometry, the ſecant of an arch which is the complement of another to 90°. See GEOMETRY.

COSENZA, the capital of the hither Calabria, in the kingdom of Naples: E. long. 16° 35′, N. lat. 39° 15′. It is an archbiſhop's ſee.

CO-SINE, in trigonometry, the ſine of an arch, which is the complement of another to 90°. See GEOMETRY.

COSMETIC, in phyſic, any medicine or preparation which renders the ſkin ſoft and white, or helps to beautify and improve the complexion; as lip-ſalves, cold creams, ceruſs, *&c.*

COSMICAL, a term in aſtronomy, expreſſing one of the poetical riſings of a ſtar: thus a ſtar is ſaid to riſe coſmically, when it riſes with the ſun, or with that point of the ecliptic in which the ſun is at that time: and the coſmical ſetting is when a ſtar ſets in the weſt at the ſame time that the ſun riſes in the eaſt.

COSMOGRAPHY, a deſcription of the ſeveral parts of the viſible world; or the art of delineating the ſeveral bodies according to their magnitudes, motions, relations, *&c.*

Coſmography conſiſts of two parts, aſtronomy and geography. See ASTRONOMY, and GEOGRAPHY.

COSSACKS, people inhabiting the banks of the rivers Neiper and Don, near the Black-ſea and frontiers of Turky. Their country is commonly called the Ukraine, and is moſtly ſubject to Ruſſia.

COSSET, among farmers, a colt, calf, lamb, *&c.* brought up by hand, without the dam.

COSTAL, an appellation given by anatomiſts to ſeveral parts belonging to the ſides: thus we meet with coſtal muſcles, vertebræ, *&c.*

COSTA-RICA, a province of Mexico, bounded by the North ſea on the north-eaſt, and by the Pacific ocean on the ſouth-weſt. Its chief town is New-Carthage.

COSTARUM *depreſſores*, in anatomy. See Vol. I. p. 215.

COSTIVENESS, in medicine, a preternatural detention of the fæces, with an unuſual dryneſs and hardneſs thereof, and thence a ſuppreſſion of their evacuation. See Medicine.

COSTMARY, the Engliſh name of a ſpecies of tanzy. See Tanacetum.

COSTRANGULA, in botany. See Scrophularia.

COSTUME, a term among painters: thus a painter muſt obſerve the coſtume; that is, he muſt make every perſon and thing ſuſtain its proper character, and not only obſerve the ſtory, but the circumſtances, the ſcene of action, the country or place, and make the habits, arms, manners, proportions, and the like, to correſpond.

COSTUS, in botany, a genus of the monandria monogynia claſs. The interior part of the corolla is inflated and ringent; the inferior lip being trifid. There is but one ſpecies, *viz.* the arabicus, a native of both the Indies. The root of the coſtus is ſaid to attenuate acid humours, and to promote expectoration, perſpiration, and urine; but is now rarely to be met with in the ſhops.

CO-TANGENT, the tangent of an arch, which is the complement of another to 90°. See Geometry.

COTHURNIX, in ornithology. See Tetrao.

COTICE, or Cotise, in heraldry, is the fourth part of the bend; and with us ſeldom if ever borne but in couples, with a bend between them. See Bend.

The bend thus bordered, is ſaid to be cotiſed; as, he bears ſable, on a bend cotiſed argent, three cinquefoils. See Plate LXV. fig. 11.

COTINUS, in botany, the trivial name of a ſpecies of rhus. See Rhus.

COTONASTER, in botany. See Cratægus.

COTRONA, a town of the further Calabria, in the kingdom of Naples, ſituated on the Mediterranean, about fifteen miles ſouth-eaſt of St Severino: E. long. 17° 40′, and N. lat. 38° 50′. It is the ſee of a biſhop.

COTTON, in commerce, a ſoft downy ſubſtance found on the bombax, or cotton-tree. See Bombax.

Cotton is ſeparated from the ſeeds of the plant by a mill, and then ſpun and prepared for all ſorts of fine works, as ſtockings, waiſtcoats, quilts, tapeſtry, curtains, *&c.* With it they likewiſe make muſlin, and ſometimes it is mixed with wool, ſometimes with ſilk, and even with gold itſelf.

The fineſt ſort comes from Bengal and the coaſt of Coromandel.

Cotton makes a very conſiderable article in commerce, and is diſtinguiſhed into cotton-wool, and cotton-thread. The firſt is brought moſtly from Cyprus, St John d'Acre, and Smyrna: the moſt eſteemed is white, long, and ſoft. Thoſe who buy it in bales ſhould ſee that it has not been wet, moiſture being very prejudicial to it. The price of the fineſt is uſually from ſix to ſeven piaſters the quintal of forty-four ocos.

Of cotton thread, that of Damas, called cotton d'ounce, and that of Jeruſalem, called bazas, are the moſt eſteemed; as alſo that of the Antilles iſlands. It is to be choſen white, fine, very dry, and evenly ſpun. The other cotton-threads are the half bazas, the rames, the beledin, and gondezel; the payas and montaſiri, the geneguins, the baquins, the joſſelaſſars, of which there are two ſorts. Thoſe of India, known by the name of Tutucorin, Java, Bengal, and Surat, are of four or five ſorts, diſtinguiſhed by the letters A, B, C, *&c.* They are ſold in bags, with a deduction of one pound and a half on each of thoſe of Tutucorin, which are the deareſt, and two pounds on each bag of the other ſorts. For thoſe of Fielebas, Smyrna, Aleppo, and Jeruſalem, the deduction at Amſterdam is eight in the hundred for the tare, and two in the hundred for weight, and on the value one *per cent.* for prompt payment.

Cotton of Siam, is a kind of ſilky cotton in the Antilles, ſo called becauſe the grain was brought from Siam. It is of an extraordinary fineneſs, even ſurpaſſing ſilk in ſoftneſs. They make hoſe of it there preferable to ſilk ones, for their luſtre and beauty. They ſell from ten to twelve and fifteen crowns a pair, but there are very few made, unleſs for curioſity.

The manner of packing Cotton, *as practiſed in the Antilles.* The bags are made of coarſe cloth, of which they take three ells and a half each: the breadth is one ell three inches. When the bag has been well ſoaked in water, they hang it up, extending the mouth of it to croſs pieces of timber nailed to poſts fixed in the ground ſeven or eight feet high. He who packs it goes into the bag, which is ſix feet nine inches deep, or thereabouts, and preſſes down the cotton, which another hands him, with hands and feet; obſerving to tread it equally every where, and putting in but little at a time. The beſt time of packing is in rainy moiſt weather, provided the cotton be under cover. The bag ſhould contain from 300 to 320 pounds. The tare abated in the Antilles is three in the hundred. Cotton being a production applicable to a great variety of manufactures, it cannot be too much cultivated in our own plantations that will admit of it.

Cotton wool, not of the Britiſh plantations, pays on importation $\frac{77}{100}$d. the pound, and draws back on exportation $\frac{67\frac{1}{2}}{100}$d. Cotton yarn the pound, not of the Eaſt Indies, pays $2\frac{87\frac{1}{4}}{100}$d. and draws back $2\frac{58\frac{3}{4}}{100}$d. Cotton yarn the pound of the Eaſt Indies pays $4\frac{56}{100}$d. and draws back $4\frac{27}{100}$d.

Lavender Cotton. See Santolina.

Philoſophic Cotton, a name given to the flowers of zinc, on account of their white colour, and reſemblance to cotton.

Cotton-weed. See Gnaphalium.

COTTUS, in ichthyology, a genus belonging to the order of thoracici. The head is broader than the body, and the gill-membrane has ſix rays. There are

fix ſpecies, *viz*. the cataphractus, quadricornis, grunniens, ſcaber, ſcorpius, and gobio.

COTULA, in botany, a genus of the ſyngcneſia polygamia ſuperflua claſs. The receptacle is naked; the pappus is marginated; and the corollulæ of the diſk are divided into four ſegments; the ſpecies are ſix, none of them natives of Britain.

COTULA, or COTYLA, in antiquity, a liquid meaſure among the Greeks, equal to the hemina of the Romans, containing half a ſextary, or four acetabula: hence it appears that it contained ten ounces of wine, and nine of oil.

COTURNIX, in ornithology. See TETRAO.

COTYLEDON, in botany, a genus of the decandria pentagynia claſs. The calix is divided into five ſegments; the corolla conſiſts of one petal; there are five nectariferous ſcales at the baſe of the germen: and it has five capſules. The ſpecies are eight, only one of which is a native of Britain, *viz*. the umbilicus, or navel-wort.

COTYLEDONES, in anatomy, are certain glandular bodies, adhering to the chorion of ſome animals.

COUGH, in medicine. See MEDICINE.

COUGH, in painting, a term uſed for each lay or impreſſion of colour, either in oil or water, wherewith the painter covers his canvas, wall, wainſcot, or other matter to be painted.

COUGH-GRASS, in botany. See TRITICUM.

COUCHANT, in heraldry, is underſtood of a lion, or other beaſt, when lying down, but with his head raiſed, which diſtinguiſhes the poſture of couchant from dormant, wherein he is ſuppoſed quite ſtretched out and aſleep. See Plate LXV. fig. 9.

COUCHE', in heraldry, denotes any thing lying along: thus, chevron couché, is a chevron lying ſideways, with the two ends on each ſide of the ſhield, which ſhould properly reſt on the baſe.

COUCHING *of a cataract*, in ſurgery. See SURGERY.

COVENANT, a contract or agreement, made between two or more perſons, to perform ſomething.

COVENTRY, a city and biſhop's fee in Warwickſhire, ſituated 80 miles north weſt of London, and 10 miles north of Warwick: W. long. 1° 26′, and N. lat. 52° 25′.

COVENTRY-BELLS, in botany. See CAMPANULA.

COVERDEN, a town of the united provinces, ſituated in that of Overyſſel, near the confines of Weſtphalia: E. long. 6° 45′, and N lat. 52° 50′.

CO-VERSED SINE, in geometry, the remaining part of the diameter of a circle, after the verſed ſine is taken from it. See GEOMETRY.

COVERT WAY, or CORRIDOR, in fortification, a ſpace of ground, level with the field on the edge of the ditch, three or four fathoms broad, ranging quite round the half moons, and other works toward the the country. It has a parapet raiſed on a level, together with its banquets and glacis. See FORTIFICATION.

COVERTURE, in law, is applied to the ſtate and condition of a married woman, who is under the power of her huſband, and therefore called *femme couvert*.

COVING, in building, is when houſes are built projecting over the ground plot, and the turned projecture arched with timber, lathed and plaiſtered.

COULTER, in huſbandry, an iron-inſtrument, fixed in the beam of a plough, and ſerving to cut the edge of each furrow. See AGRICULTURE.

COUNCIL, or COUNSEL, in a general ſenſe, an aſſembly of divers conſiderable perſons to concert meaſures relating to the ſtate.

Aulic COUNCIL. See AULIC.

Cabinet COUNCIL. See PRIVY-COUNCIL.

Common COUNCIL, in the city of London, is a court wherein are made all bye-laws which bind the citizens. It conſiſts, like the parliament, of two houſes; an upper, compoſed of the lord mayor and aldermen; and a lower, of a number of common-council-men, choſen by the ſeveral wards, as repreſentatives of the body of the citizens.

Privy COUNCIL, the *primum mobile* of the civil government of Great Britain, bearing part of that great weight in the government which otherwiſe would be too heavy upon the king.

It is compoſed of eminent perſons, the number of whom is at the ſovereign's pleaſure, who are bound by oath to adviſe the king to the beſt of their judgment, with all the fidelity and ſecrecy that becomes their ſtation. The king may declare to, or conceal from, his privy-council whatever he thinks fit; and has a ſelect council out of their number, commonly called the *cabinet council*, with whom his majeſty determines ſuch matters as are moſt important, and requires the utmoſt ſecrecy.

Privy-counſellors, though but gentlemen, have precedence of all the knights and younger ſons of barons and viſcounts, and are ſtyled right honourable.

COUNCIL *of war*, an aſſembly of the principal officers of an army or fleet, occaſionally called by the general or admiral to concert meaſures for their conduct with regard to ſieges, retreats, engagements, *&c*.

COUNCIL, in church hiſtory, an aſſembly of prelates and doctors, met for the regulating matters relating to the doctrine or diſcipline of the church.

National COUNCIL, is an aſſembly of prelates of a nation under their primate or patriarch.

Oecumenical or general COUNCIL, is an aſſembly which repreſents the whole body of the univerſal church. The Romaniſts reckon eighteeen of them; Bullinger, in his treatiſe de Conciliis, ſix; Dr Prideaux, ſeven; and biſhop Beveridge has increaſed the number to eight, which, he ſays, are all the general councils which have ever been held ſince the time of the firſt Chriſtian emperor. They are as follows: 1. The council of Nice, held in the reign of Conſtantine the Great, on account of the hereſy of Arius. 2. The council of Conſtantinople, called under the reign and by the command of Theodoſius the Great, for much the ſame end that the former council was ſummoned. 3. The council of Epheſus, convened by Theodoſius the younger, at the ſuit of Neſtorius. 4. The council of Calcedon, held in the reign of Martianus, which approved of the Eutychian hereſy. 5. The ſecond council of Conſtantinople, aſſembled by the emperor

Juſtinian,

Justinian, condemned the three chapters taken out of the book of Theodorus of Mopsuestia, having first decided that it was lawful to anathematize the dead. Some authors tell us, that they likewise condemned the several errors of Origen about the Trinity, the plurality of worlds, and pre-existence of souls. 6. The third council of Constantinople, held by the command of Constantinus Pogonatus the emperor, in which they received the definitions of the five first general councils, and particularly that against Origen and Theodorus of Mopsuestia. 7. The second Nicene council. 8. The fourth council of Constantinople, assembled when Lewis II. was emperor of the west. The regulations which they made are contained in twenty-seven canons, the heads of which are set down by M. du Pin, to whom the reader is referred.

COUNSELLOR, in general, a person who advises another: thus we say, a counsellor at law, a privy counsellor, *&c.*

Counsellor *at law*, a person retained by a client to plead his cause in a public court of judicature.

COUNT, a nobleman who possesses a domain erected into a county. The dignity is a medium between that of a duke and a baron.

Counts were originally lords of the court, or of the emperor's retinue, and had their name comites *a comitando*.

Count-wheel, in the striking part of a clock, a wheel which moves round once in twelve or twenty-four hours. It is sometimes called the locking wheel.

COUNTER, a term which enters into the composition of diverse words of our language, and generally implies opposition; but when applied to deeds, means an exact copy kept of the contrary party, and sometimes signed by both parties.

Counter alley, in gardening. See Alley.

Counter approaches, in fortification, lines and trenches made by the besieged in order to attack the works of the besiegers, or to hinder their approaches.

Counter barry, or Contre barre', in heraldry, is the same as our bendy sinister *per* bend counterchanged. See Barry.

Counter battery, is a battery raised to play upon another to dismount the guns.

Counter-changed, in heraldry, is when any field or charge is divided or parted by any line or lines of partition, consisting all interchangeably of the same tinctures. See plate LXV. fig. 12.

Counter-charge, a reciprocal charge or recrimination brought against an accuser.

Counter-chevroned, a chield chevrony, parted by one or more partition lines.

Counter-componed, in heraldry, is when the figure is compounded of two panes, as in Plate LXV. fig. 13.

Counter-drawing, in painting, is the copying a design, or painting, by means of a fine linen-cloth, an oiled paper, or other transparent matter, where the strokes appearing through are followed with a pencil, with or without colour. Sometimes it is done on glass, and with frames or nets divided into squares with silk or with thread, and also by means of instruments invented for the purpose, as the parallelogram.

Counter-ermine, in heraldry, is the contrary of ermine, being a black field with white spots. See Plate LXV. fig. 14.

Counterfeits, in law, are persons that obtain any money or goods by counterfeit letters or false tokens, who being convicted before justices of assize or of the peace, *&c.* are to suffer such punishment as shall be thought fit to be inflicted under death, as imprisonment, pillory, *&c.*

Counter-faced, or Conter-face', in heraldry, is the same that we call barry *per* pale counterchanged; but then the number of panes into which the field is divided is always specified. See Barry.

Counter-foil, or Counter-stock, in the exchequer, that part of a tally which is kept by an officer of the court.

Counter-forts, spurs or buttresses serving as props to a wall subject to bulge or be thrown down.

Counter-fugue, in music, is when the fugues go contrary to one another. See Fugue.

Counter guard, in fortification, is a work raised before the point of a bastion, consisting of two long faces parallel to the faces of the bastion, making a salliant angle: they are sometimes of other shapes, or otherwise situated.

Counter-light, or Conter-jour, a light opposite to any thing, which makes it appear to disadvantage. A single counter-light is sufficient to take away all the beauty of a fine painting.

Counter-*march*, in military affairs, a change of the face or wings of a battalion, by which means those that were in the front come to be in the rear.

It also signifies returning, or marching back again.

Counter-mine, in war, a well and gallery drove and sunk till it meet the enemy's mine, to prevent its effect.

Counter-paled, *contre pale*, in heraldry, is when the escutcheon is divided into twelve pales parted per fesse, the two colours being counter-changed; so that the upper are of one colour, and the lower of another.

Counter-part, in music, denotes one part to be applied to another. Thus the bass is said to be a counter-part to the treble.

Counter-passant, is when two lions are in a coat of arms, and the one seems to go quite the contrary way from the other.

Counter-point, in music, the art of composing harmony, or of disposing several parts in such a manner as to make an agreeable whole or a concert.

Counter-pointed, *contre pointé*, in heraldry, is when two chevrons in one escutcheon meet in the points, the one rising as usual from the base, and the other inverted falling from the chief; so that they are counter to one another in the points. They may also be counter-pointed when they are founded upon the sides of the shield, and the points meet that way, called counter-pointed in fesse.

COUNTER-POTENT, *contre-potencé*, in heraldry, is reckoned a fur as well as vair and ermine, but composed of such pieces as represent the tops of crutches, called in French *potences*, and in old English *potents*.

COUNTER-PROOF, in rolling-press printing, a print taken off from another fresh printed; which by being passed through the press, gives the figure of the former, but inverted. To counter-prove, is also to pass a design in black lead, or red chalk, through the press, after having moistened with a spunge both that and the paper on which the counter-proof is to be taken.

COUNTER-QUARTERED, *contre-ecartelé*, in heraldry, denotes the escutcheon, after being quartered, to have each quarter again divided into two.

COUNTER-SALIENT, is when two beasts are borne in a coat leaping from each other directly the contrary way.

COUNTER-SCARP, in fortification, is properly the exterior talus or slop of the ditch; but it is often taken for the covered way and the glacis. In this sense we say, the enemy have lodged themselves on the counter-scarp.

Angle of the COUNTER-SCARP, is that made by the two sides of the counter-scarp meeting before the middle of the curtin.

COUNTER-SIGNING, the signing the writing of a superior in quality of secretary. Thus charters are signed by the king, and counter-signed by a secretary of state or lord chancellor.

COUNTER-SWALLOW-TAIL, in fortification, an outwork in form of a single tenaille, wider at the gorge than the head.

COUNTER-TENOR, called by the French *haut contre*, one of the middle parts of music opposite to the tenor. See TENOR.

COUNTER-TIME, in the menage, is the defence or resistance of a horse that interrupts his cadence, and the measure of his menage, occasioned either by a bad horseman, or by the malice of the horse.

COUNTER is also the name of a counting-board in a shop, and of a piece of metal with a stamp on it, used in playing at cards.

COUNTER *of a horse*, that part of a horse's forehand which lies between the shoulders and under the neck.

COUNTERS *in a ship*, are two. 1. The hollow arching from the gallery to the lower part of the straight piece of the stern, is called the upper counter. 2. The lower counter is between the transom and the lower part of the gallery.

COUNTER is also the name of two prisons in the city of London, *viz*. the Poultry and Woodstreet.

COUNTING. See ACCOUNTING.

COUNTY, in geography, originally signified the territory of a count or earl, but now it is used in the same sense with shire. See SHIRE.

COUNTY-COURT, a court of justice, held every month in each county, by the sheriff or his deputy.

COUPED, in heraldry, is used to express the head, or any limb, of an animal, cut off from the trunk, smooth; distinguishing it from that which is called erased, that is, forcibly torn off, and therefore is ragged and uneven.

COUPED is also used to signify such crosses, bars, bends, chevrons, *&c*. as do not touch the sides of the escutcheons, but are, as it were, cut off from them.

COUPER, the name of two towns of Scotland, the one situated about twelve miles north-east of Perth, in the shire of Angus, W. long. 3°, and N. lat. 56° 30′; and the other in the county of Fife, about ten miles west of St Andrews: W. long. 2° 40′, and N. lat. 56° 20′.

COUPLE-CLOSS, in heraldry, the fourth part of a chevron, never borne but in pairs, except there be a chevron between them, saith Guillim, though Bloom gives an instance to the contrary.

COUPLET, a division of a hymn, ode, song, *&c*. wherein an equal number, or equal measure of verses is found in each part; which divisions, in odes, are called strophes.

COURBARIL, in botany. See HYMENÆA.

COURIER, a messenger sent post, or express, to carry dispatches.

COURLAND, a dutchy situated between 21° and 26° of E. long. and between 56° 30′, and 57° 30′ N. lat. It is bounded by the river Dwina, which divides it from Livonia, on the north; by Lithuania, on the east; by Samogitia, on the south; and by the Baltic sea on the west; being 130 miles long, and 30 broad.

COURSING, among sportsmen, is of three sorts, *viz*. at the deer, at the hare, and at the fox. These coursings are with greyhounds; for the deer there are two sorts of coursings, the one with the paddock, the other either in the forest or purlieu. See PADDOCK, *&c*.

In coursing the hare, the best way is to find one sitting, and when she is first started, to give her ground, or law, which is generally twelve-score yards. In coursing a fox, you are to stand close, and on a clear wind.

COURT, in a law sense, the place where judges distribute justice, or exercise jurisdiction: also the assembly of judges, jury, *&c*. in that place.

Courts are divided into superior and inferior, and into courts of record and base courts: again, courts are either such as are held in the king's name, as all the ordinary courts; or where the precepts are issued in the name of the judge, as the admiral's court.

The superior courts are those of the king's-bench, the common-pleas, the exchequer, and the court of chancery. See KING'S-BENCH, COMMON-PLEAS, EXCHEQUER, and CHANCERY.

A court of record is that which has a power to hold plea, according to the course of the common law, of real, personal, and mixt actions; where the debt or damage is forty shillings, or above, as the court of King's Bench, *&c*.

COURT *of admiralty*. See ADMIRALTY.

COURT *of arches*. See ARCHES.

COURT-BARON, a court that every lord of a manor has within his own precincts. This court must be held by

by prescription, and is of two kinds, *viz.* by common law, and by custom: the former is where the barons or freeholders, being suitors, are the judges; the other is that where the lord, or his steward, is the judge.

COURT *of chivalry*, or *the marshal's* COURT, that whereof the judges are the lord high constable, and the earl marshal of England.

This court is the fountain of martial law; and the earl marshal is not only one of the judges, but is to see execution done.

COURT *of conscience*, a court in the cities of London, Westminster, and some other places, that determines matters in all cases where the debt or damage is under forty shillings.

COURT *of delegates*, a court where delegates are appointed by the king's commission, under the great seal, upon an appeal to him from the sentence of an archbishop, *&c.* in ecclesiastical causes; or of the court of admiralty, in any marine cause.

COURT *of hustings*, a court of record held at Guildhall, for the city of London, before the lord mayor and aldermen, sheriffs and recorder, where all pleas, real, personal, and mixt, are determined; where all lands, tenements, *&c.* within the said city, or its bounds, are pleadable in two hustings; the one called the hustings of plea of lands, and the other the hustings of common pleas. The court of hustings is the highest court within the city, in which writs of exigent may be taken out, and outlawries awarded, wherein judgment is given by the recorder.

There are also other courts called wardmotes, or meeting of the wards; and courts of holymote, or assemblies of the guilds and fraternities.

COURT LEET, a court ordained for the punishment of offences under high treason against the crown.

COURT-MARTIAL, a court appointed for the punishing offences in officers, soldiers, and sailors, the powers of which are regulated by the mutiny-bill.

COURT *of requests*, was a court of equity, of the same nature with the chancery, but inferior to it.

COURTESY, or CURTESY *of England*, a certain tenure whereby a man marrying an heiress seized of lands of fee simple, or fee tail general, or seized as heir of the tail special, and getteth a child by her that cometh alive into the world, though both it and his wife die forthwith; yet, if she were in possession, he shall keep the land during his life, and is called *tenant per legem Angliæ*, or tenant by the courtesy of England; because this privilege is not allowed in any country except Scotland, where it is called *curialitas Scotiæ*.

COURTISAN, a woman who prostitutes herself for hire, especially to people of superior rank.

COURTRAY, a town of the Austrian Netherlands, situated on the river Lys, about twenty-three miles south-west of Ghent, and fourteen east of Ypres: E. long. 3° 10′, and N. lat. 50° 48′.

COUSIN, a term of relation between the children of brothers and sisters, who in the first generation are called cousin-germans, in the second generation second cousins, *&c.* If sprung from the relations of the father's side, they are denominated paternal cousins; if on the mother's, maternal.

COUSU, in heraldry, signifies a piece of another colour or metal placed on the ordinary, as if it were sewed on, as the word imports. This is generally of colour upon colour, or metal upon metal, contrary to the general rule of heraldry.

COVERT, in heraldry, denotes something like a piece of hanging, or a pavillion falling over the top of a chief or other ordinary, so as not to hide, but only to be a covering to it.

COW, in zoology. See BOS.

Sea-COW, in zoology. See TRICHECUS.

COW-ITCH, in botany. See PHASEOLUS.

COW'S-LIP, in botany. See PRIMULA.

COW'S-LIP *of Jerusalem* See PULMONARIA.

COWARD, in heraldry, a term given to a lion borne in an escutcheon with his tail doubled or turned in between his legs.

COWES, a town and harbour on the northern coast of the isle of Wight, situated about eight miles south of Plymouth: W. long. 1° 25′, and N. lat. 50° 45′.

COWL, or COUL, a habit worn by the Bernardines and Benedictines, of which there are two kinds; one white, very large, worn in ceremonies; the other black, worn on ordinary occasions, in the streets, *&c.*

Friar's COWL, in botany. See ARISARUM.

COXWOLD, a market-town in the north riding of Yorkshire, about fourteen miles north of the city of York: W. long. 50′, and N. lat. 54° 20′.

COZUMEL, an island near the western coast of Jucatan, where Cortez landed and refreshed his troops, before entering upon the conquest of Mexico: W. long. 89°, and N. lat. 13°.

CRAB, in zoology. See CANCER.

CRAB'S CLAWS, in the materia medica, are the tips of the claws of the common crab broken off at the verge of the black part, so much of the extremity of the claws only being allowed to be used in medicine as is tinged with this colour. The blackness, however, is only superficial; they are of a greyish white within, and when levigated furnish a tolerable white powder.

Crab's claws are of the number of the alkaline absorbents, but they are superior to the generality of them in some degree, as they are found on a chemical analysis to contain a volatile urinous salt.

CRAB'S EYES, in pharmacy, are a strong concretion in the head of the cray-fish. They are rounded on one side, and depressed and sinuated on the other, considerably heavy, moderately hard, and without smell. We have them from Holland, Muscovy, Poland, Denmark, Sweden, and many other places.

Crab's eyes are much used both in the shop medicines and extemporaneous prescriptions, being accounted not only absorbent and drying, but also discussive and diuretic.

CRAB, an engine of wood, with three claws, placed on the ground like a capstan, and used at launching or heaving ships into the dock.

CRABRO,

CRABRO, in zoology, See TENTHREDO.

CRACOA, in botany. See VICIA.

CRACKER, in ornithology, See ANAS.

CRACOW, by ſome accounted the capital city of Poland, is ſituated in the province of little Poland, and palatinate of Cracow, in a fine plane near the banks of the Viſtula. It has an univerſity, and is the ſee of a biſhop, and the ſeat of the ſupreme courts of juſtice: it ſtands about 140 miles ſouth-weſt of Warſaw, in 19° 30′ of E. long. and 50° N. lat.

CRADLE, a well known machine in which infants are rocked to ſleep.

It denotes alſo that part of the ſtock of a croſs bow where the bullet is put.

CRADLE, in ſurgery, a caſe in which a broken leg is laid after being ſet.

CRADLE, among ſhipwrights, a timber frame made along the outſide of a ſhip by the bilge, for the convenience of launching her with eaſe and ſafety.

CRAFT, in the ſea language, ſignifies all manner of nets, lines, hooks, *&c.* uſed in fiſhing. Hence all ſuch little veſſels as ketches, hoys, and ſmacks, *&c.* uſed in the fiſhing trade, are called ſmall craft.

CRAIL, or CAREIL, a parliament town of Scotland, ſituated on the ſea-coaſt of the county of Fife, about ſeven miles ſouth-eaſt of St Andrews: W. long. 2° 20′ and N. lat. 56° 17′.

CRAMBE, *wild* SEA-CABBAGE, in botany, a genus of the tetradynamia ſiliquoſa claſs. The four long filaments are forked at the points, and the antheræ are fixed upon one of them; the berry is dry, globular, and deciduous. The ſpecies are three, only one of which, *viz.* the maritima, or ſea-colewort, is a native of Britain.

CRAMP, in medicine, a convulſive contraction of a muſcular part of the body.

CRAMP FISH. See TORPEDO.

CRAMP IRON, or CRAMPS, a piece of iron bent at each end, which ſerves to faſten together pieces of wood, ſtones, or other things.

CRAMPER, in ichthyology. See CYPRINUS.

CRAMPONE'E, in heraldry, an epithet given to a croſs which has at each end a cramp or ſquare piece coming from it; that from the arm in chief towards the ſiniſter angle, that from the arm on that ſide downwards, that from the arm in baſe towards the dexter ſide, and that from the dexter arm upwards. See Plate LXVI. fig. 5.

CRANAGE, the liberty of uſing a crane at a wharf, and alſo the money paid for drawing up wares out of a ſhip, *&c.* with a crane.

CRANE, in ornithology. See ARDEA.

CRANE, in mechanics, a machine uſed in building and commerce for raiſing large ſtones and other weights. See MECHANICS.

CRANE'S BILL, among ſurgeons, a kind of forceps, ſo called from its figure.

CRANE'S BILL, in botany. See GERANIUM.

CRANE-FLY, in zoology. See TIPULA.

CRANGANOR, a Dutch factory on the Malabar-coaſt, in the hither India, about thirty miles north of Cochin; E. long. 75° 5′, and N. lat. 10°.

CRANIOLARIA, in botany, a genus of the didynamia angioſpermia claſs. The perianthium conſiſts of four leaves, and the ſpatha of one; and the tube of the corolla is very long. There are two ſpecies, none of them natives of Britain.

CRANIUM, in anatomy. See Vol. I. p. 151.

CRANNY, in glaſs-making, an iron-inſtrument, wherewith the necks of glaſſes are formed.

CRAPE, in commerce, a kind of ſtuff, made in the manner of gauze, with raw ſilk, gummed and twiſted on the mill.

CRAPULA, among phyſicians. See SURFEIT.

CRASIS, among phyſicians, is uſed to ſignify ſuch a due mixture of qualities in a human body, as conſtitutes a ſtate of health.

CRASSAMENTUM, in phyſic, the thick red or fibrous part of the blood, otherwiſe called cruor, in contradiſtinction to the ſerum or aqueous part.

CRASSULA, in botany, a genus of the pentandria pentagynia claſs. The calix conſiſts of five leaves, and the corolla of five petals; there are five nectariferous glands at the baſe of the germen; and it has five capſules. There are 17 ſpecies, none of them natives of Britain.

CRATÆGUS, in botany, a genus of the icoſandria digynia claſs. The calix has five ſegments, and the corolla five petals; the berry is below the flower, and contains two ſeeds. There are nine ſpecies, three of which are natives of Britain, *viz.* the aria, or white bean-tree; the torminalis, ſervice-tree, or ſorb; and the oxyacantha, white-thorn, or hawthorn.

CRATCHES, in the menage, a ſwelling on the paſtern, under the fetlock, and ſometimes under the hoof; for which reaſon it is diſtinguiſhed into the ſinew cratches, which affect the ſinew, and thoſe upon the cronet, called quitter-bones.

CRATER, in aſtronomy. See Vol. I. p. 487.

CRATEVA, in botany, a genus of the polyandria monogynia claſs.

CRATO, a town of Alentejo, in Portugal, ſituated about ſeven miles ſouth of Portalegre: W. long. 8°, and N. lat. 38° 50′.

CRAVEN, in geography, a diviſion of the weſt riding of Yorkſhire, ſituated on the river Are.

CRAX, in ornithology, a genus of birds, belonging to the order of gallinæ. The baſe of the beak of each mandible is covered with wax; and the feathers of the head are curled. There are five ſpecies, *viz.* 1. The alecator, or Indian hen of Sloane, is about the ſize of a common hen: It is black, with a white belly. A yellow wax covers about one half of each mandible: The tongue is entire; the temples are bare, and black; the tail is roundiſh, and conſiſts of 14 prime feathers; and it has no ſpur. It is found in the warm parts of America. 2. The rubra, or Peruvian hen, is red, with a blueiſh head: It is a native of Peru. 3. The mitu, or Braſilian pheaſant, is black, with a duſky belly, and red wax: It is a native of Guinea and Brazil.

zil. 4. The globicera, has a yellow protuberance between the noſtrils, and is of a blueiſh black colour: It is likewiſe a native of Brazil. 5. The pauxi, or Mexican pheaſant of Briſſonius, is of a blueiſh colour, with blue wax, and the tip of the tail and belly white: It is a native of Mexico.

CRAYON, a name for all coloured ſtones, earths, or other minerals uſed in deſigning or painting in paſtel. Crayons may be made of any colour, and adapted for the faces of men, women, landſcapes, clouds, ſunbeams, buildings, and ſhadows, in the following manner: Take plaſter of Paris, or alabaſter calcined, and of the colour of which you intend to make your crayons, a ſufficient quantity: grind them firſt aſunder, and then together, and with a little water make them into a paſte: then roll them with your hand upon the grinding ſtone into long pieces, and let them dry moderately in the air: when they are to be uſed, ſcrape them to a point like a common pencil.

CREAM, the fat part of the milk that ſwims upon the ſurface.

Cream *of tartar*. See Chemistry.

CREAT, in the menage, an uſher to a riding maſter; or, a gentleman bred in the academy, with intent to make himſelf capable of teaching the art of riding the great horſe.

CREATION, the producing ſomething out of nothing, which ſtrictly and properly is the effect of the power of God alone, all other creations being only transformations, or change of ſhape.

CREDENTIALS, letters of recommendation, and power, eſpecially ſuch as are given to ambaſſadors, or public miniſters, by the prince or ſtate that ſends them to foreign courts.

CREDIBILITY, a ſpecies of evidence, leſs indeed than abſolute certainty or demonſtration but greater than mere poſſibility: it is nearly allied to probability, and ſeems to be a mean between poſſibility and demonſtration.

CREDIT, in commerce, a mutual truſt or loan of merchandize, or money, on the reputation of the probity and ſufficiency of a dealer. See Commerce.

CREDITON, a market-town in Devonſhire, conſiderable for a good woolen manufactory: it is ſituated about nine miles north-weſt of Exeter, in 3° 50′ W. long. and 50° 50′ N. lat.

CREDITOR, a perſon to whom any ſum of money is due, either by obligation, promiſe, or otherwiſe.

CREED, a brief ſummary of the articles of a Chriſtian's belief.

The moſt ancient form of creeds is that which goes under the name of the apoſtolic creed; beſides this, there are ſeveral other ancient forms and ſcattered remains of creeds to be met with in the primitive records of the church. The firſt is a form of apoſtolical doctrine, collected by Origen; the ſecond is a fragment of a creed preſerved by Tertullian; the third remains of a creed, is in the works of Cyprian; the fourth, a creed compoſed by Gregory Thaumaturgus, for the uſe of his own church; the fifth, the creed of Lucian the martyr; the ſixth, the creed of the apoſtolical conſtitutions. Beſides theſe ſcattered remains of the ancient creeds, there are extant ſome perfect forms, as thoſe of Jeruſalem, Cæſarea, Antioch, *&c.*

The moſt univerſal creeds are, the apoſtolical, the Athanaſian, and the Nicene creeds.

CREEK, the part of a haven where any thing is landed from the ſea.

CREEPER, in ornithology. See Certhia.

CREMA, a city and biſhop's ſee of Italy, capital of a diſtrict of the Milaneſe, called from it Cremaſco: it ſtands almoſt in the middle between Milan and Mantua, in 10° 15′ E. long. and 45° 20′ N. lat.

CREMASTER, in anatomy. See Vol. I. p. 272.

CREMONA, a city of Italy, and capital of a diſtrict of the Milaneſe. called from it the Cremoneſe, is ſituated forty-five miles ſouth-eaſt of Milan, in 10° 30′. E. long. and 45° N. lat.

CRENATED, in botany. See Vol. I. p 640.

CRENCLES, in a ſhip, ſmall ropes, ſpliced into the bolt-ropes of the ſails of the main-maſt and fore-maſt. They are faſtened to the bow-line bridles; and are alſo to hold by, when a bonnet is ſhaken off.

CRENELLE′, or Imbattled, in heraldry, is uſed when any honourable ordinary is drawn, like the battlements on a wall to defend men from the enemies ſhot. See Plate LXVI. fig. 6.

CRENOPHYLAX, in antiquity, a magiſtrate at Athens, who had the inſpection of fountains.

CREPANCE, in the menage, a chop, or cratch, in a horſe's leg, given by the ſpunges of the ſhoes of one of the hinder feet croſſing and ſtriking againſt the other hinder foot. This cratch degenerates into an ulcer.

CREPIS, in botany, a genus of the ſyngeneſia polygamia æqualis claſs. The receptacle is naked; the calix is caliculated, with deciduous ſcales; and the pappus is plumoſe, and furniſhed with a ſtipes The ſpecies are fourteen, three of which are natives of Britain, *viz.* the tectarum, or ſmooth ſuccory hawk-weed; the biennis, or rough ſuccory hawk-weed; and the fœtida, or ſtinking hawk-weed.

CREPUNDIA, in antiquity, a term uſed to expreſs ſuch things as were expoſed along with children, as rings, jewels, *&c.* ſerving as tokens whereby they afterwards might be known.

CRESCENT, the new moon, which, as it begins to recede from the ſun, ſhews a little rim of light, terminating in points, called horns. that are ſtill encreaſing, till it is in oppoſition to the ſun, at which time it is full moon, or quite round.

Crescent, in heraldry, a bearing in form of a new moon. See Plate LXV. fig. 10.

It is uſed either as an honourable bearing, or as the difference to diſtinguiſh between elder and younger families; this being generally aſſigned to the ſecond ſon, and thoſe that deſcend from him. The figure of the creſcent is the Turkiſh ſymbol, with its points looking towards the top of the chief, which is its moſt ordinary repreſentation, called creſcent montant. Creſcents are ſaid to be adoſſed, when their backs are turned towards each other; a creſcent is ſaid to be inverted,

when

when its points look towards the bottom; turned crefcents have their points looking to the dexter fide of the fhield; cornuted crefcents, to the finifter fide; and affronted crefcents, contrary to the adoffed, have their points turned to each other.

CRESCENT, a term among farriers. Thus a horfe is faid to have crefcents when that part of the coffin-bone, which is moft advanced, falls down and preffes the fole outwards, and the middle of her hoof above fhrinks, and becomes flat, by reafon of the hollownefs beneath it.

CRESCENTIA, in botany, a genus of the didynamia angiofpermia clafs. The calix is fplit into two equal parts; the corolla is gibbous; and the berry is unilocular, and contains many feeds. There is but one fpecies, a native of Jamaica.

CRESS, or CRESSES, in botany. See SISYMBRIUM.

Indian CRESS. See TROPÆOLUM.

CRESSY, a port-town of Picardy in France, about forty-four miles fouth of Calais, and twenty-feven north-weft of Abbeville, remarkable on account of the victory obtained there over the French, by Edward III. of England, in the year 1346: E. long. 2°, N. lat. 50° 20′.

CREST, in armoury, the top-part of the armour, for the head, mounting over the helmet, in manner of a comb, or tuft of a cock, deriving its name from *crifta*, a cock's comb.

The creft was for the moft part made of feathers, or the hair of horfes tails or mains. The foldiers took great pride in adorning them.

CREST, in heraldry, the uppermoft part of an armoury, or that part of the cafk or helmet next to the mantle. Guillim fays, the creft, or cognizance, claims the higheft place, being feated on the moft eminent part of the helmet; yet fo as to admit of an interpofition of fome efcrol, wreathe, chapeau, crown, *&c.*

The creft is efteemed a greater mark of nobility than the armory; being borne at tournaments, to which none were admitted till fuch time as they had given proof of their nobility: fometimes it ferves to diftinguifh the feveral branches of a family; and it has ferved, on occafion, as a diftinguifhing badge of factions: fometimes the creft is taken for the device; but more ufually is formed of fome piece of the arms. Families that exchange arms do not change their creft.

CREST, among carvers, an imagery, or carved work, to adorn the head or top of any thing, like our modern corniche.

CREST-*fallen*, a fault of an horfe, when the upper part of his neck, called the creft, hangs to one fide: this they cure by placing it upright, clipping away the fpare fkin, and applying plafters to keep it in a proper pofition.

CRESTED, fomething furnifhed with a creft. See CREST.

CRETA, or CHALK, in natural-hiftory. See CHALK.

CREUX, a French term ufed among artifts, and literally fignifies a hollow cavity or pit, out of which fomething has been fcooped or dug: whence it is ufed to fignify that kind of fculpture, where the lines and figures are cut and formed within the face or plan of the plate or matter engraved; and thus it ftands in oppofition to relievo, where the lines and figures are emboffed, and rife prominent above the face of the matter engraved on.

CREW, the company of failors belonging to a fhip, boat, or other veffel.

CREX, in ornithology. See RALLUS.

CRIBBAGE, a game at cards, to be learnt only by practice.

CRIBRATION, in pharmacy, the paffing any fubftance through a fieve, or fearch, in order to feparate the finer particles from the groffer.

CRIBROSUM *os*, in anatomy, called alfo os ethmoides. See Vol. I. p. 157.

CRICETUS, in zoology. See MUS.

CRICK, among farriers, is when a horfe cannot turn his neck any manner of way, but holds it fore right, infomuch that he cannot take his meat from the ground without great pain.

CRICKET, in zoology. See GRYLLUS.

Mole-CRICKET. See GRYLLOTALPA.

CRICKLADE, a borough-town of Wiltfhire, fituated on the river Ifis, about twenty-fix miles fouth-weft of Oxford: W. long. 1° 55′, and N. lat. 51° 35′.

CRICO-ARYTANOIDÆUS, in anatomy. See Vol. I. p. 300.

CRICOIDES, in anatomy. See Vol. I. p. 300.

CRICO-THYROIDÆUS, in anatomy. See Vol. I. p. 300.

CRIM, or CRIM-TARTARY, a peninfula in the Black fea, between 33° and 37° E. long. and between 44° and 46° N. lat. It is joined to Little Tartary by a narrow ifthmus.

CRIME, the tranfgreffion of a law, either natural or divine, civil or ecclefiaftic.

CRIMSON, one of the feven red colours of the dyers. See DYING.

CRINONES, among phyficians, fmall worms that breed in the fkin, called alfo dracunculi.

CRINUM, in botany, a genus of the hexandria monogynia clafs. The corolla is tunnel-fhaped, and confifts of one leaf, divided into fix fegments; and the germen is at the bottom of the corolla. There are four fpecies, none of them natives of Britain.

CRISIS, in medicine, is ufed in different fenfes, both by the ancient and modern phyficians. With fome it means frequently no more than the excretion of any noxious fubftance from the body. Others take the word for a fecretion of the noxious humours made in a fever. Others ufe it for the critical motion itfelf; and Galen defines a crifis in fevers, a fudden and inftantaneous change, either for the better or the worfe, productive of recovery or death.

CRISTÆ, in furgery, a term for certain excrefcences about the anus and pudenda. See Vol. I. p. 157.

CRISTA GALLI, in anatomy. See Vol. I. p. 157.

CRISTA GALLI, or COCK'*s* COMB. See RHINANTHUS.

CRISTA PAVONIS, in botany. See POINCIANA.

CRITERIUM, a ftandard by which propofitions and opinions are compared, in order to difcover their truth or falfehood.

CRITHE, in furgery, commonly called the ftye, is a tubercle that grows in different parts of the eye lids.

CRITHMUM, in botany, a genus of the pentandria digynia clafs. The fruit is oval and compreffed. There are two fpecies, one of which, *viz.* the maritimum, or fampire, is a native of Britain; the leaves are faid to be ftomachic, aperient, and diuretic.

CRITICAL *days* and *fymptoms*, among phyficians, are certain days and fymptoms in the courfe of acute difeafes, which indicate the patient's ftate, and determine him either to recover or grow worfe. See MEDICINE.

CRITICISM, the art of judging with propriety concerning any object or combination of objects. But, in a more limited fenfe, the fcience of criticifm is confined to the fine arts. The principles of the fine arts are beft unfolded by ftudying the fenfitive part of our nature, and by learning what objects are naturally agreeable, and what are naturally difagreeable. The man who afpires to be a critic in thefe arts, muft pierce ftill deeper: he muft clearly perceive what objects are lofty, what low, what are proper or improper, what are manly, and what are mean or trivial. Hence a foundation for judging of tafte, and for reafoning upon it: where it is conformable to principles, we can pronounce with certainty, that it is correct; otherwife, that it is incorrect, and perhaps whimfical. Thus the fine arts, like morals, become a rational fcience; and, like morals, may be cultivated to a high degree of refinement.

Manifold are the advantages of criticifm, when thus ftudied as a rational fcience. In the firft place, a thorough acquaintance with the principles of the fine arts, redoubles the entertainment thefe arts afford. To the man who refigns himfelf entirely to fentiment or feeling, without interpofing any fort of judgment, poetry, mufic, painting, are mere paftime; in the prime of life, indeed, they are delightful, being fupported by the force of novelty, and the heat of imagination: but they lofe their relifh gradually with their novelty; and are generally neglected in the maturity of life, which difpofes to more ferious and more important occupations. To thofe who deal in criticifm as a regular fcience, governed by juft principles, and giving fcope to judgment as well as to fancy, the fine arts are a favouraite entertainment; and in old age maintain that relifh which they produce in the morning of life.

In the next place, a philofophical inquiry into the principles of the fine arts, inures the reflecting mind to the moft enticing fort of logic: the practice of reafoning upon fubjects fo agreeable tends to a habit; and a habit ftrengthening the reafoning faculties, prepares the mind for entering into fubjects more difficult and abftract. To have, in this refpect, a juft conception of the importance of criticifm, we need but reflect upon the common method of education; which, after fome years fpent in acquiring languages, hurries us, without the leaft preparatory difcipline, into the moft profound philofophy: a more effectual method to alienate the tender mind from abftract fcience, is beyond the reach of invention; and accordingly, with refpect to fuch fpeculations, the bulk of our youth contract a fort of hobgoblin terror, which is feldom, if ever fubdued. Thofe who apply to the arts, are trained in a very different manner: they are led, ftep by ftep, from the eafier parts of the operation, to what are more difficult; and are not permitted to make a new motion, till they be perfected in thofe which regularly precede it. The fcience of criticifm appears then to be a middle link, connecting the different parts of education into a regular chain. This fcience furnifheth an inviting opportunity to exercife the judgment: we delight to reafon upon fubjects that are equally pleafant and familiar; we proceed gradually from the fimpler to the more involved cafes: and in a due courfe of difcipline, cuftom, which improves all our faculties, beftows acutenefs upon thofe of reafon, fufficient to unravel all the intricacies of philofophy.

Nor ought it to be overlooked, that the reafonings employed upon the fine arts are of the fame kind with thofe which regulate our conduct. Mathematical and metaphyfical reafonings have no tendency to improve focial intercourfe; nor are they applicable to the common affairs of life: but a juft tafte in the fine arts, derived from rational principles, furnifhes elegant fubjects for converfation, and prepares us finely for acting in the focial ftate with dignity and propriety.

The fcience of rational criticifm tends to improve the heart not lefs than the underftanding. It tends, in the firft place, to moderate the felfifh affections: by fweetening and harmonizing the temper, it is a ftrong antidote to the turbulence of paffion and violence of purfuit: it procures to a man fo much mental enjoyment, that in order to be occupied, he is not tempted in youth to precipitate into hunting, gaming, drinking; nor in middle-age, to deliver himfelf over to ambition; nor in old-age, to avarice. Pride and envy, two difguftful paffions, find in the conftitution no enemy more formidable than a delicate and difcerning tafte: the man upon whom nature and culture have beftowed this bleffing, feels great delight in the virtuous difpofitions and actions of others: he loves to cherifh them, and to publifh them to the world: faults and failings, it is true, are to him not lefs obvious; but thefe he avoids, or removes out of fight, becaufe they give him pain. On the other hand, a man void of tafte, upon whom the moft ftriking beauties make but a faint impreffion, has no joy but in gratifying his pride or envy by the difcovery of errors and blemifhes. In a word, there may be other paffions, which, for a feafon, difturb the peace of fociety more than thofe mentioned; but no other paffion is fo unwearied an antagonift to the fweets of focial intercourfe: thefe paffions, tending affiduoufly to their gratification, put a man perpetually in oppofition to others; and difpofe him more to relifh bad than good qualities, even in a companion. How different that difpofition of mind, where every

virtue

virtue in a companion or neighbour, is, by refinement of tafte, fet in its ftrongeft light; and defects or blemifhes, natural to all, are fuppreffed, or kept out of view!

In the next place, delicacy of tafte tends not lefs to invigorate the focial affections, than to moderate thofe that are felfifh. To be convinced of this tendency, we need only reflect, that delicacy of tafte neceffarily heightens our fenfibility of pain and pleafure, and of courfe our fympathy, which is the capital branch of every focial paffion. Sympathy in particular invites a communication of joys and forrows, hopes and fears: fuch exercife, foothing and fatisfactory in itfelf, is neceffarily productive of mutual good-will and affection.

One other advantage of rational criticifm is referved to the laft place, being of all the moft important; which is, that it is a great fupport to morality. No occupation attaches a man more to his duty than that of cultivating a tafte in the fine arts: a juft relifh of what is beautiful, proper, elegant, and ornamental, in writing or painting, in architecture or gardening, is a fine preparation for the fame juft relifh of thefe qualities in character and behaviour. To the man who has acquired a tafte fo acute and accomplifhed, every action wrong or improper, muft be highly difguftful: if, in any inftance, the overbearing power of paffion fway him from his duty, he returns to it upon the firft reflection, with redoubled refolution never to be fwayed a fecond time: he has now an additional motive to virtue, a conviction derived from experience, that happinefs depends on regularity and order, and that a difregard to juftice or propriety never fails to be punifhed with fhame and remorfe.

For the rules of criticifm, applicable to the fine arts, and derived from human nature, fee ARCHITECTURE, BEAUTY, CONGRUITY, COMPARISON, GRANDEUR, *&c.*

CROATIA, a frontier province of Germany, bounded by Sclavonia on the north and eaft, by Bofnia on the fouth, and by Carniola on the weft. It is fubject to the houfe of Auftria.

CROCCEUS, or HOAMEO, a large river of China, which, after a courfe of two thoufand miles, falls into the bay of Nankin: it is fometimes called the Yellow river, on account of the flime of this colour with which its waters are tinged.

CROCINUM, among phyficians, denotes the oil of faffron, faid to be of a heating quality, and to procure fleep.

CROCODES, an appellation given to paftils or troches, whereof crocus, or faffron, is the principal ingredient.

CROCODILE, in zoology. See LACERTA.

CROCUS, or SAFFRON, in botany, a genus of the triandria monogynia clafs. The corolla is divided into fix equal parts; and it has three erect ftigmata. There is but one fpecies, a native of Britain. The antheræ, or cluves, picked off and preffed together into cakes, goes by the name of faffron, which is an elegant and ufeful aromatic, and is defervedly accounted one of the higheft cordials.

CROCUS, in chemiftry, denotes any metal calcined to a red or deep yellow colour. See CHEMISTRY.

CROCUS METALLORUM, an emetic preparation of antimony and nitre. See CHEMISTRY.

CROFT, a little clofe adjoining to a dwelling-houfe, and enclofed for pafture or arable land, or any other particular ufe.

CROISADE, CRUSADE, or CRUZADO, a name given to the expeditions of the Chriftians againft the infidels, for the conqueft of Paleftine; fo called, becaufe thofe who engaged in the undertaking wore a crofs on their cloaths, and bore one on their ftandard.

This expedition was alfo called the holy war, to which people flocked in great numbers out of pure devotion, the pope's bulls and the preaching of the priefts of thofe days making it a point of confcience. The feveral nations engaged in the holy war were diftinguifhed by the different colours of their croffes: the Englifh wore white, the French red, the Flemifh green, the Germans black, and the Italians yellow. From this enterprife feveral orders of knighthood took their rife. They reckon eight croifades for the conqueft of the holy land; the firft begun in the year 1095, at the folicitation of the Greek emperor and the patriarch of Jerufalem.

CROISES, or CROIZES, in Englifh antiquity, pilgrims bound for the holy land, or fuch as had been there; fo called from a badge they wore in imitation of a crofs. The knights of St John of Jerufalem, created for the defence and protection of pilgrims, were particularly called croifes.

CROISIERS, a religious order founded in honour of the invention or difcovery of the crofs by the emprefs Helena.

They are difperfed in feveral parts of Europe, particularly in the Low Countries, France, and Bohemia, thofe in Italy being at prefent fuppreffed. Thefe religious follow the rule of St Auguftine. They had in England the name of crouched friers.

CROMARTY, the capital of the fhire of Cromarty, in Scotland, with an excellent and fafe harbour capable of containing the greateft fleets: W. long. 3° 40′, and N. lat. 57° 54′.

CRONENBURG, a fortrefs of Denmark, fituated in the ifland of Zealand, at the entrance of the Sound, where the Danes take toll of fhips bound for the Baltic: E. long. 12° 5′, and N. lat. 56°.

CRONSLOT, or CROWN-CASTLE, a caftle and harbour in a little ifland of the fame name, at the mouth of the river Neva, and entrance of the gulf of Finland, in Ruffia, about twelve miles weft of Peterfburgh: E. long. 30°, and N. lat. 60°. Here is a ftation for the Ruffian men of war, and a yard for building and refitting them.

CRONSTAT, a town of Tranfilvania, fituated near the frontiers of Moldavia, about fifty miles north-eaft of Hermanftat, and fubject to the houfe of Auftria: E. long. 25°, and N. lat. 47′.

CROPPER, in ornithology. See Columba.

CROSIER, or Crozier, a ſhepherd's crook; a ſymbol of paſtoral authority, conſiſting of a gold or ſilver ſtaff, crooked at the top, carried occaſionally before biſhops and abbots, and held in the hand when they give the ſolemn benedictions. The cuſtom of bearing a paſtoral ſtaff before biſhops is very ancient. Regular abbots are allowed to officiate with a mitre and croſier. Among the Greeks none but a patriarch had a right to the croſier.

Crosier, in aſtronomy, four ſtars in the ſouthern hemiſphere, in the form of a croſs, ſerving thoſe who ſail in ſouth latitudes to find the antarctic pole.

CROSLET, in heraldry, is when a croſs is croſſed again at a ſmall diſtance from each of the ends. Upton ſays it is not ſo often borne by itſelf in arms, as other croſſes are, but often in diminutives, that is, in ſmall croſſets ſcattered about the field. See Plate LXVI. fig. 7.

CROSS, in antiquity, a ſpecies of puniſhment, or rather the inſtrument wherewith it was inflicted, conſiſting of two pieces of wood croſſing each other.

This puniſhment was only inflicted on malefactors and ſlaves, and thence called *ſervile ſupplicium*. The moſt uſual method was to nail the criminal's hands and feet to this machine, in an erect poſture; though there are inſtances of criminals ſo nailed with their head downward.

Invention of the Cross, a feſtival obſerved on May 3, by the Latin church, in memory of the empreſs Helena's (the mother of Conſtantine) finding the true croſs of Chriſt on mount Calvary, where ſhe cauſed erect a church for the preſervation of it.

Exaltation of the Cross, a grand feſtival ſolemnized on September 14, in commemoration of Heraclius's reſtoring to mount Calvary the true croſs, that had been carried off by Coſroes king of Perſia, upon taking the city of Jeruſalem.

Order of the Cross, an order of ladies inſtituted in 1668, by the empreſs Eleanora de Gonzagua, wife of the emperor Leopold, on occaſion of the miraculous recovery of a little golden croſs, wherein were incloſed two pieces of the true croſs, out of the aſhes of a part of the palace that had been burnt down: though the fire burnt the caſe wherein it was encloſed, and melted the cryſtal, it appears that the wood had not received the leaſt damage.

Cross, in heraldry, an ordinary compoſed of fourfold lines, whereof two are perpendicular, and the other two tranſverſe; for ſo we muſt conceive of them, though they are not drawn throughout, but meet, by couples, in four right angles, near about the feſſe-point of the eſcutcheon. The content of a croſs is not always the ſame; for when it is not charged, it has only the fifth part of the field; but if it be charged, then it muſt contain the third part thereof.

This bearing was beſtowed on ſuch as had performed, or at leaſt undertaken ſome ſervice for Chriſt and the Chriſtian profeſſion; and is therefore held by ſeveral authors the moſt honourable charge in all heraldry. What brought it into ſuch frequent uſe was the ancient expeditions into the holy land, the croſs being the enſigns of that war.

In theſe wars, the Scots carried St Andrew's croſs; the French, a croſs argent; the Engliſh, a croſs or; the Germans, ſable; the Italians, azure; the Spaniards, gules.

Cross bar-shot, a bullet with an iron-bar paſſing through it, and ſtanding ſix or eight inches out at both ſides: it is uſed at ſea, for deſtroying the enemy's rigging.

Cross-bill, in ornithology. See Loxia.

Cross-wort, in botany. See Valantia.

CROSSELET, a little or diminutive croſs, uſed in heraldry, where the ſhield is frequently ſeen covered with croſſelets; alſo feſſes and other honourable ordinaries, charged or accompanied with croſſelets. Croſſes frequently terminate in croſſelets. See Plate LXVI. fig. 7.

CROTALARIA, in botany, a genus of the diadelphia decandria claſs. The pod is ſwollen, inflated, and pedicellated. There are eleven ſpecies, none of them natives of Britain.

CROTALOPHORUS, in zoology. See Crotalus.

CROTALUS, or Rattle-snake, in zoology, a genus belonging to the order of amphibia ſerpentes, the characters of which are theſe: The belly is furniſhed with ſcuta, and the tail has both ſcuta and ſcales; but the principal characteriſtic of this genus, is the rattle at the end of the tail. The rattles conſiſt of ſeveral articulated cruſtaceous, or rather horny bags, which make a conſiderable rattling noiſe when the creature moves, and ſerves to warn people of their approach. There are five ſpecies, and the bite of every one of them is ſo highly poiſonous, that it generally kills in a ſhort time. 1. The horridus, or American rattleſnake, has 167 ſcuta, and 23 ſcutellæ. It is generally of an orange, tawny, or blackiſh colour on the back, and the belly is aſh coloured: they are from four to ſix inches in length; ſome are as thick as a man's leg: Dr Tyſon diſſected one which was four feet five inches long, and the body ſix and a half inches in diameter. They devour birds, ſquirrels, hares, &c. 2. The miliaris has 13 ſcuta, and 31 ſcutellæ. It is aſh-coloured, interſperſed with black ſpots, and is a native of Carolina. 3. The dryinas has 165 ſcuta, and 30 ſcutellæ. It is whitiſh, with a few yellow ſpots, and is a native of America. 4. The duriſſus has 172 ſcuta, and 21 ſcutellæ. It is variegated with white and yellow colours, and is likewiſe found in America. 5. The mutus has 217 ſcuta, and 34 ſcutellæ. It has a chain of rhomboidal black ſpots on the back, a black line behind the eyes, and is a native of Surinam.

CROTCHET, in muſic, one of the notes or characters of time, marked thus ♩, equal to half a minum, and double of a quaver.

Crotchets are alſo marks or characters, ſerving to incloſe a word or ſentence which is diſtinguiſhed from the reſt, being generally in this form [ ], or this ( ).

CROTON, in botany, a genus of plants of the monoecia polyandria claſs. The calix of the male is cylindrical,

drical, and has five teeth; the corolla has five petals; and the ſtamina are from 10 to 15. The calix of the female conſiſts of many leaves; it has no corolla; but has three bifid ſtyli; and the capſule has three cells, and contains one ſeed. There are 21 ſpecies, none of them natives of Britain.

CROTOY, a town of France, ſituated in the province of Picardy, at the mouth of the river Somme: E. long. 1° 30′, and N. lat. 50° 15′.

CROUP *of a horſe*, in the menage, the extremity of the reins above the hips.

CROUPADE, in the menage, a leap, in which the horſe pulls up his hind legs, as if he drew them up to his belly.

CROW, or CARRION-CROW, in ornithology. See CORVUS.

Royſton CROW. See CORVUS.

CROW, in mechanics, a kind of iron lever, with a claw at one end, and a ſharp point at the other; uſed for heaving or purchaſing great weights.

CROW'S BILL, among ſurgeons, a kind of forceps, for drawing bullets and other foreign bodies out of wounds.

CROW-FLOWERS, in botany. See LYCHNIS.

CROW'S FEET, in the military art, machines of iron, having four points, each about three or four inches long, ſo made, that whatever way they fall, there is ſtill a point up: they are thrown upon breaches, or in paſſes where the enemy's cavalry are to march, proving very troubleſome by running into the horſe's feet and laming them.

CROW'S FEET, in a ſhip, ſmall lines or ropes, ſometimes eight or ten, reeved through the deadmens eyes; and ſcarce of any other uſe than to make a ſhew of ſmall rigging. They are uſually placed at the bottom of the back-ſtays of the fore-top-maſt, mizen-top-maſt, and gallant-top-maſt.

CROW'S FOOT, in botany. See RANUNCULUS.

CROWLAND, a market-town of Lincolnſhire: W. long. 10′, and N. lat. 52° 40′.

CROWN, an ornament worn on the head by kings, ſovereign princes, and noblemen, as a mark of their dignity.

In ſcripture there is frequent mention of crowns, and the uſe of them ſeems to have been very common among the Hebrews. The high prieſt wore a crown, which was a fillet of gold placed upon the forehead, and tied with a ribbon of hyacinth colour, or azure blue. It ſeems alſo as if private prieſts, and even common Iſraelites, wore alſo a ſort of crown, ſince God commands Ezekiel not to take off his crown, nor aſſume the marks of one in mourning. This crown was no more than a ribbon or fillet, with which the Jews and ſeveral people in the eaſt girt their heads. And indeed the firſt crowns were no more than a bandelet drawn round the head, and tied behind, as we ſtill ſee it repreſented on medals round the heads of Jupiter, the Ptolemies, and kings of Syria. Afterwards they conſiſted of two bandelets: by degrees they took branches of trees of divers kinds; at length they added flowers, inſomuch that Claudius Saturninus ſays, there was not any plant whereof crowns had not been made. The woods and groves were ſearched to find different crowns for the ſeveral deities; and they were uſed not only on the ſtatues and images of the gods, by the prieſts in ſacrificing, and by kings and emperors, but alſo on altars, temples, doors of houſes, ſacred veſſels, victims, ſhips, *&c.*

The Roman emperors had four kinds of crowns, ſtill ſeen on medals, *viz.* a crown of laurel, a radial or radiating crown, a crown adorned with pearls and precious ſtones, and the fourth a kind of bonnet or cap, ſomething like the mortier.

The Romans had alſo various kinds of crowns, which they diſtributed as rewards of military atchievements; as, 1. The oval crown, made of myrtle, and beſtowed upon generals, who were entitled to the honours of the leſſer triumph, called ovation. 2. The naval or roſtral crown, compoſed of a circle of gold, with ornaments repreſenting beaks of ſhips, and given to the captain who firſt grappled, or the ſoldier who firſt boarded, an enemy's ſhip. 3. The crown called in Latin vallaris, or caſtrenſis, a circle of gold raiſed with jewels or paliſades; the reward of him who firſt forced the enemy's entrenchments. 4. The mural crown, a circle of cold indented and embattled; given to him who firſt mounted the wall of a beſieged place, and there lodged a ſtandard. 5. The civic crown, made of the branch of a green oak, and given him who had ſaved the life of a citizen. 6. The triumphal crown, conſiſting at firſt of wreaths of laurel, but afterwards made of gold; proper to ſuch generals as had the honour of a triumph. 7. The crown called obſidionalis, or graminea, made of graſs growing on the place; the reward of a general who had delivered a Roman army from a ſiege. 8. The crown of laurel, given by the Greeks to their athletæ; and by the Romans to thoſe who had negociated or confirmed a peace with an enemy: this was the leaſt honourable of all. We meet alſo with the corona aurea, often beſtowed on ſoldiers, without any other additional term; the radial crown, given to princes at their tranſlation among the gods; athletic crowns, and crowns of laurel, deſtined to crown victims at the public games, poets, orators, *&c.* All theſe crowns were marks of nobility to the wearers; and upon competitions with rivals for rank and dignities, often determined the preference in their favour. See Plate LXVI. fig. 8, n°. 1. 2. 3. *&c.*

The Imperial CROWN is a bonnet or tiara, with a ſemicircle of gold, ſupporting a globe with a croſs at top. See Plate LXVI. fig. 9. n°. 1.

The Britiſh CROWN is adorned with four croſſes, between which there are four fleurs de lis: it is covered with four diadems, which meet at a little globe ſupporting a croſs. *Ibid.* n°. 2.

The French CROWN, is a circle of eight fleurs de lis, encompaſſed with ſix diadems, bearing at top a double fleurs de lis, which is the creſt of France. *Ibid.* n°. 3.

The Spaniſh CROWN is adorned with large indented leaves, and covered with diadems terminating in a globe, ſurmounted with a croſs. *Ibid.* n°. 4.

The crowns of almoſt all other kings are adorned with large leaves, bordered with four, ſix, or eight diadems, with a globe and croſs at top.

The Papal CROWN is compoſed of a tiara, and a triple crown encompaſſing it, with two pendants like the biſhop's mitres. Theſe crowns repreſent the pretended triple capacity of the pope, as high prieſt, ſupreme judge, and ſole legiſlator of Chriſtians. *Ibid.* n°. 5.

An electoral CROWN, or coronet, is a ſcarlet cap turned up with ermine, and cloſed with a ſemicircle of gold, all covered with pearls, with a globe at top, ſurmounted with a golden croſs. *Ibid.* n°. 6.

CROWNS *of Britiſh princes of the blood.* 1. The prince of Wales's crown conſiſts alternately of croſſes and fleurs de lis, with one arch, in the middle of which is a ball and croſs, as in the royal diadem. 2. That of all the younger ſons and brothers of the king, conſiſts likewiſe of croſſes and fleurs de lis alternately, but without any arch, or being ſurmounted with a globe and croſs at top. 3 That of the other princes of the blood conſiſts alternately of croſſes and leaves, like thoſe in the coronet of dukes, *&c. Ibid.* fig. 10. n°. 1. 2. 3.

CROWNS *of noblemen* are, a duke's, compoſed of leaves of ſmallage, or parſley: that of a marquis, of flowers and pearls placed alternately: an earl's has no flowers about the circle, like the duke and marquis, but only points riſing, and a pearl on every one of them: a viſcount has neither flowers nor points raiſed above the circle, like the other ſuperior degrees, but only pearls placed on the circle itſelf without any limited number: a baron's has only ſix pearls on the golden border, not raiſed, to diſtinguiſh him from the earl's; and the number of them limited, to ſhew he is inferior to the viſcount. *Ibid.* fig. 11. n°. 1. 2. *&c.*

CROWN, in commerce, a general name for coins both foreign and domeſtic, which are of, or very near, the value of five ſhillings ſterling.

CROWN-OFFICE, an office belonging to the king's bench court, of which the king's coroner or attorney is commonly maſter. In this office, the attorney general and clerk of the crown ſeverally exhibit informations for crimes and miſdemeanors at common law, as in the caſe of batteries, conſpiracies, libelling, *&c.* on which the offender is liable to pay a fine to the king.

CROWN-GLASS, denotes the fineſt ſort of window-glaſs. See GLASS.

CROWN-WHEEL *of a watch*, the upper wheel next the balance, which by its motion drives the balance, and in royal pendulums is called the ſwing-wheel

CROWN IMPERIAL, in botany. See FRITILLARIA.

CROYDON, a market-town in Surrey, about ten miles ſouth of London.

CRUCIAL INCISION, in ſurgery, an inciſion made in form of a croſs.

CRUCIANELLA, in botany, a genus of the tetrandria monogynia claſs. The corolla conſiſts of one turnnel-ſhaped petal, with a filiform tube; the calix has three leaves; and the ſeeds are two, ſituate between the calix and corolla. The ſpecies are five, none of them natives of Britain.

CRUCIATA, in botany. See VALENTIA.

CRUCIBLE, a chemical veſſel made of earth, and ſo tempered and backed as to endure the greateſt fire. They are uſed to melt metals, and to flux minerals, ores, *&c.*

The figure of a crucible is commonly that of an obtuſe conoid, with its baſe at the top, and obtuſe apex at the bottom; whence this conical figure may be varied, till it comes to the hollow ſegment of a ſphere.

The crucibles moſt generally uſed are thoſe of Heſſe and Auſtria.

CRUCIFIX, a croſs upon which the body of Chriſt is faſtened in effigy, uſed by the Roman-catholics to excite in their minds a ſtrong idea of our Saviour's paſſion.

They eſteem it an eſſential circumſtance of the religious worſhip performed at the altar; and on Good Friday they perform the ceremony of adoring it, which is done in theſe words, *O crux ave, ſpes unica; Hail, thou croſs, our only hope.* The officiating prieſt uncovers the crucifix, elevates it with both his hands, and ſays, *Ecce lignum crucis; Behold the wood of the croſs.* The people anſwer, *in quo ſalus mundi pependit*; *on which the Saviour of the world ſuffered death.* Then the whole congregation bow with great reverence, and devoutly kiſs the holy wood.

CRUCIFIXION, a capital puniſhment by nailing the criminal to a croſs. See CROSS.

CRUCIFORM, in general, ſomething diſpoſed croſswiſe; but more eſpecially uſed by botaniſts, for flowers conſiſting of four petals diſpoſed in the form of a croſs.

CRUDE, an epithet given to ſomething that has not paſſed the fire, or had a proper degree of coction.

CRUDITY, among phyſicians, is applied to undigeſted ſubſtances in the ſtomach; to humours in the body which are unconcocted, and not prepared for expulſion; and to the excrements.

CRUISE, in the ſea-language, ſignifies to ſail back and fore within a certain ſpace of the ſea, as well to annoy the enemy, as to protect our own trading veſſels.

CRUMENTATA, among zoologiſts, animals furniſhed with a pouch, or bag, wherein to receive their young in time of danger.

CRUOR, ſometimes ſignifies the blood in general; ſometimes only the venous blood; and ſometimes extravaſated, or coagulated blood.

CRUPPER, in the menage, the buttocks of a horſe, the rump; alſo a thong of leather put under a horſe's tail, and drawn up by thongs to the buckle behind the ſaddle, ſo as to keep him from caſting the ſaddle forwards on his neck.

CRURA CLITORIDIS, in anatomy. See Vol. I. p. 276.

CRURA MEDULLÆ OBLONGATÆ. See Vol. I. p. 287.

CRURÆUS, or CRUREUS MUSCULUS, in anatomy. See Vol. I. p. 207.

CRURAL, in anatomy, an epithet given to the artery which conveys the blood to the crura, or legs, and to the

the vein by which this blood returns towards the heart. See ANATOMY, Part III. IV.

CRUS, in anatomy, all that part of the body contained between the buttocks and the toes. See ANATOMY, Part I.

CRUSCA, an Italian term ſignifying bran, is in uſe amongſt us to denote that celebrated academy called *della cruſca*, eſtabliſhed at Florence, for purifying and perfecting the Tuſcan language.

CRUSTA VILLOSA, in anatomy. See Vol. I. p. 258.

CRUSTA LACTEA, in medicine, the ſame with achor, being ſcabby eruptions with which the heads of children are often troubled. See MEDICINE.

CRUSTACEOUS, an appellation given to animals covered with ſhells made up of ſeveral pieces, in contradiſtinction to thoſe conſiſting of a ſingle piece.

CRUX, or St CROIX, one of the Caribbee-iſlands, ſitutuated about ſixty miles ſouth-eaſt of Porto-Rico, and ſubject to France: W. long. 64°, and N. lat. 17° 30′.

CRUSADO, in commerce, a Portugueſe coin, ſtruck under Alphonſus V. about the year 1457, at the time when pope Calixtus ſent thither the bull for a croiſade againſt the infidels.

This coin has a croſs on one ſide, and the arms of Portugal on the other.

CRYMODES, among phyſicians, a kind of fever attended with a ſhivering cold and inflammation of the internal parts of the body.

CRYPTOGAMIA, in botany. See the *Scheme*, p. 635. and Plate LIII. fig. 24. alſo p. 636.

CRYPTOGRAPHY, the art of writing in cipher, or with ſympathetic ink. See CIPHER and INK.

CRYSTAL, the name of a very large claſs of foſſils; hard, pellucid, and naturally colourleſs; of regularly angular figures, compoſed of ſimple, not filamentous plates; not flexible nor elaſtic, giving fire with ſteel; not fermenting in acid menſtrua, and calcining in a ſtrong fire.

The orders of pure cryſtal are three; the firſt is perfect columnar cryſtals, with double pyramids, compoſed of eighteen planes, in an hexangular column, terminated by an hexangular pyramid at each end: the ſecond order is that of perfect cryſtals, with double pyramids, without a column, compoſed either of twelve or of ſixteen planes, in two hexangular pyramids, joined cloſely, baſe to baſe, without the intervention of any column: the third order is that of imperfect cryſtals, with ſingle pyramids, compoſed either of twelve or ten planes, in an hexangular or pentangular column, affixed irregularly, at one end, to ſome ſolid body, and terminated, at the other, by an hexangular or pentangular pyramid.

Theſe are all the general forms into which cryſtal, when pure, is found concreted: but under theſe there are almoſt infinite varieties in the number of angles, and the length, thickneſs, and other accidents of the columns and pyramids.

When cryſtal is blended with metalline particles at the time of its formation, it aſſumes a variety of figures wholly different from theſe, conſtituting a fourth order, under the name of metalline cryſtals: when that metal is lead, the cryſtal aſſumes the form of a cube; when it is tin, of a quadrilateral pyramid, with a broad baſe; when iron, the cryſtal is found concreted in rhomboidal cryſtals: theſe cryſtals are very common about mines; but the common ſpars, which are liable to be influenced in the ſame manner by the metals, and to appear in the very ſame form, are to be carefully diſtinguiſhed from them. There is one very eaſy teſt for this purpoſe, which is, that all ſpars are ſubject to be diſſolved by aqua fortis, and effervefce violently only on its touching it: but it has no ſuch effects on cryſtal.

The pebble cryſtal is common enough in all parts of the world; but that which is formed of hexangular columns, affixed to a ſolid baſe at one end, and terminated by a hexangular column at the other, is infinitely more ſo: this is what we call ſprig or rock cryſtal, and is the ſpecies deſcribed by moſt authors under the name of cryſtal of the ſhops, or that kept for medicinal uſe.

It is to be choſen the cleareſt, pureſt, and moſt tranſparent that can be had: it ſhould be proved to be no ſpar, by means of aquafortis, or by drawing a point of it along a pane of glaſs, which it cuts in the manner of a diamond. It is found in vaſt abundance in many parts of England and Ireland; and in Germany it is yet more frequent. It is found about Briſtol of amethyſtine tinge; in Sileſia and Bohemia it is ſtained to the colour of the ruby, ſapphire, emerald, and topaz, in which caſe jewellers make great advantage of it, ſelling it under the name of accidental ſapphire, *&c.*

CRYSTAL is alſo uſed for a factitious body, caſt in glaſs-houſes, called cryſtal-glaſs; being, in fact, no more than glaſs carried, in the compoſition and manufacture, to a greater perfection than the common glaſs.

The beſt kind of glaſs-cryſtal is that called Venice cryſtal, made at Moran, near Venice. See GLASS.

CRYSTALS, in chemiſtry, ſalts or other matters ſhot, or congealed, in the manner of cryſtal. See CHEMISTRY.

CRYSTALLINE HUMOUR, in anatomy. See Vol. I. p. 289.

CRYSTALLIZATION, in chemiſtry. See CHEMISTRY.

CRYSTALLOMANCY, in antiquity, a kind of divination, performed by means of a mirror, wherein the figures of the things required are ſaid to have been repreſented.

CUB, a bear's whelp. Among hunters, a fox and martern of the firſt year, are called cubs. See URSUS.

CUBA, an iſland of North America, ſituated in the Atlantic ocean, between 74° and 87° of W. long. and between 20° and 23° N. lat. being eight hundred miles and upwards in length from eaſt to weſt, and generally about ſeventy miles broad. It lies about fifty miles weſt of Hiſpaniola, and ſeventy-five north of Jamaica.

CUBAGUA, an American iſland, ſituated between the iſland of Margaretta and Terra Firma, and ſubject to Spain: W. long. 64°, and N. lat. 10° 15′.

CUBE, in geometry, a ſolid body, conſiſting of ſix equal ſquare ſides. See Geometry.

CUBEBS, in the materia medica, a ſmall dried fruit, reſembling a grain of pepper, but often ſomewhat longer, brought into Europe from the iſland of Java. In aromatic warmth and pungency, they are far inferior to pepper.

CUBIC, or Cubical equation, in algebra. See Algebra.

CUBIT, in the menſuration of the ancients, a long meaſure, equal to the length of a man's arm, from the elbow to the tip of the fingers.

Dr Arbuthnot makes the Engliſh cubit equal to 18 inches; the Roman cubit equal to 1 foot 5, 406 inches; and the cubit of the ſcripture equal to 1 foot, 9, 888 inches.

CUCKOW, in ornithology. See Cuculus.

Cuckow-spit, the ſame with froth-ſpit. See Froth-spit.

Cuckow-spit-insect. See Cicada.

CUCUBALUS, in botany, a genus of the decandria trigynia claſs. The calix is inflated; the corolla has five petals with ungues; and the capſule has three cells. There are 13 ſpecies, five of which are natives of Britain, *viz.* the bacciferus, or berry-bearing chickweed; the beken, or white corn campion; the viſcoſus, or Dover campion; the olites, or Spaniſh catchfly; and the acaulis, or moſs campion.

CUCULUS, the Cuckow, in ornithology, a genus belonging to the order of picæ. The bill is ſomewhat cylindrical; the edges of the noſtrils are a little prominent; the tongue is arrow-ſhaped, plain, and not divided, and the toes are of the climbing kind, *i. e.* two before and two behind. It is about the ſize of a pigeon. The cuckow is a migrating bird; it comes to Britain about the end of April, hatches its young, and diſappears about St John's day. The cuckow neither builds a neſt, nor ſits upon its eggs; but takes poſſeſſion of a neſt built by ſmall birds of the ſparrow kind, in which it generally lays but one egg, which is hatched by the ſmall bird along with its own eggs; during the time of hatching, the cuckow ſits upon hedges or trees, and almoſt conſtantly ſings. If the cuckow's egg be firſt hatched, ſhe immediately throws out and deſtroys the eggs of the ſmall bird; but if the ſmall bird's eggs be firſt hatched, the cuckow allows the young to live till its own egg is hatched, and then deſtroys the young belonging to the ſmall bird. The ſmall bird feeds and brings up the young cuckow with as much care and attention as if it were its own, till it be able to procure its own food, when, ſome ſay, it ungratefully kills and eats its nurſe. The cuckow feeds upon caterpillars and ſmall birds; but is never tranſformed into a hawk, as is vulgarly ſuppoſed. It is a native of Europe. Linnæus enumerates no leſs than 22 ſpecies, which inhabit different parts of the globe, and are chiefly diſtinguiſhed by the ſhape of the tail and variations in colour.

CUCUMBER, in botany. See Cucumis.

CUCUMIS, or Cucumber, in botany, a genus of the monoecia ſyngeneſia claſs. The calix of the male has five teeth; the corolla is divided into five ſegments; and the filaments are three: The calix and corolla of the female are the ſame with thoſe of the male; the piſtillum is trifid; and the ſeeds of the apple are ſhort and ſlender. There are 11 ſpecies, none of them natives of Britain.

CUCURBIT, in chemiſtry. See Chemistry, Vol. II. p. 109.

CUCURBITA, the gourd, in botany, a genus of the monoecia ſyngeneſia claſs. The calix has five teeth; the corolla is divided into five ſegments; and the filaments are three: The calix and corolla of the female are the ſame with thoſe of the male; the piſtillum is quinquefid; and the ſeeds of the apple are turned at the edges. The ſpecies are five, none of them natives of Britain.

CUD ſometimes means the inſide of the throat in beaſts, and ſometimes the food that they keep there and chew over again: from whence, *to chew the cud*, ſignifies, to ponder, think, or ruminate upon a thing.

CUDWEED, in botany. See Gnaphalium.

CUENCA, a city and biſhop's ſee of New Caſtile, in Spain, about eighty-five miles eaſt of Madrid: W. long. 2° 40′, and N. lat. 40° 12′.

CUIRASSE, a piece of defenſive armour, made of iron plate, well hammered, ſerving to cover the body, from the neck to the girdle, both before and behind. Whence,

CUIRASSIERS, cavalry armed with cuiraſſes, as moſt of the Germans are: the French have a regiment of cuiraſſiers; but we have had none in the Britiſh army ſince the revolution.

CULDEES, in church-hiſtory, a ſort of monkiſh prieſts, formerly inhabiting Scotland and Ireland. Being remarkable for the religious exerciſes of preaching and praying, they were called, by way of eminence, *cultores Dei*; from whence is derived the word culdees. They made choice of one of their own fraternity to be their ſpiritual head, who was afterwards called the Scots biſhop.

CULEUS, in Roman antiquity, the largeſt meaſure of capacity for things liquid, containing twenty amphoræ, or forty urnæ. It contained one hundred forty-three gallons, three pints, Engliſh wine-meaſure; and was 11.095 ſolid inches.

CULEX, in zoology, a genus of inſects belonging to the order of diptera: The mouth is armed with ſetaceous prickles incloſed in a flexile ſheath. There are ſeven ſpecies, principally diſtinguiſhed by their colour.

CULIACAN, the capital of a province of the ſame name in Mexico, oppoſite to the ſouthern end of California: W. long. 113°, and N. lat. 24°.

CULLIAGE, a barbarous and immoral practice, whereby the lords of manors anciently aſſumed a right to the firſt night of their vaſſals brides.

CULLEN, a parliament town in Scotland, ſituated on the ſea-coaſt of Banffſhire: W. long. 2° 12′, and N. lat. 57° 38′.

CULM, or Culmus, among botaniſts. See Vol. I. p. 641.

CULMINATION, in aſtronomy, the paſſage of any heavenly body over the meridian, or its greateſt altitude for that day.

CULMORE, a town of Ireland, in the county of Londonderry, and province of Ulſter, about five miles north of Londonderry: W. long. 7° 40′, and N. lat 55°.

CULMUS. See CULM.

CULPRIT, a formal reply of a proper officer in court, in behalf of the king, after a criminal has pleaded not guilty, affirming him to be guilty, without which the iſſue to be tried is not joined.

The term culprit is a contraction of the Latin *culpabilis*, and the French *priſt;* importing that he is ready to prove the criminal guilty.

CULROSS, a parliament town of Scotland, ſituated on the river Forth, about twenty-three miles north-weſt of Edinburgh: W. long. 3° 34′, and N. lat. 56° 8′.

CULVERIN, in the military art, a large cannon, or piece of artillery; for the kinds, weight, and proportions of which, ſee CANNON.

CULVERTAILED, among ſhip-wrights, ſignifies the faſtening, or letting, of one timber into another, ſo that they cannot ſlip out, as the carlings into the beams of a ſhip.

CUMBERLAND, one of the moſt northerly counties of England, ſeparated from Scotland by the frith and river of Solway. It gives the title of duke to his royal highneſs William duke of Cumberland, *&c.*

CUMINOIDES, in botany. See LAGOECIA.

CUMINUM, in botany, a genus of the pentandria digynia claſs. The fruit is oval and ſtriated; it has four umbellulæ, and the involucrum conſiſts of four ſegments. There is but one ſpecies, a native of Egypt. The ſeeds are carminative and ſtomachic.

CUNEIFORM, in general, an appellation given to whatever reſembles a wedge.

CUNEIFORM BONE, in anatomy. See Vol. I. p. 180.

CUNEUS, the wedge, in mechanics. See MECHANICS.

CUNICULUS, in zoology. See LEPUS.

CUNILA, in botany, a genus of the diandria monogynia claſs; of which there are three ſpecies, none of them natives of Britain.

CUNNINGHAM, one of the four bailiwicks of Scotland, and one of the three into which the ſhire of Aire is ſubdivided. It lies north-eaſt of Kyle. Its chief town is Irwin.

CUP, among botaniſts, the ſame with calyx. See CALYX.

CUPANIA, in botany, a genus of the pentandria monogynia claſs. The calix conſiſts of three leaves; the ſtylus is trifid; the capſule has three valves; and the ſeeds are ſix. There is but one ſpecies, a native of America.

CUPOLA, in architecture, a ſpherical vault; or the round top of the dome of a church, in form of a cup inverted.

CUPPEL, or COPPEL, in chemiſtry. See COPPEL.

CUPPING, in ſurgery, the operation of applying cupping-glaſſes for the diſcharge of blood, and other humours, by the ſkin. See SURGERY.

CUPRESSUS, the CYPRESS-TREE, a genus of the monoecia monodelphia claſs. The calix of the male is a ſcale of the amentum; it has no corolla; and the antheræ have no filaments: The calix of the female is a ſtrobilus, and the ſquama contains a ſingle flower; it has no corolla; the ſtylus is a concave point; and the nut is angular. The ſpecies are four, none of them natives of Britain.

CUPRUM, or COPPER. See CHEMISTRY, Vol. II. p. 80.

CURASSOW, or CURAÇAO, one of the leſſer Antille-iſlands, ſubject to the Dutch, and ſituated in 68° 30′ W. long. and 12° 30′ N. lat.

CURATE, properly ſignifies the parſon or vicar of a pariſh, who has the charge or cure of the pariſhoners ſouls. See CURE.

CURATE, alſo ſignifies a perſon ſubſtituted by the incumbent, to ſerve his cure in his ſtead.

CURATOR, among civilians, a perſon regularly appointed to manage the affairs of minors, or perſons mad, deaf, dumb, *&c.* See LAW.

CURB, in the menage, a chain of iron, made faſt to the upper part of the branches of the bridle, in a hole called the eye, and running over the horſe's beard. It conſiſts of theſe three parts; the hook, fixed to the eye of the branch; the chain of SS's, or links; and the two rings, or mailes. Large curbs, provided they be round, are always moſt gentle: but care is to be taken, that it reſt in its proper place, a little above the beard, otherwiſe the bit-mouth will no have the effect that may be expected from it.

Engliſh watering bits have no curbs; the Turkiſh bits, called genettes, have a ring that ſerves inſtead of a curb. See GENETTES.

CURCULIO, in zoology, a genus of inſects belonging to the order of coleoptera. The feelers are ſubclavated, and reſt upon the ſnout, which is prominent and horny. There are no leſs than ninety-five ſpecies, principally diſtinguiſhed by their colour.

CURCUMA, or TURMERIC, in botany, a genus of the monandria monogynia claſs. It has four barren ſtamina, and only the fifth is fertile. There are two ſpecies, both natives of India. See Vol. I. p. 633.

CURDISTAN, a province of Perſia, having Turcomania, or Armenia, on the north, and Eyraca-Arabic, or Chaldea, on the ſouth.

CURDLING, the coagulating any fluid body, eſpecially milk.

It is ſaid, that at Florence they curdle their milk for the making of cheeſe with artichoke-flowers, inſtead of the rennet uſed among us for that purpoſe.

CURFEW, or COURFEW, a ſignal given in cities taken in war, *&c.* to the inhabitants to go to bed. Paſquin ſays, it was ſo called, as being intended to advertiſe the people to ſecure themſelves from the robberies and debaucheries of the night.

The moſt eminent curfew in England was that eſtabliſhed by William the Conqueror, who appointed, under

under ſevere penalties, that, at the ringing of a bell at eight o'clock in the evening, every one ſhould put out their lights and fires, and go to bed: whence, to this day, a bell rung about that time is called a curfew-bell.

CURIA, in Roman antiquity, a certain diviſion, or portion of a tribe. Romulus divided the people into thirty curiæ, or wards, whereof there were ten in every tribe, that each might keep the ceremonies of their feaſts and ſacrifices in the temple, or holy place, appointed for every curia. The prieſt of the curia was called curio.

CURIA, in the Engliſh law, generally ſignifies a court; and has been taken for the cuſtomary tenants, who do their ſuit and ſervice at the court of the lord. See COURT.

CURING, a term uſed for the preſerving fiſh, fleſh, and other animal ſubſtances, by means of certain additions of things, to prevent putrefaction. One great method of doing this, is by ſmoking the bodies with the ſmoke of wood, or rubbing them with ſalt, nitre, *&c.*

CURLEW, in ornithology. See SCOLOPAX.

CURNOCK, a meaſure of corn, containing four buſhels, or half a quarter.

CURRANS, or CURRANTS, the fruit of a ſpecies of groſſularia. See GROSSULARIA.

The white and red ſort are moſtly uſed; for the black, and chiefly the leaves, upon firſt coming out, are in uſe to flavour Engliſh ſpirits, and counterfeit French brandy. Currants greatly aſſuage drought, cool and fortify the ſtomach, and help digeſtion.

CURRANTS alſo ſignify a ſmaller kind of grapes brought principally from Zant and Cephalonia. They are gathered off the buſhes, and laid to dry in the ſun, and ſo put up in large butts. They are opening and pectoral, but are more uſed in the kitchen, than in medicine.

Currants, the hundred weight pay on exportation 1 l. 2s. $1\frac{35}{100}$d. and draw back on exportation 1 l. 0s. $7\frac{35}{100}$d. If imported in Venetian ſhips, they pay the 112 lb. 1 l. 3 s. $7\frac{35}{100}$d. and draw back 1 l. 1 s. $8\frac{85}{100}$d. In other foreign bottoms they pay 1 l. 7s. $4\frac{95}{100}$d. and draw back 1 l. 5 s. $6\frac{45}{100}$d.

CURRENT, in hydrography, a ſtream or flux of water in any direction. In the ſea, they are either natural, occaſioned by the diurnal motion of the earth round its axis, or accidental, cauſed by the waters being driven againſt promontories, or into gulfs and ſtreights, where, wanting room to ſpread, they are driven back, and thus diſturb the ordinary flux of the ſea. Dr Halley makes it highly probable that in the Downs, there are under-currents, by which as much water is carried out as is brought in by the upper-currents.

CURRENTS, in navigation, are certain ſettings of the ſtream, by which ſhips are compelled to alter their courſe or velocity, or both, and ſubmit to the motion impreſſed upon them by the current. See NAVIGATION.

CURRIERS, thoſe who dreſs and colour leather after it comes from the tan yard. See TANNING.

CURRUCU, in ornithology. See MOTACILLA.

CURRYING, the method of preparing leather with oil, tallow, *&c.* See TANNING.

CURTATE *diſtance*, in aſtronomy, the diſtance of a a planet from the ſun to that point where a perpendicular let fall from the planet meets with the ecliptic.

CURTATION, in aſtronomy, is the interval between a planet's diſtance from the ſun, and the curtate diſtance.

CURTIN, CURTAIN, or COURTIN, in fortification, is that part of the rampart of a place which is betwixt the flanks of two baſtions, bordered with a parapet five feet high, behind which the ſoldiers ſtand to fire upon the covered way and into the moat.

CURVATOR *coccygis*, in anatomy. See Vol. I. p. 220.

CURVATURE *of a line*, is the peculiar manner of its bending or flexure by which it becomes a curve of ſuch and ſuch peculiar properties.

CURVE, in geometry, a line which running on continually in all directions, may be cut by one right line in more points than one. See CONIC SECTIONS, and FLUCTIONS.

CURVET, or CORVET, in the menage, an air in which the horſe's legs are raiſed higher than in the demi volt; being a kind of leap up, and a little forwards, wherein the horſe raiſes both his fore-legs at once, equally advanced, (when he is going ſtraight forward, and not in a circle), and as his fore-legs are falling, he immediately raiſes his hind-legs, equally advanced, and not one before the other: ſo that all his four legs are in the air at once; and as he ſets them down, he marks but twice with them.

CURVILINEAR, or CURVILINEAL, is ſaid of figures bounded by curves, or crooked lines.

CURVIROSTRA, in ornithology. See LOXIA.

CURULE *chair*, in Roman antiquity, a chair adorned with ivory, wherein the great magiſtrates of Rome had a right to ſit and be carried.

The curule magiſtrates were the ædiles, the prætors, cenſors, and conſuls. This chair was fitted in a kind of chariot, whence it had its name. The ſenators who had borne the offices of ædiles, prætors, *&c.* were carried to the ſenate-houſe in this chair, as were alſo thoſe who triumphed, and ſuch as went to adminiſter juſtice, *&c.* See ÆDILE, *&c.*

CURZOLA, an iſland in the gulf of Venice, upon the coaſt of Dalmatia, about twelve miles from the iſland of Leſſina.

CUSCO, the capital city of Peru, during the reigns of the Incas: it is ſtill a fine city, and the ſee of a biſhop, and ſtands about 350 miles eaſt of Lima, in 70° W. long. and 13° S. lat.

CUSCUTA, or DODDER, a genus of the tetrandria digynia claſs. The calix conſiſts of four ſegments; the corolla has but one petal; and the capſule is bilocular. The are two ſpecies, one of which is a native of Britain, *viz.* the Europæa, dodder, hell-weed, or devil's-guts.

CUSPIDATED, in botany, are ſuch plants whoſe leaves are pointed like a ſpear.

CUSTOM,

CUSTOM, a very comprehenfive term, denoting the manners, ceremonies and fafhions of a people, which having turned into a habit, and paffed into ufe, obtains the force of laws; in which fenfe it implies fuch ufages, as, though voluntary at firft, are yet, by practice, become neceffary.

Cuftom is hence, both by lawyers and civilians, defined *lex non fcripta*, a law, or right, not written, eftablifhed by long ufage, and the confent of our anceftors: in which fenfe it ftands oppofed to the *lex fcripta*, or the written law.

CUSTOMS, in commerce, the tribute or toll, paid by merchants to the king, for goods exported or imported: they are otherwife called duties. See DUTY.

CUSTOM HOUSE, an office eftablifhed by the king's authority in the maritime cities, or port-towns, for the receipt and management of the cuftoms and duties of importation and exportation, impofed on merchandifes, and regulated by books of rates.

CUSTOS *brevium*, the principal clerk belonging to the court of common pleas, whofe bufinefs it is to receive and keep all the writs made returnable in that court, filing every return by itfelf; and, at the end of each term, to receive of the prothonotaries all the records of the nifi prius, called the pofteas.

CUSTOS *rotulorum*, an officer who has the cnftody of the rolls and records of the feffions of peace, and alfo of the commiffion of the peace itfelf.

He ufually is fome perfon of quality, and always a juftice of the peace, of the quorum, in the county where he is appointed.

CUSTOS *fpiritualium*, he that exercifes the fpiritual jurifdiction of a diocefe, during the vacancy of any fee, which, by the canon law, belongs to the dean and chapter; but at prefent, in England, to the archbifhop of the province, by prefcription.

CUSTOS *temporalium* was the perfon to whom a vacant fee or abbey was given by the king, as fupreme lord. His office was, as fteward of the goods and profits, to give an account to the efcheator, who did the like to the exchequer.

CUTAMBULI, certain worms, either under the fkin, or upon it, which, by their creeping, caufe an uneafy fenfation. It is alfo applied to wandering fcorbutic pains.

CUT-A-FEATHER, in the fea-language. If a fhip has too broad a bow, it is common to fay, *fhe will not cut a feather*; that is, fhe will not pafs through the water fo fwift, as to make it foam or froth.

CUTANEOUS, in general, an appellation given to whatever belongs to the cutis or fkin.

CUTICLE, in anatomy. See Vol. I. p. 285.

CUTICULAR, the fame with cutaneous.

CUTIS, the SKIN, in anatomy. See Vol. I. p. 254.

CUTTER *of the tallies*, an officer of the exchequer, whofe bufinefs is to provide wood for the tallies, to cut or notch the fum paid upon them; and then to caft them into court, to be written upon. See TALLY.

CUTTLE-FISH. See SEPIA.

CUZT, the moft eaftern province of the kingdom of Fez, in Africa.

CYANUS, in botany. See CENTAURIA.

CYATHUS, in Roman antiquity, a liquid meafure, containing four ligulas, or half a pint Englifh winemeafure, being $469\frac{2}{3}$ folid inches.

CYCLAMEN, or SOW-BREAD, in botany, a genus of the pentandria monogynia clafs. The corolla is rotated and reflected; the tube is very fhort, with a prominent faux; and the berry is covered with a capfule. There are two fpecies, none of them natives of Britain. The root is a powerful aperient and abftergent.

CYCLE. See Vol. I. p. 491.

CYCLE *of the moon*. See Vol. I. p. 491.

CYCLE *of the Roman indiction*. See Vol. I. p. 491.

CYCLISCUS, in furgery, an inftrument in the form of a half moon, ufed in fcraping the fkull, in cafe of fractures of that part.

CYCLOID, a curve on which the doctrine of pendulums and time-meafuring inftruments in a great meafure depend; Mr Huygens demonftrated, that from whatever point or height a heavy body, ofcillating on a fixed centre, begins to defcend, while it continues to move in a cycloid, the time of its falls or ofcillations will be equal to each other. It is likewife demonftrable, that it is the curve of quickeft defcent, *i. e.* a body falling in it, from any given point above, to another not exactly under it, will come to this point in a lefs time than in any other curve paffing through thofe two points.

CYCLOMETRY, a term fometimes ufed for the menfuration of circles.

CYCLOPÆDIA, or ENCYCLOPÆDIA, denotes the circle or compafs of arts and fciences. A cyclopædia, fay the authors of the French Encyclopædia, ought to explain, as much as poffible, the order and connection of human knowledge. See DICTIONARY.

CYCLOPTERUS, the LUMP-FISH, in ichthyology, a genus belonging to the order of amphibia nantes. The head is obtufe, and furnifhed with faw-teeth; there are four rays in the gills; and the belly-fins are connected together in an orbicular form. There are three fpecies.

CYDER, an excellent drink made of the juice of apples. It conduces greatly to the goodnefs of the cyder, to let the apples lie a week or two in heaps, before they are preffed. After ftraining the liquor through a fieve, let it ftand a day or two in an open tun, covered only with a cloth, or boards, to keep out the duft, that the more grofs parts may fubfide. Then draw it off in pails into veffels, wherein it is intended to be kept, obferving to leave an eighth part of them empty. Set thefe veffels in your coldeft cellars, with the bung open, or covered only with a loofe cover, both that the volatile fteams may have free vent, and that the muft may be kept cool, otherwife it is apt to ferment too much. Having fermentad in this manner for fifteen or twenty days, the veffel may be ftopped up clofe; and, in two or three months time, the cyder will be fit for drinking. But if you expect cyder in perfection, fo as to flower in the glafs, it muft be glued as they call it, and drawn off into bottles, after it has been a fhort time in the cafk: this is done by pouring into each vef-

fel

ſel a pint of the infuſion of ſixty or ſeventy grains of the moſt tranſparent iſing-glaſs, or fiſh-glue, in a little white-wine and river or rain water, ſtirred well together, after being ſtrained through a linen cloth. When this viſcous ſubſtance is put into the caſk, it ſpreads itſelf over the ſurface like a net, and carries all the dregs to the bottom with it.

Ginger added to cyder, not only corrects its windineſs, but makes it more briſk; and a few drops of currant-juice, beſides tinging, adds a pleaſant quickneſs to it. Honey, or ſugar, mixed with ſome ſpices, and added to flat cyder, will very much revive it.

Some commend boiling of cyder-juice, which ſhould be done as ſoon as it is preſſed, ſcumming it continually, and obſerving to let it boil no longer than till it acquires the colour of ſmall beer: when cold, put it into a caſk, leaving a ſmall vent; and when it begins to bubble up out of the vent, bottle it for uſe.

CYDONIA, in botany. See Crateva.

CYGNUS, in ornithology. See Anas.

Cygnus, in aſtronomy. See Vol. I. p. 486.

CYLINDER, in geometry, a ſolid body, ſuppoſed to be generated by the rotation of a parallelogram.

Rolling, or *loaded* Cylinder. See Mechanics.

CYLINDROID, in geometry, a ſolid body, approaching to the figure of a cylinder, but differing from it in ſome reſpect, as having the baſes elliptical, but parallel and equal.

CYLINDRUS, in natural hiſtory. See Voluta.

CYMA, in botany, the tender ſtalks which herbs ſend forth in the beginning of the ſpring, particularly thoſe of the cabbage-kind.

CYMATIUM, in architecture, a member or moulding, of the corniche, the profile of which is waved, that is, concave at top, and convex at bottom. See Architecture.

CYMBAL, a muſical inſtrument in uſe among the ancients. The cymbal was round, made of braſs, like our kettle-drums, and, as ſome think, in their form, but ſmaller, and of different uſe.

CYMBALARIA, in botany. See Antirrhinum.

CYMBARIA, in botany, a genus of the didynamia angioſpermia claſs of plants. The calix is divided into many parts; and the capſule is unilocular. There is but one ſpecies.

CYNÆDUS, in ichthyology. See Sparus.

CYNANCHE, among phyſicians, denotes an inflammation of the larynx.

CYNANCHUM, in botany, a genus of the pentandria digynia claſs. The nectarium is cylindrical, and has five teeth. There are five ſpecies, none of them natives of Britain.

CYNANTHROPIA, in medicine, the diſtemper occaſioned by the bite of a mad dog. See Medicine.

CYNAPIUM, in botany. See Ethusa.

CYNARA, the Artichoak, in botany, a genus of the ſyngeneſia polygamia æqualis claſs. The calix is dilated and imbricated, with fleſhy ſcales ſharp at the points. There are four ſpecies, none of them natives of Britain. The uſe of the artichoke as a food is well known.

CYNICS, a ſect of ancient philoſophers, who valued themſelves upon their contempt of riches and ſtate, arts and ſciences, and every thing, in ſhort, except virtue or morality.

The cynic philoſophers owe their origin and inſtitution to Antiſthenes of Athens, a diſciple of Socrates, who, being aſked of what uſe his philoſophy had been to him, replied, "It enables me to live with myſelf." Diogenes was the moſt famous of his diſciples, in whoſe life the ſyſtem of this philoſophy appears in its greateſt perfection: he led a moſt wretched life, a tub having ſerved him for a lodging, which he rolled before him where-ever he went; yet he was, nevertheleſs, not the more humble on account of his ragged cloak, bag, and tub; for, one day, entering Plato's houſe, at a time that there was a ſplendid entertainment there for ſeveral perſons of diſtinction, he jumped up upon a very rich couch, in all his dirt, ſaying, "I trample on the pride of Plato." "Yes (replied Plato,) but with great pride, Diogenes." He had the utmoſt contempt for all the human race, for he walked the ſtreets of Athens, at noon-day, with a lighted lantern in his hand, telling the people, "He was in ſearch of a man." Amongſt many excellent maxims of morality, he held ſome very pernicious opinions; for he uſed to ſay, that the uninterrupted good fortune of Harpalus, who generally paſſed for a thief and a robber, was a teſtimony againſt the gods. He regarded chaſtity and modeſty as weakneſſes; hence Laertius obſerves of him, that he did every thing openly, whether it belonged to Ceres or Venus, though he adds that Diogenes only ran to an exceſs of impudence to put others out of conceit with it: but impudence was the characteriſtic of theſe philoſophers, who argued, that what was right to be done, might be done at all times, and in all places. The chief principle of this ſect, in common with the ſtoics, was, that we ſhould follow nature; but they differed from the ſtoics in their explanation of that maxim, the cynics being of opinion that a man followed nature, that gratified his natural motions and appetites; while the ſtoics underſtood right reaſon, by the word nature.

Cynic spasm, a kind of convulſion, wherein the patient imitates the howlings of dogs.

CYNIPS, in zoology, a genus of inſects belonging to the order of hymenoptera. The mouth conſiſts of two jaws, without any proboſcis; and the ſting in the tail is ſpiral, and generally hid. There are nineteen ſpecies, diſtinguiſhed by their colour, and the plants they inhabit.

CYNOCEPHALUS, in zoology, the trivial name of a ſpecies of ſimia. See Simia.

CYNOGLOSSUM, in botany, a genus of the pentandria monogynia claſs. The corolla is tunnel-ſhaped; the ſeeds are depreſſed, and the ſtylus is fixed to the interior ſide of them. There are eight ſpecies, only one of which is a native of Britain, *viz.* the officinale, or hound's-tongue; the root is ſaid to be pectoral and narcotic.

CYNOMETRA, in botany, a genus of the decandria monogynia claſs. The calix conſiſts of four ſegments, the

the oppoſite ones being broader; and the legumen is fleſhy, lunated, and contains but one ſeed. There are two ſpecies, both natives of India.

CYNOMORIUM, in botany, a genus of the monoecia monandria claſs. The calix of the female is an imbricated amentum, and neither male nor female has a corolla; the female has one ſtylus, and one round ſeed. There is but one ſpecies, a native of Jamaica.

CYNOSURUS, in botany, a genus of the triandria dygínia claſs. The calix is a double valve, and includes many flowers. There are ten ſpecies, four of which are natives of Britain, *viz.* the criſtatus, or creſted dog-tail graſs; the echinatus, or rough dog-tail graſs; the cæruleus, or blue dog-tail graſs; and the paniceus, or bearded dog-tail graſs.

CYPERUS, in botany, a genus of the triandria monogynia claſs. The gluma is paleaceous and imbricated; it has no corolla, and but one naked ſeed. There are twenty ſpecies, only one of which is a native of Britain, *viz.* the longus, ſweet cyperus, or Engliſh galingale; the root is carminative and attenuant.

CYPHOMA, Cyphos, or Cyphosis, an incurvation of the ſpine, forming a crookedneſs in the back.

CYPRÆA, in zoology, a genus of inſects belonging to the order of vermes teſtacea. It is an animal of the limax or ſnail-kind; the ſhell is one involated, ſubovated, obtuſe, ſmooth valve. The aperture on each ſide is linear, longitudinal, and teethed. There are forty-four ſpecies, diſtinguiſhed by the form of their ſhells.

CYPRESS. See Cupressus.

CYPRINUS, in ichthyology, a genus of fiſhes belonging to the order of abdominales. The mouth is toothleſs; there are three rays in the gills; the body is ſmooth, and white; and the belly-fins have frequently nine rays. There are thirty-one ſpecies, principally diſtinguiſhed by the number of rays in the vent-fin.

CYPRIPEDIUM, in botany, a genus of the gynandria diandria claſs. The nectarium is ventricoſe, inflated, and hollow. There are two ſpecies, one of them, *viz.* the calceolus, or ladies-ſlipper, a native of Britain.

CYPRUS, an iſland ſituated in the moſt eaſterly part of the Levant, or Mediterranean ſea, between 33° and 36° E. long. and between 34° and 30° N. lat.

Knights of Cyprus, an order inſtituted by Guy de Luſignan, titular king of Jeruſalem, to whom Richard I. of England, after conquering this iſland, made over his right.

CYRENAICS, a ſect of ancient philoſophers, ſo called from their founder, *Ariſtippus* of Cyrene, a diſciple of Socrates.

The great principle of their doctrine was, that the ſupreme good of man in this life is pleaſure; whereby they not only meant a privation of pain, and a tranquillity of mind, but an aſſemblage of all mental and ſenſual pleaſures, particularly the laſt.

CYST, the bag, or tunic, including all incyſted tumors, as the ſcirrhus, atheroma, ſteotoma, meliceres, *&c.*

CYSTIC, a name given to two arteries and two veins. See Vol. I. p. 245.

Cystic duct. See Vol. I. p. 265.

CYTISUS, in botany, a genus of the diadelphia decandria claſs. The calix is bilabiated; and the legumen is attenuated at the baſe. There are eleven ſpecies, none of them natives of Britain.

CZACKATHURN, a town of Germany, in the dutchy of Stiria, and circle of Auſtria, ſituated near the conflux of the rivers Muer and Save, about fifty miles ſouth-eaſt of Gratz: E. long. 17°, and N. lat. 46° 50′.

CZAR, a title of honour aſſumed by the great dukes, or, as they are now ſtyled, emperors of Ruſſia.

Beckman makes no doubt but they took this title, by corruption, from Cæſar, emperor; and accordingly they bear an eagle, as the ſymbol of their empire, and the word Cæsar in their arms.

CZASLAW, a town of Bohemia, about thirty-five miles ſouth-eaſt of Prague: E. long. 15° 8′, and N. lat. 49° 50′.

CZERNIGOF, the capital of the province of Czernigof, in Ruſſia, near the frontiers of Poland: E. long. 31°, 30′, and N. lat. 52° 30′.

CZONGRODT, a town of Hungary, ſituated on the river Thieſſe, about thirty miles north of Segedin: E. long. 20° 45′, and N. lat. 46° 36′.

D

DAB, in ichthyology, the Engliſh name of a ſpecies of pleuronectes. See Pleuronectes.

DACA, a city of the province of Bengal, in the Eaſt-Indies, ſituated on a branch of the river Ganges: E. long. 89° and N. lat. 23° 30′.

DA CAPO, in muſic, ſignifies from the head or beginning; intimating, that the air is to be begun again, and ended with the firſt part.

DACE, the Engliſh name of a ſpecies of cyprinus. See Cyprinus.

DACOLITHUS, in ichthyology. See Cobitis.

DACTYL, in poetry, a metrical foot conſiſting of a long and two ſhort ſyllables, as *carmina, evident, excellence.*

The dactyl and ſpondee are the only feet or meaſures uſed in hexameter verſes. See Hexameter.

DACTYLIS, in botany, a genus of the triandria digynia claſs of plants. The calix conſiſts of two obtuſe valves, the one being ſomewhat larger than the other. The ſpecies are two, *viz.* the cynoſuroides, or

or ſmooth cock's-foot graſs; and the glomeratus, or rough cock's-foot graſs; both natives of Britain.

DACTYLUS, in zoology. See PHOLAS.

DADUCHI, in antiquity, prieſts of the goddeſs Ceres, ſo called, becauſe at the feaſts and ſacrifices of that goddeſs, they ran about the temple, carrying a lighted torch, which they delivered from hand to hand, till it had paſſed through them all. This they did in memory of Ceres's ſearching for her daughter Proſerpine, by the light of a torch, which ſhe kindled in mount Ætna.

DÆMON, a name given by the ancients to certain ſpirits, or genii, which appeared to men, either to do them ſervice, or to hurt them. The Platoniſts diſtinguiſh between gods, dæmons, and heroes. The gods are thoſe whom Cicero calls *Dii majorum gentium.* The dæmons are thoſe whom we call angels. Chriſtians, by the word dæmon, underſtand only evil ſpirits, or devils.

DÆMONIAC, a word applied to a perſon ſuppoſed to be poſſeſſed with an evil ſpirit, or dæmon. See DÆMON.

DÆMONIACS, in church-hiſtory, a branch of the anabaptiſts, whoſe diſtinguiſhing tenet is, that the devils ſhall be ſaved at the end of the world.

DAGO, or DAGERWORT, the capital of an iſland of the ſame name in the Baltic, near the coaſt of Livonia, ſubject to Ruſſia: E. long. 21° 30′, and N. lat. 58° 45′.

DAHGESTAN, a country of Aſia, bounded by Circaſſia on the north, by the Caſpian ſea on the Eaſt, by Chirvein a province of Perſia on the ſouth, and by Georgia on the weſt. Its chief towns are Tarku and Derbent, both ſituated on the Caſpian ſea.

DAHOME, a kingdom of Africa, on the Guinea coaſt.

DAISY. See BELLIS.

Great DAISY. See LEUCANTHEMUM.

Ox-eye DAISY. See BUPHTHALMUM.

DALEA, in botany. See PSORALEA.

DALEBURGH, the capital of the province of Dalia, in Sweden, ſituated on the weſtern ſide of the Wener-lake, fifty miles north-eaſt of Gottenburg; E. long. 13°, and N. lat. 59°.

DALECARLIA, a province of Sweden, abounding with iron and copper mines.

DALECHAMPIA, in botany, a genus of the monoecia monodelphia claſs. It has no corolla either in the male or female; and the ſeeds are roundiſh and ſolitary. There is but one ſpecies, *viz.* the ſcandens, a native of America.

DALKEITH, a town of Scotland, in the county of Lothian, ſix miles ſouth-eaſt of Edinburgh: W. long. 2° 40′, and N. lat. 55° 50′.

DALIA, a province of Sweden, bounded on the north by Dalecarlia, on the eaſt by Wermeland and the Wener-lake, on the ſouth by Gothland, and on the weſt by Norway.

DALMATIA, a frontier province of Europe, moſtly ſubject to the Turks, but ſome towns on the ſea-coaſt to the Venetians: it is bounded by Boſnia on the north, by Servia on the eaſt, by Albania on the ſouth, and by Morlachia and the gulph of Venice on the weſt.

DAMA, in zoology. See CERVUS.

DAMAGE, in law, is generally underſtood of a hurt, or hindrance attending a perſon's eſtate.

DAMALA, a ſea-port town of the Morea in Greece, at the entry of the gulf of Engea.

DAMAN, a port-town of the hither India, in the province of Guzurat or Cambay, ſituated on the weſt coaſt, about eighty miles ſouth of Surat, in 72° 20′ E. long. and 20° N. lat. It is ſubject to the Portugueſe.

DAMASCUS, or SCHAM, the capital city of the ſouth part of Syria, ſituated ninety miles north-eaſt of Jeruſalem, in a pleaſant, extenſive, and fruitful plain; E. long. 37° 20′, and N. lat. 33° 15′.

DAMASK, a ſilk-ſtuff, with a raiſed pattern, ſo as that the right ſide of the damaſk is that which hath the flowers raiſed or ſattined.

DAMASKEENING, or DAMASKING, the art or operation of beautifying iron, ſteel, *&c.* by making inciſions therein, and filling them up with gold and ſilver wire; chiefly uſed for adorning ſword-blades, guards and gripes, locks of piſtols, *&c.*

DAMASONIUM, in botany. See ALISONA.

DAMBEA, the capital of Abyſſinia, or Ethiopia, ſituated at the head of a lake, to which it gives name: E. long. 34°, and N. lat. 15°.

DAMELOPRE, a kind of bilander, uſed in Holland for conveying merchandize from one canal to another; being very commodious for paſſing under the bridges.

DAMIANISTS, in church-hiſtory, a branch of the ancient acephali-ſeveritæ. They agreed with the catholics in admitting the IVth council, but diſowned any diſtinctions of perſons in the Godhead; and profeſſed one ſingle nature, incapable of any difference; and yet they called God, the Father, Son, and Holy Ghoſt.

DAMIETTA, a port-town of Egypt, ſituated on the eaſtern mouth of the river Nile, four miles from the ſea, and 100 miles north of Grand Cairo; E. long. 32°, and N. lat. 31°.

DAMNATA TERRA, among chemiſts, the ſame with caput mortuum. See CAPUT.

DAMPS, in natural hiſtory, noxious ſteams and exhalations, frequently found in mines, pits, wells, and other ſubterraneous places. See PNEUMATICS.

DAMSEL, from the French *damoiſel*, or *damoiſeau*, an appellation anciently given to all young people of either ſex, that were of noble or genteel extraction, as the ſons and daughters of princes, knights, and barons: thus we read of Damſel Pepin, Damſel Louis le Gros, Damſel Richard prince of Wales.

From the ſons of kings this appellation firſt paſſed to thoſe of great lords and barons, and at length to thoſe of gentlemen, who were not yet knights.

At preſent, damſel is applied to all maids or girls, not yet married, provided they be not of the vulgar.

DANAE, in antiquity, a coin ſomewhat more than an obolus, uſed to be put into the mouths of the dead, to pay their paſſage over the river Acheron.

DANCE, an agreeable motion of the body, adjuſted by art to the meaſures or tune of inſtruments, or of the voice.

Athenæus concludes, that in the early ages of antiquity, they accounted dancing an exerciſe becoming perſons of honour and wiſdom; and that, as ſuch, it had been eſteemed by the greateſt men in all ages. Thus, Homer calls Merion a fine dancer; and ſays, that the graceful mein and great agility which he had acquired by that exerciſe, diſtinguiſhed him above the reſt in the armies of either Greeks or Trojans. Dancing was in very great eſteem among the Greeks, even the Lacedemonians encouraged it: but, at Rome, we find the cuſtom was quite otherwiſe; for there, to uſe the words of Cicero, no man dances unleſs he is mad or drunk: Cicero reproaches Gabinius with having danced: and we read, that Domitian excluded ſeveral members from the ſenate for having danced.

Dancing in general, was by the ancients divided into cubiſtic, ſpheriſtic, and orcheſtic: the cubiſtic dance was performed with certain wreſtlings and contorſions of the body; the ſpheriſtic with a ſort of ball, or bowl play; but the orcheſtic was moſt uſual, and what indeed was dancing properly ſo called.

Dancing is uſually an effect and indication of joy; though Mr Palleprat aſſures us, that there are nations in South America, who dance to ſhew their ſorrow. It has been in uſe among all nations, civilized and barbarous; though held in eſteem among ſome, and in contempt among others. It has often been, and ſtill is, ſometimes made an act of religion. Thus David danced before the ark to honour God, and expreſs his exceſs of joy for its return into Sion. Among the pagans it made a part of the worſhip paid to the gods, it being uſual to dance round the altars and ſtatues; and at Rome, the ſalii, who were prieſts of Mars, danced through the ſtreets in honour of that God. The poets made the gods themſelves dance. The Chriſtians are not free from this ſuperſtition; for in popiſh countries certain feſtivals, particularly thoſe of the ſacrament, and paſſion of our Lord, are celebrated with dancing.

DANCETTE, in heraldry, is when the outline of any bordure, or ordinary, is indented very largely, the largeneſs of the indentures being the only thing that diſtinguiſhes it from indented.

DANDELION, in botany. See LEONTODON.

DANEGELT, a tax or tribute on every hide of land, impoſed on our anceſtors the Saxons by the Danes, on their frequent invaſions, as the arbitrary terms of peace and departure.

DARNAMAS, the name of the beſt ſort of cotton that comes from Smyrna, ſo called from a plain near that city.

DANTELLE, in heraldry. See DANCETTE.

DANTIA, in botany. See ISNARDIA.

DANTZICK, the capital of regal Pruſſia, in the kingdom of Poland, ſituated on the weſtern ſhore of the river Weſel, or Viſtula, which a little below falls into the Baltic ſea: E. long. 19°, and N. lat. 54°. It is an excellent harbour, and has the beſt foreign trade within the Baltic.

DANUBE, one of the largeſt rivers in Europe, which, taking its riſe in the Black Foreſt in Swabia, runs eaſtward through Bavaria, Auſtria, Hungary, and Turky in Europe; diſcharging itſelf by ſeveral channels into the Pontus Euxinus, or Black Sea.

DAPHNE, in botany, a genus of the octandria monogynia claſs. It has no calix; the corolla conſiſts of four ſegments; and the berry contains but one ſeed. There are 11 ſpecies, two of which are natives of Britain, *viz.* the laureola, or ſpurge laurel; and the mezereum, or ſpurge olive. The laureola is a ſtrong cathartic.

DAPPLE BAY, in the menage: when bay horſes have marks of a dark bay, they are called dapple-bays.

DAPPLE-BLACK; when a black horſe has got ſpots or marks, more black or ſhining than the reſt of his ſkin, he is called a dapple-black.

DARAPTI, among logicians, one of the modes of ſyllogiſms of the third figure, whoſe premiſes are univerſal affirmatives, and the concluſion is a particular affirmative: thus,

DAR- Every body is diviſible;
AP- Every body is a ſubſtance;
TI, Therefore, ſome ſubſtance is diviſible.

DARBY, the capital of Darbyſhire, ſituated on the river Darwent: W. long. 1° 25′, and N. lat. 53°.

DARDANELLS, two caſtles at the entrance of the Helleſpont, where all ſhips going to Conſtantinople are examined: E. long. 27°, and N. lat. 40° 5′.

DARIEN, a province of Terra Firma, in South America, being the narrow iſthmus which joins North and South America.

DARII, in logic, one of the modes of ſyllogiſm of the firſt figure, wherein the major propoſition is an univerſal affirmative, and the minor and concluſion particular affirmatives: thus,

DA- Every thing that is moved, is moved by another;
RI- Some body is moved;
I. Therefore, ſome body is moved by another.

DARKING, a market-town of Surrey, ſituated ten miles eaſt of Guilford: W. long. 20′, and N. lat. 51° 18′.

DARLINGTON, a market-town of the county of Durham, ſituated twenty miles ſouth of the city of Durham: W. long. 1° 15′, and N. lat. 54° 30′.

DARMSTAT, the capital of Heſſe-Darmſtat, in the circle of the upper Rhine in Germany, ſituated on a river of the ſame name, fourteen miles ſouth of Francfort, and thirteen ſouth-eaſt of Mentz: E. long. 8° 25′, and N. lat. 49° 45′.

DARNEL, in botany. See LOLIUM.

DARTFORD, a market-town of Kent, in the Dover-road, fourteen miles ſouth-eaſt of London: E. long. 16′, and N. lat. 51° 25′.

DARTMOUTH, a borough and port town of Devonſhire, ſituated on the Engliſh channel, twenty-ſix miles

ſouth

fouth of Exeter, which fends two members to parliament: W. long. 4°, and N. lat. 50° 25′.

DARWENT, a river, which, rifing in the Peak of Darbyfhire, runs from north to fouth through that county, and falls into the Trent.

DASYPUS, the ARMADILLO, in zoology, a genus of quadrupeds belonging to the order of bruta. The dafypus has neither fore-teeth nor dog-teeth; it is covered with a hard boney fhell, interfected with diftinct moveable zones or belts: This fhell covers the head, the neck, the back, the flanks, and extends even to the extremity of the tail; the only parts to which it does not extend, are the throat, the breaft, and the belly, which are covered with a whitifh fkin of a coarfe grain, refembling that of a hen after the feathers are pulled off. The fhell does not confift of one entire piece, like that of the tortoife, but is divided into feparate belts connected to each other by membranes, which enable the animal to move it, and even to roll itfelf up like a hedge-hog. The number of thefe belts does not depend on the age of the animal, as fome have imagined, but is uniformly the fame at all times, and ferves to diftinguifh the different fpecies. All the fpecies of this animal were originally natives of America: they were entirely unknown to the ancients; and modern travellers mention them as peculiar to Mexico, Brafil, and the fouthern parts of America; though fome indeed have confounded them with two fpecies of manis, or fhell lizard, which are found in the Eaft Indies: Others report that they are natives of Africa, becaufe fome of them have been tranfported from Brafil to the coaft of Guinea, where a few have fince been propagated: but they were never heard of in Europe, Afia, or Africa, till after the difcovery of America. — They are all endowed with the faculty of extending and contracting their bodies, and of rolling themfelves up like a ball, but not into fo compleat a fphere as the hedge-hog. They are very inoffenfive animals, excepting when they get into gardens, where they devour the melons, potatoes, and other roots. They walk quickly; but can hardly be faid to run or leap; fo that they feldom efcape the purfuit either of men or dogs. But nature has not left them altogether defencelefs. They dig deep holes in the earth; and feldom go very far from their fubterraneous habitations: Upon any alarm, they immediately go into their holes; but, when at too great a diftance, they require but a few moments to make one. The hunters can hardly catch them by the tail before they fink their body in the ground, where they ftick fo clofe, that the tail frequently comes away and leaves the body in the earth; which obliges the hunters, when they want to take them alive and immutilated, to dilate the fides of the hole. When they are taken, and find that there is no refource, they inftantly roll themfelves up, and will not extend their bodies, unlefs they are held near a fire. When in deep holes, there is no other method of making them come out, but by forcing in fmoke or water. They keep in their holes through the day, and feldom go abroad in queft of fubfiftence but in the night. The hunters ufually chafe them with fmall dogs, which eafily come up with them. When the dogs are near, the creatures inftantly roll themfelves up, and in this condition the hunters carry them off. However, if they be near a precipice, they often efcape both the dogs and hunters: they roll themfelves up, and tumble down like a ball, without breaking their fhell, or receiving any injury. The dafypus is a very fruitful animal; the female generally brings forth four young ones every month; which is the reafon why the fpecies is fo numerous, notwithftanding they are fo much fought after on account of the fweetnefs of their flefh. The Indians likewife make bafkets, boxes, &c. of the fhells which cover their heads.

Linnæus enumerates fix fpecies of dafypus, principally diftinguifhed by the number of their moveable belts.

1. The novemcinctus, or dafypus, with nine moveable belts, (fee Plate LXVIII. fig. 1.) The head is long and narrow; the muzzle extends a good way beyond the under lip; the mouth is large; the eyes are fmall, and placed on the fides of the head; the ears are long, and placed near each other; the tail is long and conical, and terminates in a fharp point. It has five toes on the hind-feet, and only four on the fore-feet; the claws are long, and of a yellowifh colour. The length of the body, from the point of the muzzle, to the origin of the tail, is about eleven inches; and the length of the tail, about nine and a half.

2. The unicinctus, or dafypus, with eighteen moveable belts: the other fpecies have two large immoveable pieces of fhell, one on the fhoulders, and another on the buttocks: this fpecies has but one, which is on the fhoulders, from that to the tail confifting entirely of moveable belts. The length of the body, from the point of the muzzle, to the origin of the tail, is about nine inches, and the tail about five.

3. The tricinctus, or dafypus, with three moveable belts. The head is oblong, and covered with an entire piece of fhell; the ears are fhort and roundifh; it has five toes on all the feet, and the two middle claws of the fore-feet are remarkably larger than the reft; the tail is fhort, being about two inches in length; and the body is about one foot long.

4. The quadricinctus, or dafypus, with four moveable belts: Linnæus is miftaken with regard to the trivial name and fpecific character of this animal; it ought to be called the fexcinctus, or dafypus, with fix moveable belts; for, according to Briffonius, Bouffon, and moft other natural hiftorians, none of the fpecies of this genus have four moveable belts. It has five toes on every foot.

5. The feptemcinctus, or dafypus, with feven moveable belts: Here Linnæus is in another error of the fame kind; for this animal has eight moveable belts. It has four toes on the fore-feet, and five on the hind-feet.

6. The dafypus with 12 moveable belts. This is the largeft fpecies, being about two feet in length.

DATA, among mathematicians, a term for fuch things or quantities as are given or known, in order to find other things thereby that are unknown. Euclid ufes the word data (of which he hath a particular tract) for

for ſuch ſpaces, lines, and angles as are given in magnitude, or to which we can aſſign others equal.

DATE, in law, is the deſcription of the day, month, year of our Lord, and year of the reign of the king, in which a deed or other writing was made.

DATE, the fruit of the phœnix, or great palm-tree. See PHOENIX.

DATISI, in logic, a mode of ſyllogiſms in the third figure, wherein the major is an univerſal affirmative, and the minor and concluſion particular affirmative propoſitions. For example,

DA- All who ſerve God are kings;
TI- Some who ſerve God are poor;
SI. Therefore, ſome who are poor are kings.

DATIVE, among grammarians, the third caſe in the declenſion of nouns, expreſſing the relation of a thing to whoſe profit or loſs ſome other thing is referred. It is called dative, becauſe uſually governed by a verb, implying ſomething to be given to ſome perſon. In Engliſh, the dative is expreſſed by the ſigns *to* or *for*.

DATURA, the THORN-APPLE, in botany, a genus of the pentandria monogynia claſs. The corolla is plaited and tunnel-ſhaped; the calix is tubulous, angular, and deciduous; and the capſule conſiſts of four valves. There are ſix ſpecies, all natives of warm climates. The thorn-apple is a narcotic poiſon: It has lately been recommended in caſes of madneſs by Dr Stork, but without anſwering any uſeful purpoſe.

DAUCUS, the CARROT, in botany, a genus of plants belonging to the pentandria digynia claſs. The corollæ are ſubradiated, and all hermaphrodite; and the ſeeds are rough and hairy. There are five ſpecies, only one of which, *viz.* the carota, wild-carrot, or bird's-neſt, is a native of Britain. The ſeeds are ſaid to be diuretic and carminative.

DAVENTRY, a market-town of Northamptonſhire, ſituated about ten miles north of Northampton: W. long. 1° 15′, and N. lat. 52° 12′.

DAVIDISTS, in church-hiſtory, a ſect of Chriſtian heretics in the XVIth century; ſo called from David George, their leader, who began by giving out that he was the Meſſiah, and was ſent into the world in order to people the kingdom of heaven, which was quite empty of inhabitants, for want of virtuous and good men: he rejected marriage, and denied the reſurrection.

DAVIDS, or ST DAVID's, a city and biſhop's ſee of Pembrokeſhire, ſituated near the Iriſh channel, about twenty miles north-weſt of Pembroke: W. long. 5° 20′, and N. lat. 52°.

ST DAVID's is alſo the name of a town and fort ſituated on the coaſt of Coromandel, in the hither India, about eighty miles ſouth of Fort St George: E. long. 79° 40′, and N. lat. 11° 45′.

DAVIS's STRAITS run north-weſt from Cape Farewell, in 60° N. lat. to Baffin's bay, in 80° N. lat. ſeparating Greenland from North America.

DAVIT, in a ſhip, that ſhort piece of timber with a notch at one end, wherein, by a ſtrap, hangs the fiſh-block.

The uſe of this block is to help up the fluke of the anchor, and to faſten it at the ſhip's bow or loof. The davit is ſhiftable from one ſide of the ſhip to the other, as there is occaſion.

DAUPHIN, a title given to the eldeſt ſon of France, and heir preſumptive of the crown, on account of the province of Dauphiny, which, in 1343, was given to Philip of Valois, on this condition, by Humbert dauphin of the Viennois.

DAUPHIN-FORT, a fort built by the French, on the eaſtern coaſt of the iſland of Madagaſcar, E. long. 48°, and S. lat. 24°.

DAUPHINE, or DAUPHINY, a province of France, bounded by Burgundy on the north, by Piedmont on the eaſt, by Provence on the ſouth, and by the river Rhone, which ſeparates it from Languedoc and the Lyonois, on the weſt.

DAY. See Vol. I. p. 491.

DAYS *of grace*, are thoſe granted by the court at the prayer of the defendant, or plaintiff, in whoſe delay it is.

DAYS *of grace*, in commerce, are a cuſtomary number of days allowed for the payment of a bill of exchange, *&c.* after the ſame becomes due.

Three days of grace are allowed in Britain; ten in France and Dantzic; eight at Naples; ſix at Venice, Amſterdam, Rotterdam, and Antwerp; four at Francfort; five at Leipſic; twelve at Hamburg; ſix in Portugal; fourteen in Spain; thirty in Genoa, *&c.*

DAY's MAN, in the north of England, an arbitrator or perſon choſen to determine an affair in diſpute.

Intercalary DAYS. See Vol. I. p. 489.

DEACON, one of the three ſacred orders of the Chriſtian church.

As to the office of deacons, the moſt common and ordinary was to be attendant on the biſhops and preſbyters in the ſervice of the altar, to take care of the holy table and all the ornaments and utenſils belonging to it; and, in the next place, to receive the offerings of the people, and to preſent them to the prieſt; at the ſame time reciting the names of thoſe that offered. In ſome churches, though not in all, the deacons read the goſpel both before and at the communion-ſervice; but their moſt peculiar office was to aſſiſt the biſhop and preſbyters in the adminiſtration of the euchariſt, at which their buſineſs was to diſtribute the elements to the people who were preſent, and carry them to thoſe who were abſent. That they were never allowed to conſecrate them at the altar, appears from the teſtimonies of Hilary, Jerom, and the author of the conſtitutions. They were permitted, however, to adminiſter ſolely the ſacrament of baptiſm in ſome caſes. Another part of the office of deacons, was to be a ſort of monitors and directors to the people in the exerciſe of their public devotions in the church; for which purpoſe they made uſe of certain known forms of words, to give notice when each part of the ſervice began. Whence they are ſometimes called [*eirokerukes*,] the the holy cryers of the church.

Deacons had, by licence and authority from the biſhop, a power to preach, to reconcile penitents and grant them abſolution, and to repreſent their biſhops in

in general councils. Their office out of the church was to take care of the neceſſitous, ſuch as orphans, widows, priſoners, and all the poor and ſick who had any title to be maintained out of the public revenues of the church; to inquire into the morals and converſation of the people, and to make their report thereof to the biſhop. Whence, on account of the variety of buſineſs, it was uſual to have ſeveral deacons in the ſame church.

In the Romiſh church, it is the deacons office to incenſe the officiating prieſt or prelate; to lay the corporal on the altar; to receive the paten or cup from the ſubdeacon, and preſent them to the perſon officiating; to incenſe the choir; to receive the pax from the officiating prelate, and carry it to the ſubdeacon; and at the pontifical maſs, when the biſhop gives the bleſſing, to put the mitre on his head, and to take off the archbiſhop's pall, and lay it on the altar. In England, the form of ordaining deacons, declares that it is their office to aſſiſt the prieſt in the diſtribution of the holy communion; in which, agreeably to the practice of the ancient church, they are confined to the adminiſtering the wine to the communicants. A deacon, with us, is not capable of any eccleſiaſtical promotion, yet he may be a chaplain to a family, curate to a beneficed clergyman, or lecturer to a pariſh church. He may be ordained at twenty-three years of age, *anno currente*; but it is expreſsly provided, that the biſhop ſhall not ordain the ſame perſon a prieſt and deacon in the ſame day. Deacons according to St Paul, ſhould be chaſte, ſincere, and blameleſs; neither great drinkers, nor given to filthy lucre; they ſhould hold the myſtery of the faith in a pure conſcience, and ſhould be well approved before they are admitted to the miniſtry.

DEACONESS, *a female deacon*, an order of women, who had their diſtinct offices and ſervices in the primitive church. This office appears as ancient as the apoſtolical age; for St Paul calls Phebe a ſervant of the church of Cenchrea. The original word is [*diakonos*], anſwerable to the Latin word *miniſtra*. Tertullian calls them *viduæ*, widows, becauſe they were commonly choſen out of the widows of the church; and, for the ſame reaſon, Epiphanius, when the council of Laodicea, calls them [*preſbutidas*], elderly women, becauſe none but ſuch were ordinarily taken into this office. For, indeed, by ſome ancient laws, theſe four qualifications were required in every one that was to be admitted into this order. 1. That ſhe ſhould be a widow. 2. That ſhe ſhould be a widow that had born children. 3. A widow that was but once married. 4. One of a conſiderable age, forty, fifty, or ſixty years old. Though all theſe rules admitted of exceptions. Concerning their ordination, whether it was always performed by impoſition of hands, the learned are much divided in their ſentiments. Baronius and Valeſius think they were not, and make no other account of them than as mere lay-perſons. But the author of the conſtitutions, ſpeaking of their ordination, requires the biſhop to uſe impoſition of hands, with a form of prayer which is there recited. We are not, however, to imagine, that this ordination gave them any power to execute any part of the ſacerdotal office. They were only to perform ſome inferior ſervices of the church, and thoſe chiefly relating to the women for whoſe ſakes they were ordained. One part of their office was to aſſiſt the miniſter at the baptizing of women, to undreſs them for immerſion, and to dreſs them again, that the whole ceremony might be performed with all the decency becoming ſo ſacred an action. Another part of their office was to be private catechiſts to the women-catechumens who were preparing for baptiſm. They were likewiſe to viſit and attend women that were ſick and in diſtreſs; to miniſter to the martyrs and confeſſors in priſon; to attend the womens gate in the church; and, laſtly, to aſſign all women their places in the church, regulate their behaviour, and preſide over the reſt of the widows, whence in ſome canons they are ſtyled [*prokathemenai*] governeſſes. This order, which ſince the tenth or twelfth century has been wholly laid aſide, was not aboliſhed every where at once, but continued in the Greek church longer than in the Latin, and in ſome of the Latin churches longer than in others.

DEAD-MAN's HEAD, in geography, a cape or promontory near Tregony in Cornwall, between St Mawes and Fowey.

DEAD-MENS-EYES, in the ſea-language, a kind of blocks with many holes in them, but no ſheevers, whereby the ſhrowds are faſtened to the chains: the crow-feet reeve alſo through theſe holes; and, in ſome ſhips, the main-ſtays are ſet tight in them; but then they have only one hole, through which the lanyards are paſſed ſeveral times.

DEAD-NETTLE. See LAMIUM.

DEAD-RECKONING, in navigation, the calculation made of a ſhip's place by means of the compaſs and log; the firſt ſerving to point out the courſe ſhe ſails on, and the other the diſtance run. See NAVIGATION.

DEAD's PART, in Scots law, that proportion of the funds of a marriage, which, upon the diſſolution of it, goes to the executor of the deceaſed huſband or wife, as the defunct or dead's part. See SCOTS LAW, title 28.

DEAD-SEA, in geography, a lake of Judea, into which the river Jordan diſcharges itſelf; being about ſeventy miles long, and twenty broad.

DEAD-TOPS, a diſeaſe incident to young trees, and cured by cutting off the dead parts cloſe to the next good twig or ſhoot, and claying them over as in grafting.

DEAD-WATER, at ſea, the eddy-water juſt aſtern of a ſhip, ſo called, becauſe it does not paſs away ſo ſwift as the water running by her ſides does They ſay that a ſhip makes much dead-water, when ſhe has a great eddy following her ſtern.

DEADLY CARROT. See THAPSIA.

DEADLY NIGHTSHADE. See ATROPA.

DEADS, among miners, denotes the earth or other foſſile ſubſtances which incloſe the ore on every ſide. Hence, *breaking up the deads*, is the removing theſe ſubſtances for the conveniency of carrying on their work.

DEAFNESS,

DEAFNESS, the ſtate of a perſon who either wants the ſenſe of hearing, or has it greatly impaired. See DUMB.

DEAL, a thin kind of fir-planks, of great uſe in carpentry: they are formed by ſawing the trunk of a tree into a great many longitudinal diviſions, of more or leſs thickneſs, according to the purpoſes they are intended to ſerve.

Deals are rendered much harder, by throwing them into ſalt water as ſoon as they are ſawed, keeping them there three or four days, and afterwards drying them in the air or ſun; but neither this nor any other method yet known, will preſerve them from ſhrinking.

Deals called Burgendorp deals, the hundred containing ſix ſcore, pay on importation 3 l. 8 s. $8\frac{40}{100}$ d. and draw back 3 l. 3 s. the rate 12 l. Meabro deals, ſix ſcore, pay 1 l. 2 s. $10\frac{80}{100}$ d. and draw back 1 l. 1s. the rate 4 l. Norway deals, ſix ſcore, pay 1 l. 8 s. $7\frac{1}{2}$ d. and draw back 1 l. 6 s. 3 d. the rate 5 l. Spruce deals, ſix ſcore, pay 4 l. 5 s. $10\frac{1}{2}$ d. and draw back 3 l. 18 s. 9 d. the rate 15 l. Deals from Ruſſia, and all other countries not particularly rated, exceeding twenty foot in length, pay 4 l. 5 s. $10\frac{50}{100}$ d. and draw dack 3 l. 18 s. 9 d. the rate 15 l. Deals from Sweden, or any other country, of twenty feet in length or under, not otherwiſe rated, the 120, pay 1 l. 8 s. $7\frac{1}{2}$d. and draw back 1 l. 6 s. 3 d. the rate 5 l.

DEAL, in geography, a port-town of the county of Kent, between which and the Goodwin-ſands, the ſhipping uſually rides in the Downs, in going out or coming home: it is about ſixty-ſeven miles eaſtward of London: E. long. 1° 30′, and N. lat. 51° 16′.

DEAN, an eccleſiaſtical dignitary in cathedral and collegiate churches, and head of the chapter.

DEAN *and* CHAPTER, are the biſhop's council to aſſiſt him in the affairs of religion, and to aſſent to every grant which the biſhop ſhall make to bind his ſucceſſors. As a deanry is a ſpiritual dignity, a man cannot be a dean and prebendary of the ſame church.

DEAN *of guild*, in Scots law, a magiſtrate of a royal borough, who has the cognizance of mercantile cauſes, and the inſpection of buildings within borough. See SCOTS LAW, title 4.

DEATH is generally conſidered as the ſeparation of the ſoul and body; in which ſenſe it ſtands oppoſed to life, which conſiſts in the union thereof.

The law of DEATH-BED, in Scots law, the privilege which that law allows to an heir of reducing all deeds reſpecting the heretable eſtate of his predeceſſor, granted by him while on death-bed, in prejudice of the lawful heir. All deeds are liable to reduction *ex capite lecti*, that are granted by a perſon within ſixty days of his death, if he had then contracted the diſeaſe of which he died, and had not afterwards recovered, ſo as to have gone to kirk or market unſupported. See SCOTS LAW, title 27.

DEBENHAM, a market-town of Suffolk, about twenty miles eaſt of Bury: E. long. 1° 20′, and N. lat. 52° 20′.

DEBENTURE, a term of trade uſed at the cuſtom-houſe for a kind of certificate ſigned by the officers of the cuſtoms, which intitles a merchant exporting goods to the receipt of a bounty or draw-back. All merchandiſes that are deſigned to be taken on board for that voyage being entered and ſhipped, and the ſhip being regularly cleared out, and ſailed out of port on her intended voyage, debentures may be made out from the exporter's entries, in order to obtain the drawbacks, allowances, bounties, or premiums; which debentures for foreign goods are to be paid within one month after demand. And in making out theſe debentures, it muſt be obſerved, that every piece of vellum, parchment, or paper, containing any debenture for drawing back cuſtoms or duties, muſt, before writing, be ſtamped, and pay a duty of 8 d.

The forms of debentures vary, according to the merchandiſe exported. In the execution of debentures for tobacco, it muſt be particularly obſerved, 1. That debentures for the ſame quantity, may be made in one or more parchments. 2. That the exporter's oath muſt be printed, ſpecifying whether he acts for himſelf or by commiſſion. If exported to any other foreign ports than Ireland, the word *Ireland* muſt be added to the oath after Great Britain. 4. That as no tobacco may be conſumed on board ſhips of war in Europe, but what has paid full duties, and been manufactured in Great Britain, no drawback is to be allowed for tobacco exported in any man of war. 5. That the eight pounds *per* hogſhead of 350 pounds, or more, allowed for draught at importation, muſt not be deducted on exportation. 6. That debentures for tobacco exported to Ireland, muſt not be paid till a certificate be produced, teſtifying the landing thereof. 7. That no perſons may ſwear to the exportation, but ſuch as are permitted to ſwear to debentures for other goods. In debentures for all other foreign goods, no perſon may be admitted to ſwear to the exportation, but the true exporter, either as a proprietor, or who being employed by commiſſion, is concerned in the direction of the voyage. All kinds of debentures before delivered or paid to the exporters, are entered into a ſeparate book kept for that purpoſe by the collector and comptroller of the cuſtoms.

DEBITA *fundi*, in Scots Law. A debt is ſaid to be a *debitum fundi*, when it is recoverable either by a perſonal action againſt the debtor himſelf, or by a real action againſt his lands.

DEBITA *fructuum*, in Scots law. Funds are *debita fructuum* not *fundi*; ſo are not recoverable out of the lands themſelves, but out of the fruits of the lands out of which they are payable. See SCOTS LAW, title 17.

DEBILITY, among phyſicians, a relaxation of the ſolids, occaſioning oftentimes weakneſſes and faintings.

DEBRECHEN, a town of Upper Hungary, about ſeventy-ſeven miles eaſt of Buda: E. long. 21° 10′ N. lat. 47° 45′.

DEBRUIZED, in heraldry, a term peculiar to the Engliſh, by which is intimated the grievous reſtraint of any animal, debarred of its natural freedom, by any of the ordinaries being laid over it.

DEBT, in law, any thing due to another, whether it be

money,

money, goods, or ſervices; or the action brought for recovering the ſame.

DEBTOR, a perſon who owes any thing to another; in contradiſtinction to creditor, which is he to whom the debt is owing.

DEBTOR, in merchants accounts. See BOOK-KEEPING.

DECAGON, in geometry, a plane figure with ten ſides and ten angles.

DECALOGUE, the ten precepts or commandments delivered by God to Moſes, after engraving them on two tables of ſtone.

The Jews, by way of excellence, call theſe commandments the *ten words*, from whence they had afterwards the name of decalogue: but it is to be obſerved, that they joined the firſt and ſecond into one, and divided the laſt into two: they underſtand that againſt ſtealing, to relate to the ſtealing of men, or kidnapping; alledging, that the ſtealing one anothers goods or property, is forbidden in the laſt commandment.

The emperor Julian objected to the decalogue, that the precepts it contained (thoſe only excepted which concern the worſhip of falſe gods, and the obſervation of the ſabbath) were already ſo familiar to all nations, and ſo univerſally received, that they were unworthy, for that very reaſon, to be delivered, by ſo great a legiſlator, to ſo peculiar a people. The church of Rome has ſtruck the ſecond commandment quite out of the decalogue, and to make their number complete, hath ſplit the tenth into two. The reaſon of which may be eaſily conceived.

DECAN, a province of the Hither India, bounded by the province of Cambaya, or Guzurat, on the north; by Golconda and Berar, on the eaſt; by Viſapour, on the ſouth; and by the Indian ocean on the weſt.

DECANDRIA, in the Linnæan ſyſtem of botany. See BOTANY, the *Scheme*, p. 635. and Plate LIII. fig. 10.

DECANTATION, among chemiſts, *&c.* the gently pouring off a liquor from its fæces, by inclining the lip or canthus of the veſſel; whence the name.

DECANUS, in Roman antiquity, an officer who preſided over other ten officers, and was head of the contuberinum, or ſerjeant of a file of ſoldiers.

DECAPROTI, *decemprimi*, in Roman antiquity, officers for gathering the tributes and taxes.

The decaproti were alſo obliged to pay for the dead, or to anſwer to the emperor for the quota parts of ſuch as died, out of their own eſtates.

DECASTYLE, in the ancient architecture, a building with an ordnance of ten columns in front, as the temple of Jupiter Olympius was.

DECEIT, in law, a ſubtle trick, or device, to which may be added all manner of craft and collufion, or underhand practice, uſed to defraud another, by any means whatever.

DECEMBER, the laſt month of the year, conſiſting of thirty-one days, and ſo called as being the tenth month in the Roman year, which commenced with March.

DECEMPEDA, in antiquity, a rule or rod divided into ten feet, each of which was ſubdivided into inches, and thoſe into digits, uſed in meaſuring of land, and, by architects, in giving the proper dimenſions and proportions to the parts of their buildings.

DECEMVIRI, in Roman antiquity, ten magiſtrates choſen annually at Rome, to govern the commonwealth inſtead of conſuls, with an abſolute power to draw up and make laws for the people.

One of the decemviri had all the enſigns and honours of the function, and the reſt had the like in their turn, during the year of their decemvirate. In them was veſted all the legiſlative authority ever enjoyed by the kings, or, after them, by the conſuls. It was the decemviri drew up the laws of the Twelve Tables, thence called *leges decemvirales*, which were the whole of the Roman law, for a conſiderable time.

DECENNALIA, ancient Roman feſtivals celebrated by the emperors, every tenth year of their reign, with ſacrifices, games, and largeſſes for the people. The emperor Auguſtus firſt inſtituted theſe ſolemnities, in which he was imitated by his ſucceſſors.

DECIDUOUS, an appellation chiefly uſed in reſpect of plants: thus, the calix or cup of a flower is ſaid to be deciduous, when it falls along with the flower-petals; and, on the contrary, it is called permanent, when it remains after they are fallen. Again, deciduous leaves are thoſe which fall in autumn, in contradiſtinction to thoſe of the ever-greens, which remain all the winter.

DECIL, in aſtronomy, an aſpect or poſition of two planets, when they are diſtant from each other a tenth part of the zodiac.

DECIMAL ARITHMETIC, the art of computing by decimal fractions.

DECIMAL FRACTION, in arithmetic. See Vol. I. p. 395.

DECIMATION, a puniſhment inflicted by the Romans, on ſuch ſoldiers as quitted their poſt, or behaved themſelves cowardly in the field. The names of all the guilty were put into an urn or helmet, and as many were drawn out as made the tenth part of the whole number, and theſe were put to the ſword, and the others ſaved.

DECIPHERING, the art of finding the alphabet of a cypher. See CYPHER.

Every language has, beſides the form of its characters, ſomething peculiar in the place, order, combination, frequency, and number of the letters; to all which particular regard is to be had in deciphering. In all languages, however, the following rules ought to be obſerved: 1. One word is to be compared with another, that their reſemblance and difference may be known. 2. No word can be without a vowel. 3. A word of one letter is always a vowel, or a conſonant with an apoſtrophe. 4. The vowels recur much more frequently than the conſonants. 5. Double vowels may be at the beginning of a word, but not double conſonants. 6. Double characters at the beginning of a word are always vowels. 7. Short words of two or three letters have two or three, or one or two conſonants. 8. The vowels are therefore moſt eaſily learned from the ſhort words which are to be firſt conſidered by the decipherer. 9. If double characters are preceded by a ſingle letter, the letter is a vowel. 10. In languages abounding with diphthongs one

one vowel is often joined with another. 11. The letter that precedes or follows double consonants is, if a consonant, always one of the liquids, *l*, *m*, *n*, *r*, 12. If two different characters occur, of which the latter is often conjoined with various letters, and the former is never found either by itself, or followed by any other letter, those two are *qu*. 13. These letters *qu* are always followed by a vowel. 14. One vowel recurs more frequently than another, as do the consonants, according to the language, *&c.*

DECISE, a town of the Orleanois, in France, situated on the river Loire, about fifteen miles south-east of Nevers: E. lon. 3° 32′, and N. lat. 46° 40′

DECK *of a ship* is a planked floor from stem to stern, upon which the guns lie, and where the men walk to and fro.

Great ships have three decks, first, second, and third, beginning to count from the lowermost.

Half deck reaches from the main-mast to the stem of the ship.

Quarter-deck is that aloft the steerage, reaching to the round house.

Flush-deck is that which lies even in a right-line fore and aft, from stem to stern. A rope-deck is that made of cordages, interwoven and stretched over a vessel, through which it is easy to annoy an enemy who comes to board her. They are little used but by small vessels, to defend them against privateers.

DECKENDORF, a town of Bavaria, in Germany, situated on the Danube, about thirty-seven miles south-east of Ratisbon: E. long. 13°, and N. lat. 48° 45′.

DECLAMATION, a speech made in public, in the tone and manner of an oration, uniting the expression of action to the propriety of pronunciation, in order to give the sentiment its full impression upon the mind.

DECLARATORY *action*, in Scots law, is that by which a pursuer only craves, that some right or privilege shall be declared to belong to him, without demanding the payment or performance of any thing from the defender. See SCOTS LAW, title, 30.

DECLENSION, in grammar, an inflexion of nouns according to their divers cases, as nominative, genitive, dative, *&c.* It is a different thing in the modern languages, which have not properly any cases, from what it is in the ancient Greek and Latin. With respect to languages, when the nouns admit of changes, either in the beginning, the middle, or ending; declension is properly the expression of all those changes in a certain order, and by certain degrees called cases. With regard to languages, where the nouns do not admit of changes in the same number, declension is the expression of the different states a noun is in, and the different relations it has; which difference of relations is marked by particles, and called articles, as *a*, *the*, *of*, *to*, *from*, *by*, &c.

DECLINATION, in astronomy, the distance of any celestial object from the equinoctial, either northward or southward. It is either true or apparent, according as the real or apparent place of the object is considered. See ASTRONOMY.

DECLINATION *of a wall or plane for dials*. See DIALLING.

DECLINATOR, or DECLINATORY, an instrument contrived for taking the declinations, inclinations, and reclinations of planes.

DECLINATURE *of judges*, in Scots law, declining the jurisdiction of a judge, or refusing to acquiesce in his judgment from any legal obligation to the judge himself, the incompetency of his jurisdiction to the nature of the action, or upon the privilege of the objector or decliner. See SCOTS LAW, title 2.

DECLIVITY denotes the reverse of acclivity. See ACCLIVITY.

DECOCTION, in pharmacy, the boiling simples, or other drugs, in order to extract their virtues for some medicinal purpose. The general subjects of decoction are animals and vegetables, and sometimes minerals, as antimony and quicksilver. The liquors which serve to boil them, are water, wine, vinegar, milk, and whey.

DECOMPOSITION, in chemistry, the reduction of a body into its principles or component parts. See CHEMISTRY.

DECORATION, in architecture, is used for whatever adorns a building, either withoutside or within.

DECORUM, in architecture, is the suitableness of a building, and the several parts and ornaments thereof, to the station and occasion.

DECOUPLE′, in heraldry, the same as uncoupled: thus a chevron decouplé, is a chevron wanting so much of it towards the point, that the two ends stand at a distance from one another, being parted and uncoupled.

DECOURS, in heraldry. See DECREMENT.

DECOY, a place made for catching wild-fowl. Hence,

DECOY-DUCK is a duck that flies abroad, and lights into company with wild ones, which by her allurements she draws into the decoy.

DECREE, an order made by a superior power, for the regulation of an inferior.

DECREE, in the civil law, is a determination that the emperor pronounces upon hearing a particular cause between plaintiff and defendant.

DECREE, or DECREET, in Scots law, the decisive sentence or judgment of a court of law.

DECREET-ARBITRAL, in Scots law, the sentence or judgment of one to whom parties voluntarily submit the determination of any question betwixt them. See SCOTS LAW, title 32.

DECREMENT, in heraldry, signifies the wane of the moon from the full to the new. The moon in this state is called moon decrescent, or in decours; and when borne in coat-armour, faces to the left side of the escutcheon, as she does to the right side when in the increment. See CRESCENT.

DECREPITATION, in chemistry, the act of calcining salt over the fire, till it cease to crackle. See CHEMISTRY.

It is alſo applied to the crackling of the ſalts during the operation.

DECRETAL, in the canon-law, a letter of a pope, determining ſome point or queſtion in the eccleſiaſtical law. The decretals compoſe the ſecond part of canon law. The firſt genuine one acknowledged by all the learned as ſuch, is the letter of pope Siricius, written in the year 385, to Himerus biſhop of Tarragona in Spain, concerning ſome diſorders which had crept into the churches of Spain.

DECUMANI DENTES, in heraldry. See DANCETTE.

DECUPLE PROPORTION, that of ten to one.

DECURIO, in Roman antiquity, a commander of ten men in the army, or the chief of a decury.

DECURRENT LEAF. See BOTANY, p. 641.

DECURY, ten perſons ranged under one chief, or leader, called the decurio.

The Roman cavalry was divided into decuries, which were ſubdiviſions of a century, each century containing ten decuries.

DECUSSATION, a term in geometry, optics, and anatomy, ſignifying the croſſing of any two lines, rays, or nerves, when they meet in a point, and then go on ſeparately from one another.

DECUSSORIUM, a ſurgeon's inſtrument, which, by preſſing gently on the dura mater, cauſes an evacuation of the pus collected between the cranium and the before mentioned membrane, through the perforation made by the trepan.

DEDDINGTON, a market town of Oxfordſhire, about fifteen miles north of Oxford: W. long. 1° 20′, and N. lat. 51° 55′.

DEDHAM, a market-town in Eſſex, about thirty-five miles north-eaſt of Chelmsford: E. long. 1° 10′, and N. lat. 52° 5′.

DEDICATION, a ſolemn devoting or ſetting apart any perſon or thing to the ſervice of God and the purpoſes of religion.

Feaſt of DEDICATION, an anniverſary feſtival among the Jews, in memory of Judas Maccabæus, who repaired and dedicated anew the temple and altar, which had been plundered and profaned by Antiochus Epiphanes. It was obſerved on the twenty-fifth of Ciſleu, and continued eight days.

DEE, the name of ſeveral rivers, as that on which Cheſter ſtands, that whereon Aberdeen ſtands, *&c.*

DEED, in Scots laws, any ſettlement, diſpoſition, contract, or other legal writing.

DEED, an inſtrument written on paper or parchment, comprehending ſome contract, bargain or agreement between the parties thereto, in relation to the matter therein contained.

DEEMSTERS, or DEMSTERS. All controverſies in the Iſle of Man are decided without proceſs, writings, or any charges, by certain judges, choſen yearly from among themſelves, called deemſters; there being two of them for each diviſion of the iſland: they ſit judges in all courts, either for life or property; and with the advice of twenty-four keys, declare what is law, in uncommon emergencies.

DEEPING, a market-town of Lincolnſhire, about thirty-five miles ſouth of Lincoln: W. long. 20°, and N. lat. 52° 35′.

DEER, in zoology. See CERVUS.

DEFAMATION, the ſpeaking ſlanderous words of another; for which the ſlanderer is puniſhable, according to the nature of his offence, either by action upon the caſe at common law, or by ſtatute, or in the eccleſiaſtical court.

DEFAULT, in law, is generally taken for non-appearance in court, at a day aſſigned; but imports any omiſſion of that which we ought to do, for which judgment may be given againſt the defaulter.

DEFEASANCE. See DEFEISANCE.

DEFECATE, or DEFÆCATE, in chemiſtry, a term applied to a body freed and purged from fæces and impurities,

DEFEISANCE, in law, a condition relating to ſome certain deed, which being performed, the deed is defeated and rendered void, as if it had never been made.

DEFENCE, in fortification, all ſorts of works that cover and defend the oppoſite poſts, as flanks, caſements, parapets, and fauſſebrays. See FORTIFICATION.

Line of DEFENCE, a ſuppoſed line drawn from the angle of the curtin, or from any other part in the curtin, to the flanked angle of the oppoſite baſtion. See FORTIFICATION.

DEFENDER *of the faith*, a peculiar title, belonging to the king of Great Britain, as Catholic does to the king of Spain, Chriſtian to the king of France, *&c.*

This title was firſt given by pope Leo X. to king Henry VIII. for writing againſt Luther.

DEFERENT, in anatomy, a term applied to certain veſſels in the body, that ſerve for the conveyance of humours from one part to another. See ANATOMY.

DEFERENT, in the Ptolemaic aſtronomy, a circle invented to account for the eccentricity, perigee, and apogee of the planets.

DEFERENTIA VASA. See Vol. I. p. 273.

DEFILE, in fortification, a ſtrait narrow paſſage, thro' which a company of horſe or foot can paſs only in file, by making a ſmall front.

DEFINITE, in grammar, is applied to an article that has a preciſe determinate ſignification; ſuch as the article *the* in Engliſh, *le* and *la* in French, *&c.* which fix and aſcertain the noun they belong to, to ſome particular, as *the king*, *le roy*; whereas in the quality *of king*, *de roy*, the articles *of* and *de* mark nothing preciſe, and are therefore indefinite.

DEFINITION, an idea of any ſcience, ſubject, *&c.* conveyed in a few words.

DEFINITIVE, a term applied to whatever terminates a proceſs, queſtion, *&c.* in oppoſition to proviſional and interlocutory.

DEFLAGRATION, in chemiſtry, the kindling or ſetting fire to a ſalt or mineral, *&c.* either alone, or mixed for that purpoſe with a ſulphureous one in order to purify it. See CHEMISTRY.

DEFLECTION *of the rays of light*. See OPTICS.

DEFLUXION, in medicine, the falling of humours from a ſuperior to an inferior part of the body.

DEFORCEMENT,

DEFORCEMENT, in Scots law, the oppoſing or reſiſting the officers of the law in the execution of their office. See Scots Law, titles 25 and 33.

DEFORMITY, the want of that uniformity neceſſary to conſtitute the beauty of an object. See Beauty.

DEGENERATION, or Degenerating, in general, denotes the growing worſe, or loſing ſome valuable qualities whereof a thing was formerly poſſeſſed.

DEGLUTITION, in medicine, the act of ſwallowing the food, performed by means of the tongue driving the aliment into the œſophagus, which, by the contraction of the ſphincter, protrudes the contents downwards.

DEGRADATION, the act of depriving a perſon for ever of a dignity or degree of honour, and taking away the title, badge, and privileges of it.

Degradation, in painting, expreſſes the leſſening the appearance of diſtant objects in a landſkip, in the ſame manner as they would appear to an eye placed at that diſtance from them.

DEGRADED CROSS, in heraldry, a croſs divided into ſteps at each end, diminiſhing as they aſcend towards the centre, called by the French *perronnée*. See Plate LXVIII. fig. 6.

DEGREE, in geometry, a diviſion of a circle, including a three hundred and ſixtieth part of its circumference. See Astronomy, and Geography.

Degree *of latitude*. See Geography.

Degree *of longitude*. See Geography.

Degrees, in muſic, are the little intervals whereof the concords or harmonical intervals are compoſed.

Degree, in univerſities, denotes a quality conferred on the ſtudents or members thereof as a teſtimony of their proficiency in the arts or ſciences, and intitling them to certain privileges.

DEJECTION, in medicine, the act of ejecting or evacuating the excrements. It is alſo applied to the excrements themſelves thus evacuated, in which ſenſe it is of the ſame import with ſtool.

DEIFICATION, in antiquity. See Apotheosis.

DEISM, the ſyſtem of religion acknowledged by the deiſts.

DEISTS, in the modern ſenſe of the word, are thoſe perſons in Chriſtian countries, who, acknowledging all the obligations and duties of natural religion, diſbelieve the Chriſtian ſcheme, or revealed religion. They are ſo called from their belief in God alone, in oppoſition to Chriſtians. The learned Dr Clarke taking the denomination in the moſt extenſive ſignification, diſtinguiſhes deiſts into four ſorts. 1. Such as pretend to believe the exiſtence of an eternal, infinite, independent, intelligent Being; and who teach, that this ſupreme Being made the world, though they fancy he does not at all concern himſelf in the management of it. 2. Thoſe who believe not only the being, but alſo the providence of God with reſpect to the natural world; but who, not allowing any difference between moral good and evil, deny that God takes any notice of the morally good or evil actions of men; theſe things depending, as they imagine, on the arbitrary conſtitutions of human laws. 3. Thoſe who having right apprehenſions concerning the natural attributes of God, and his all governing providence, and ſome notion of his moral perfections alſo; yet, being prejudiced againſt the notion of the immortality of the human ſoul, believe that men periſh entirely at death, and that one generation ſhall perpetually ſucceed another, without any future reſtoration or renovation of things. 4. Such as believe the exiſtence of a ſupreme Being, together with his providence in the government of the world, as alſo the obligations of natural religion; but ſo far only as theſe things are diſcoverable by the light of nature alone, without believing any divine revelation. Theſe laſt are the only true deiſts; but as the principles of theſe men would naturally lead them to embrace the Chriſtian revelation, the learned author concludes there is now no conſiſtent ſcheme of deiſm in the world.

DEITY, a term frequently uſed in a ſynonymous ſenſe with God.

DELEGATES, commiſſioners appointed by the king under the great ſeal to hear and determine appeals from the eccleſiaſtical court.

DELEGATION, a commiſſion extraordinary given by a judge to take cognizance of and determine ſome cauſe which ordinarily does not come before him.

DELEGATION, in Scots law, a method of extinguiſhing obligations by the creditor's diſcharging his former debitor upon another becoming bound in his place.

DELETERIOUS, an appellation given to things of a deſtructive or poiſonous nature. See Poison.

DELF, in heraldry, is by ſome ſuppoſed to repreſent a ſquare rod or turf, and to be ſo called from delving, or digging. A delf tenne is due to him that revokes his own challenge, or any way goes from his word; and to ſuch this is given as an abatement to the honour of their arms, and is always placed in the middle of the eſcutcheon. However, if two or more delfs are found in an eſcutcheon, they are not then to be looked upon as ſigns of an abatement, but of honour. Alſo, if it be of metal, or charged upon, it then becomes a charge of perfect bearing.

DELFT, a city of the United Netherlands, in the province of Holland, eight miles north-eaſt of Rotterdam, and thirty ſouth-weſt of Amſterdam: E. long. 4° 5′, and N. lat. 52° 6′.

DELIA, in antiquity, feaſts celebrated by the Athenians in honour of Apollo, ſurnamed Delius.

Delia was alſo a quinquennial feſtival in the iſland of Delos, inſtituted by Theſeus at his return from Crete, in honour of Venus, whoſe ſtatue, given him by Ariadne, he erected on that place, having by her aſſiſtance met with ſucceſs in his expedition.

DELIBAMENTA, in antiquity, a libation to the infernal gods, always offered by pouring downwards. See Libation.

Jus DELIBERANDI, in Scots law, an apparent heir is allowed a year after his predeceſſor's death, called *annus deliberandi*, to deliberate whether he will enter and repreſent him or not, during which time he cannot be purſued for the debts of his predeceſſor. See Scots Law, title 27.

DELIBERATIVE,

DELIBERATIVE, an appellation given to a kind or branch of rhetoric, employed in proving a thing, or convincing an aſſembly thereof, in order to perſuade them to put it in execution.

To have a deliberative voice in the aſſembly, is when a perſon has a right to give his advice and his vote therein. In councils, the biſhops have deliberative voices; thoſe beneath them have only conſultative voices.

DELICT, in Scots law, ſignifies ſuch ſmall offences or breaches of the peace as are puniſhable only by fine or ſhort impriſonment. See SCOTS LAW, title 33.

DELIMA, in botany, a genus of the polyandria monogynia claſs. It has no corolla; the calix conſiſts of five leaves; and the berry contains two ſeeds. There is but one ſpecies, a native of Ceylon.

DELINEATION. See DESIGNING.

DELINQUENT, a guilty perſon, or one who has committed ſome fault or offence, for which he is puniſhable.

DELIQUIUM, or ANIMI DELIQUIUM. See LIPOTHYMIA.

DELIQUIUM, in chemiſtry, ſignifies the ſolution of any body, when expoſed to a cool and damp place, by the humidity it attracts from the air.

DELIRIUM, in medicine, the production of ideas not anſwerable to external cauſes, from an internal indiſpoſition of the brain. See MEDICINE.

DELIVERY, or CHILD-BIRTH. See MIDWIFERY.

DELLY, the capital of a province of the ſame name, and at preſent of all the Hither India: E. long. 79°, and N. lat. 28.

DELOS, the principal of the Cyclades-iſlands, in the Archipelago: E. long. 25° 50′, and N. lat. 37° 26′.

DELPHINIUM, or LARK'S SPUR, in botany, a genus of the polyandria trigynia claſs. It has no calix; the corolla conſiſts of five petals; and the nectarium is bifid, and horned behind. There are ſeven ſpecies, only one of which, *viz.* the conſolida, or wild lark's-ſpur, is a native of Britain.

DELPHINUS, or DOLPHIN, in ichthyology, a genus belonging to the order of cete; the characters of which are theſe: they have teeth in each jaw; and a fiſtula or pipe in the head. There are three ſpecies, *viz.* 1. The phocœna, with a conical body, a broad back, and an obtuſe ſnout. The colour of the back is a blackiſh blue, and the belly is white. The fiſtula, or pipe, through which they breathe and ſpout up the water, is betwixt the eyes: it has forty-ſix teeth in each jaw: it is found in the Baltic and different parts of the European ocean. The ſkin is ſmooth and ſoft. The external orifice of the fiſtula reſembles the letter C: it has two ſtrong pectoral fins, and a cartilaginous fin on the back. The tail is bifid. The penis of the male is not covered with a præputium, it lies concealed within the body, but is eaſily protruded when occaſion requires. In the female, the cervix of the vulva is about nine inches long, and ſituate betwixt the navel and anus. They copulate in the ſummer; bring forth one at a birth; they nouriſh their young with milk; and they live about thirty years. They live ſeveral days out of the water, provided they be not wounded. See Plate LXVIII. fig. 2. It is about four feet long, and two and a half thick. 2. The delphus, or dolphin of the ancients, is of an oblong cylindrical ſhape, and the ſnout is ſharp and tapering; the teeth are ſubulated. It likewiſe frequents the European ocean. 3. The orca, or leſſer whale of Ray, has the upper part of the ſnout waved, and broad ſerrated teeth. The inferior jaw is much longer than the ſuperior one.

DELPHINUS, in aſtronomy, a conſtellation of the northern hemiſphere. See ASTRONOMY.

DELSBERG, or DESBERG, a town of Switzerland, about ſeventeen miles ſouth-weſt of Baſil.

DELTOIDES, in anatomy. See Vol. I. p. 195.

DELUGE, an inundation or overflowing of the earth, either wholly or in part, by water.

We have ſeveral deluges recorded in hiſtory, as that of Ogyges, which overflowed almoſt all Attica; and that of Deucalion, which drowned all Theſſaly in Greece: but the moſt memorable was that called the univerſal deluge, or Noah's flood, which overflowed and deſtroyed the whole earth, and out of which only Noah, and thoſe with him in the ark, eſcaped. See ARK.

Many attempts have been made to account for the deluge by means of natural cauſes: but theſe attempts have only tended to diſcredit philoſophy, and to render their authors ridiculous.

DEMAIN, or DEMESNE, in its common acceptation, is uſed for the lands round a manor-houſe, occupied by the lord.

DEMAIN, or DEMESNE, in law, is commonly underſtood to be the lord's chief manor-place, with the lands thereto belonging, which he and his anceſtors have time out of mind kept in their own manual occupation.

DEMEMBRE', in heraldry, is ſaid of diſmembered animals, or thoſe with their limbs cut off.

DEMEMBRATION, in Scots law, ſignifies either the crime of depriving another of any member of his body, or the puniſhment of a crime by cutting off any member of the criminal's body. See SCOTS LAW, title 33.

DEMER, a river in the Auſtrian Netherlands, on which the city of Mechlin ſtands.

DEMESNE. See DEMAIN.

DEMETRIA, a feſtival celebrated by the Greeks in honour of Ceres, wherein it was uſual for the devotees to laſh themſelves.

DEMETRIOWITZ, a city of the dutchy of Smolenſko, in the Ruſſian empire, ſituated upon the river Ugra, in 37° E. long. and 52° 30′ N. lat.

DEMI, a word uſed in compoſition with other words to ſignify half.

DEMI-CULVERIN, a piece of ordnance uſually $4\frac{1}{2}$ inches bore, 2700 pound weight, ten feet long, and carrying point blank 175 paces.

DEMI-CULVERIN *of the leaſt ſize*, is $4\frac{1}{4}$ inches bore,


Plate LXVIII.
Fig. 1. DASYPUS or ARMADILLO
6.
DEGRADED
7.
DISPLAYED
Fig 2 DELPHINIS or DOLPHIN
Fig. 5.
DRACO or FLYING DRAGON
8.
DOUBLE FICHE
Fig. 3.
DIDELPHIS or OPOSSUM
Fig. 4. DIODON
A. Bell Sct

10 feet long, and 2000 pounds weight. It carries a ball of 4 inches diameter, and of 9 pounds weight, and its level range is 174 paces.

DEMI-CULVERIN *of the largeſt ſort*, is $4\frac{3}{4}$ inches bore, $10\frac{1}{2}$ feet long, and weighs 3000 pounds weight. It carries a ball $4\frac{1}{2}$ inches diameter, weighing 12 pounds 11 ounces, point blank 178 paces.

DEMI-GORGE, in fortification, is that part of the polygon which remains after the flank is raiſed, and goes from the curtin to the angle of the polygon. It is half of the vacant ſpace or entrance into a baſtion.

DEMI-QUAVER, a note in muſic, two of which are equal to a quaver.

DEMI-SEMI-QUAVER, in muſic, the ſhorteſt note, two of them being equal to a ſemi-quaver.

DEMOCRACY, the ſame with a popular government, wherein the ſupreme power is lodged in the hands of the people: ſuch were Rome and Athens of old; but as to our modern republics, Baſil only excepted, their government comes nearer to ariſtocracy than democracy.

DEMONSTRABLE, a term uſed in the ſchools, to ſignify that a thing may be clearly proved. Thus it is demonſtrable that the three angles of a triangle are equal to two right ones.

DEMONSTRATION, in logic, a ſeries of ſyllogiſms, all whoſe premiſes are either definitions, ſelf-evident truths, or propoſitions already eſtabliſhed. See LOGIC.

DEMONSTRATIVE, in grammar, a term given to ſuch pronouns as ſerve to indicate or point out a thing. Of this number are *hic*, *hæc*, *hoc*, among the Latins; and *this*, *that*, *theſe*, *thoſe*, in Engliſh.

DEMULCENTS, among phyſicians, medicines good againſt acrimonious humours. Such are the roots of marſh-mallows, of white lilies, of liquorice, and of viper graſs, the five emollient herbs, *&c.*

DEMURRAGE, in commerce, an allowance made to the maſter of a ſhip by the merchants, for ſtaying in a port longer than the time firſt appointed for his departure.

DEMURRER, in law, a ſtop put to any action upon ſome point of difficulty which muſt be determined by the court, before any further proceedings can be had in the ſuit.

DEN, a ſyllable which added to the names of places ſhews them to be ſituated in valleys or near woods, as Tenterden.

DENARIUS, in Roman antiquity, the chief ſilver coin among the Romans, worth in our money about ſevenpence three farthings. As a weight, it was the ſeventh part of a Roman ounce.

DENARIUS is alſo uſed in our law books for an Engliſh penny.

DENBY, the capital of Denbyſhire, in North Wales: W. long. 3° 30′, and N. lat. 53° 15′. It ſends only one member to parliament.

DENDERMOND, a fortified town of Flanders, ſituated at the confluence of the rivers Scheld and Dender, twelve miles eaſt of Ghent: E. long. 3° 50′, and N. lat. 51° 10′.

DENDRACHATES, in natural hiſtory, the name uſed by the ancients for an extremely elegant and beautiful ſpecies of agate, the ground of which is whitiſh, variegated with veins of a brighter white. Theſe veins are beautifully diſpoſed in a number of various figures, but generally in many concentric irregular circles, drawn round one or more points. It is common alſo, in various parts of this ſtone, to find very beautiful delineations of trees, moſſes, ſea-plants, and the like, ſo elegantly expreſſed, that many have erroneouſly taken them for real plants included in the ſubſtance of the ſtone; whence the name dendrachates.

DENDRANATOMY, a term uſed by ſome for a deſcription of the various parts of trees, as root, trunk, branch, bark, wood, pith, flower, fruit, *&c.* See AGRICULTURE, Part I.

DENDROPHORIA, in antiquity, the carrying of boughs or branches of trees, a religious ceremony ſo called, becauſe certain prieſts called from thence dendrophori, tree-bearers, marched in proceſſion, carrying the branches of trees in their hands in honour of ſome god, as Bacchus, Cebele, Sylvanus, *&c.* The college of the dendrophori is often mentioned in ancient marbles; and we frequently ſee in baſſo relievos the bacchanals repreſented as men carrying little ſhrubs or branches of trees.

DENEB, an Arabic term ſignifying tail, uſed by aſtronomers to denote ſeveral fixed ſtars. Thus deneb eleet, ſignifies the bright ſtar in the lion's tail. Deneb adigege, that in the ſwan's tail, *&c.*

DENIER, a ſmall French copper-coin, of which twelve make a ſol.

There were two kinds of deniers, the one tournois, the other pariſis, whereof the latter was worth a fourth part more than the former.

DENIZEN, in law, an alien made a ſubject by the king's letters patent, otherwiſe called donaiſon, becauſe his legitimation proceeds *ex donatione regis*, from the king's gift.

DENMARK, a kingdom ſituated between 8° and 13° of E. long. and between 54° and 58° of N. lat.: it comprehends the peninſula of Jutland, and the iſlands of Zeland, Funen, *&c.* To the king of Denmark likewiſe belong Norway, Iceland, and the dutchy of Holſtein.

DENNIS, or ST DENNIS, a town of France four miles north of Paris, where the kings of France are interred.

DENOMINATOR, in arithmetic, a term uſed in ſpeaking of fractions. See ARITHMETICK, p. 387.

DENS CANIS, or DOG'S-TOOTH, in botany. See ERYTHRONIUM.

DENS LEONIS. See LEONTODON.

DENSITY *of bodies*, is that property directly oppoſite to rarity, whereby they contain ſuch a quantity of matter under ſuch a bulk.

Accordingly, a body is ſaid to have double or triple the denſity of another body, when their bulk being equal, the quantity of matter is in the one double or triple the quantity of matter in the other.

DENSITY *of the air*. See PNEUMATICS.

DENTALIUM, in natural hiſtory, a ſhell-fiſh belonging to the order of vermes teſtacea. The ſhell conſiſts of one tubulous ſtrait valve, open at both ends. There are eight ſpecies, diſtinguiſhed by the angles, ſtriæ, *&c.* of their ſhells.

DENTARIA, or TOOTHWORT, in botany, a genus of the tetradynamia ſiliquoſa claſs. The ſiliqua or pod burſts open by elaſtic valves; the ſtigma is emarginated; and the calix is connivent. There are three ſpecies, only one of which, *viz.* the bulbifera, or coralwort, is a native of Britain.

DENTATED LEAF. See botany, p. 640.

DENTEX, in ichthyology. See SPARUS.

DENTILES, or DENTILS, in architecture, an ornament in corniches bearing ſome reſemblance to teeth, particularly uſed in the Ionic and Corinthian orders. See ARCHITECTURE, p. 352.

DENTIFRICE, in medicine, a remedy for rubbing the teeth, and purging them from ſordes; and for cleanſing and abſterging the gums, when replete with humours. There are dentifrices of various kinds and forms; ſome in form of a powder compoſed of corals, pumice-ſtone, ſalt, allum, egg-ſhells, crabs-claws, hartſhorn, *&c.* others in form of an electuary, conſiſting of the ſame powders mixt up with honey; others are in form of a liquor drawn by diſtillations from drying herbs, and aſtringent medicines, *&c.*

DENTILLARIA. See PLUMBAGO.

DENTISCALPRA, in ſurgery, an inſtrument for ſcouring yellow, livid, or black teeth; to which being applied, near the gums, it ſcrapes off the foul morbid cruſt.

DENTITION, the breeding or cutting the teeth in children. See MEDICINE.

DENUNCIATION, a ſolemn publication or promulgation of any thing.

All veſſels of enemies are lawful prizes, after denunciation or proclamation of war. The deſign of the denunciation of excommunicated perſons, is that the ſentence may be the more fully executed by the perſon's being more known.

DENUNCIATION at the horn, in Scots law, is that form by which a debtor, after the expiry of a charge to make payment upon letters of horning, is denounced rebel to the king for diſobedience. No caption for apprehending and impriſoning the debtor can be obtained upon an expired charge of horning till he is firſt denounced rebel, and the horning with the executions of charge and denunciation regiſtered. As to the other legal effects of denunciation, ſee SCOTS LAW, title 12.

DEOBSTRUENTS, in pharmacy, ſuch medicines as open obſtructions. See DETERGENT.

DEODAND, in our cuſtoms, implies a thing devoted or conſecrated to God, for the pacification of his wrath, in caſe of any misfortune; as a perſon's coming to a violent end, without the fault of any reaſonable creature; as if a horſe ſhould ſtrike his keeper, and ſo kill him. In this caſe, the horſe is to be a deodand; that is, he is to be ſold, and the price diſtributed to the poor, as an expiation of that dreadful event.

DEPONENT, in Latin grammar, a term applied to verbs which have active ſignifications, but paſſive terminations or conjugations, and want one of their participles paſſive.

DEPONENT, in the law of Scotland, a perſon who makes a depoſition. See DEPOSITION.

DEPOPULATION, the act of diminiſhing the number of people in any country, whether by war or bad politics.

DEPORTATION, a ſort of baniſhment uſed by the Romans, whereby ſome iſland or other place was allotted to a criminal for the place of his abode, with a prohibition not to ſtir out of the ſame on pain of death.

DEPOSIT, among civilians, ſomething that is committed to the cuſtody of a perſon, to be kept without any reward, and to be returned again on demand.

DEPOSITARY, in law, a perſon intruſted as keeper or guardian of a depoſit.

DEPOSITATION, in Scots law, is a contract by which one commits the cuſtody or poſſeſſion of any thing to another, to be kept for behoof of the owner, and returned on demand, or at any period ſpecified in the contract. The owner is called the depoſitor, and the perſon to whoſe cuſtody the thing is committed the depoſitary. See SCOTS LAW, title 20.

DEPOSITION, in law, the teſtimony given in court by a witneſs upon oath.

DEPRECATION, in rhetoric, a figure whereby the orator invokes the aid and aſſiſtance of ſome one; or prays for ſome great evil or puniſhment to befal him who ſpeaks falſely, either himſelf or his adverſary.

DEPRECATORY, or DEPRECATIVE, in theology, a term applied to the manner of performing ſome ceremonies in the form of prayer.

The form of abſolution is deprecative in the Greek church, being conceived in theſe terms, *May God abſolve you:* whereas it is in the declarative form in the Latin church, and in ſome of the reformed churches, *I abſolve you.*

DEPRESSION *of the pole.* See ASTRONOMY, and GEOGRAPHY.

DEPRESSOR, or DEPRIMENS, in anatomy, a name applied to ſeveral muſcles, becauſe they depreſs the parts they are faſtened to.

DEPRIVATION, in the canon-law, the depoſing a biſhop, parſon, vicar, *&c.* from his office and preferment.

DEPTFORD, a town three miles eaſt of London, on the ſouthern banks of the Thames; chiefly conſiderable for its fine docks for building ſhips, and the king's yard.

DEPURATION. See CLARIFICATION.

DEPURATORY FEVER, a name given by Sydenham to a fever which prevailed much in the years 1661, 1662, 1663, and 1664. He called it depuratory, becauſe he obſerved, that nature regulated all the ſymptoms in ſuch a manner, as to fit the febrile matter, prepared by proper concoction, for expulſion in a certain time, either by a copious ſweat, or a freer perſpiration.

DEPUTATION, a miſſion of ſelect perſons out of a company

company or body, to a prince or aſſembly, to treat of matters in their name.

DEPUTY, a perſon ſent upon ſome buſineſs, by ſome community.

DEPUTY is alſo one that exerciſes an office in another's right; and the forfeiture or miſdemeanor of ſuch deputy ſhall cauſe the perſon whom he repreſents to loſe his office.

DEPUTATUS, among the ancients, a name applied to perſons employed in making of armour: and likewiſe to briſk active people, whoſe buſineſs was to take care of the wounded in engagements, and carry them off the field.

DERBENT, a city of Dagiſtan, on the weſtern coaſt of the Caſpian ſea: E. long. 51°, and 41° 15′ N. lat.

DEREHAM, a market-town of Norfolk, about fifteen miles weſt of Norwich: E. long. 1°, and N. lat. 52° 40′.

DERIVATIVE, in grammar, a word which is derived from another called its primitive. See PRIMITIVE.

Thus, *manhood* is derived from *man*, *deity* from *Deus*, and *lawyer* from *law*.

DERMESTES, in zoology, a genus of inſects belonging to the order of coleoptera. The antennæ are clavated, with three of the joints thicker than the reſt; the breaſt is convex; and the head is inflected below the breaſt. There are thirty ſpecies, diſtinguiſhed by their colour, *&c.*

DERNIER RESSORT. See RESSORT.

DEROGATORY, a clauſe importing derogation. A derogatory clauſe in a teſtament, is a certain ſentence, cipher, or ſecret character, which the teſtator inſerts in his will, and of which he reſerves the knowledge to himſelf alone, adding a condition, that no will he may make hereafter is to be reckoned valid, if this derogatory clauſe is not inſerted expreſsly, and word for word. It is a precaution invented by lawyers againſt latter-wills extorted by violence, or obtained by ſuggeſtion.

DERPT, a town of Livonia, ſituated on the tiver Eimbec: E. long. 28° 10′, and N. lat. 58° 10′.

DERVIS, a name given to all Mahommedan monks, though of various orders. The moſt noted among them are the Bektaſhi, the Mevelevi, the Kadri, and the Seyah. The Bektaſhi, who are allowed to marry and live in cities and towns, are obliged, by the rules of their order, to viſit remote lands, and to ſalute every one they meet with *gazel*, or love-ſongs, and with *eſma*, or the invocation of the names of God, and humbly to wiſh him proſperity, which they do by repeating the word *eivallah*, a ſolemn exclamation of the wreſtlers, by which the conquered yields the palm to the conqueror. The Mevelevi, ſo called from Mevelava their founder, are uſed to turn round for two or three hours together, with ſuch ſwiftneſs that you cannot ſee their faces; they are great lovers of muſic: in their monaſteries they profeſs great humility and poverty, and when viſited make no diſtinction of perſons; they firſt bring their gueſts coffee to drink; and if the ways have been dirty, they waſh their feet and ſandals. The Kadri, with a peculiar ſuperſtition, emaciate their bodies; they go quite naked, except their thighs, and often join hands and dance, ſometimes a whole day, repeating with great vehemence, *hu! hu! hu!* (one of the names of God) till, like madmen, they fall on the ground, foaming at the mouth, and running down with ſweat: the prime vizir Kupruli Achmed Paſha, thinking this ſect unbecoming the Mahommedan religion, ordered it to be ſuppreſſed; but, after his death, it revived, and is at preſent more numerous than ever, eſpecially at Conſtantinople. The Seyah are wanderers, and though they have monaſteries, yet they often ſpend their whole life in travelling; when they are ſent out, their ſuperiors impoſe upon them ſuch a quantity of money or proviſions, forbidding them to come back till they have procured it, and ſent it to the monaſtery; wherefore when a Seyah comes into a town, he cries aloud in the market-place, *Ya allah ſenden*, &c. *O God! give me, I pray, five thouſand crowns*, or *a thouſand meaſures of rice.* Many of theſe derviſes travel over the whole Mahommedan world, entertaining the people where-ever they come, with agreeable relations of all the curioſities they have met with. There are derviſes in Egypt, who live with their families, and exerciſe their trades, of which kind are the dancing derviſes at Damaſcus. They are all diſtinguiſhed among themſelves by the different forms and colours of their habits; thoſe of Perſia wear blue; the ſolitaries and wanderers wear only rags of different colours; others carry on their heads a plume made of the feathers of a cock; and thoſe of Egypt wear an octagonal badge of a greeniſh white alabaſter at their girdles, and a high ſtiff cap, without any thing round it.

DERWENT, a river, which, taking its riſe in the north riding of Yorkſhire, runs ſouth, and falls into the Ouſe.

DERWENT-WATER, a river of Cumberland, which falls into the Iriſh ſea below Cockermouth.

DESART, a large extent of country entirely barren, and producing nothing. In this ſenſe ſome are ſandy deſarts, as thoſe of Lop, Xamo, Arabia, and ſeveral others in Aſia; in Africa, thoſe of Lybia and Zara: others are ſtony, as the deſart of Pharan in Arabia Petrea.

The DESART, abſolutely ſo called, is that part of Arabia, ſouth of the Holy Land, where the children of Iſrael wandered forty years.

DESCANT, in muſic, the art of compoſing in ſeveral parts. See MUSIC.

DESCENDENTS, in Scots law. The iſſue of a common parent *in infinitum* are called his deſcendents.

DESCENSION, in aſtronomy, is either right or oblique.

Right DESCENSION is an arch of the equinoctial, intercepted between the next equinoctial point and the interſection of the meridian, paſſing through the centre of the object, at its ſetting, in a right ſphere.

Oblique DESCENSION, an arch of the equinoctial, intercepted

tercepted between the next equinoctial point and the horizon, paſſing through the centre of the object, at its ſetting, in an oblique ſphere.

DESCENT, in general, is the tendency of a body from a higher to a lower place; thus all bodies, unleſs otherwiſe determined by a force ſuperior to their gravity, deſcend towards the centre of the earth. See Mechanics.

Descent, or Discent, in law, an order or method whereby lands or tenements are derived to any man from his anceſtors.

Descent, in genealogy, the order or ſucceſſion of deſcendants in a line or family; or their diſtance from a common progenitor: thus we ſay, one deſcent, two deſcents, *&c.*

Descent, in heraldy, is uſed to expreſs the coming down of any thing from above; as, a lion en deſcent, is a lion with his head towards the baſe points, and his heels towards one of the corners of the chief, as if he were leaping down from ſome high place.

DESCRIPTION, is ſuch a ſtrong and beautiful repreſentation of a thing, as gives the reader a diſtinct view and ſatisfactory notion of it. See Narration *and Deſcription.*

DESEADA, or Desiderada, one of the Caribbee-iſlands, ſubject to France, lying eaſtward of Guardaloupe. See Caribbee.

DESERTER, in a military ſenſe, a ſoldier who, by running away from his regiment or company, abandons the ſervice.

A deſerter is, by the articles of war, puniſhable by death, and, after conviction, is hanged at the head of the regiment he formerly belonged to, with his crime writ on his breaſt.

DESERTION, in Scots Law, when one of the married perſons deſerts or forſakes the other. Wilful deſertion for four years together is a ground of divorce. See Scots Law, title 6.

DESHACHE', in heraldry, is where a beaſt has its limbs ſeparated from its body, ſo that they ſtill remain on the eſcutcheon, with only a ſmall ſeparation from their natural places.

DESIDERATUM is uſed to ſignify the deſirable perfections in any art or ſcience: thus, it is a deſideratum with the blackſmith, to render iron fuſible by a gentle heat, and yet preſerve it hard enough for ordinary uſes; with the glaſsman, and looking-glaſs maker, to render glaſs malleable; with the clock-maker, to bring pendulums to be uſeful where there are irregular motions, *&c.*

DESIGN, in a general ſenſe, the plan, order, repreſentation, or conſtruction of a building, book, painting, *&c.*

Design, in the manufactories, expreſſes the figures wherewith the workman enriches his ſtuff, or ſilk, and which he copies after ſome painter, or eminent draughts-man, as in diaper, damaſk, and other flowered ſilk and tapeſtry, and the like.

In undertaking of ſuch kinds of figured ſtuffs, it is neceſſary, ſays Monſ. Savary, that, before the firſt ſtroke of the ſhuttle, the whole deſign be repreſented on the threads of the warp; we do not mean in colours, but with an infinite number of little packthreads, which, being diſpoſed ſo as to raiſe the threads of the warp, let the workmen ſee, from time to time, what kind of ſilk is to be put in the eye of the ſhuttle for woof. This method of preparing the work is called reading the deſign, and reading the figure, which is performed in the following manner: a paper is provided, conſiderably broader than the ſtuff, and of a length proportionate to what is intended to be repreſented thereon. This they divide lengthwiſe, by as many black lines as there are intended threads in the warp; and croſs theſe lines, by others drawn breadthwiſe, which, with the former, make little equal ſquares: on the paper thus ſquared, the draughtsman deſigns his figures, and heightens them with colours, as he ſees fit. When the deſign is finiſhed, a workman reads it, while another lays it on the ſimblot.

To read the deſign, is to tell the perſon who manages the loom, the number of ſquares, or threads, compriſed in the ſpace he is reading, intimating at the ſame time, whether it is ground or figure. To put what is read on the ſimblot, is to faſten little ſtrings to the ſeveral packthreads, which are to raiſe the threads named; and thus they continue to do till the whole deſign is read.

Every piece being compoſed of ſeveral repetitions of the ſame deſign, when the whole deſign is drawn, the drawer, to re-begin the deſign afreſh, has nothing to do but to raiſe the little ſtrings, with ſlip-knots, to the top of the ſimblot, which he had let down to the bottom: this he is to repeat as often as is neceſſary till the whole be manufactured.

The ribbon-weavers have likewiſe a deſign, but far more ſimple than that now deſcribed. It is drawn on paper with lines and ſquares, repreſenting the threads of the warp and woof. But inſtead of lines, whereof the figures of the former conſiſt, theſe are conſtituted of points only, or dots, placed in certain of the little ſquares, formed by the interſection of the lines. Theſe points mark the threads of the warp that are to be raiſed, and the ſpaces left blank denote the threads that are to keep their ſituation: the reſt is managed as in the former.

Design is alſo uſed, in painting, for the firſt idea of a large work, drawn roughly, and in little, with an intention to be executed and finiſhed in large.

Deſign, in painting, is the ſimple contour, or outlines of the figures intended to be repreſented, or the lines that terminate and circumſcribe them: ſuch deſign is ſometimes drawn in crayons, or ink, without any ſhadows at all; ſometimes it is hatched, that is, the ſhadows are expreſſed by ſenſible outlines, uſually drawn acroſs each other with the pen, crayon, or graver. Sometimes, again, the ſhadows are done with the crayon rubbed ſo as that there do not appear any lines: at other times, the grains or ſtrokes of the crayon appear, as not being rubbed: ſometimes the deſign is waſhed, that is, the ſhadows are done with a pencil in Indian ink, or ſome other liquor; and ſometimes

times the design is coloured, that is, colours are laid on much like those intended for the grand work.

The essential requisites of a design are correctness, good taste, elegance, character, diversity, expression, and perspective. Correctness depends on the justness of the proportions, and knowledge of anatomy. Taste is a certain manner of correctness peculiar to one's self, derived either from nature, masters, or studies, or all of them united. Elegance gives a delicacy that not only strikes persons of judgment, but communicates an agreeableness that pleases universally. The character is what is peculiar to each thing, wherein there must be diversity, insomuch that every thing has its peculiar character to distinguish it. The expression is the representation of an object, according to the circumstances it is supposed to be in. Perspective is the representation of the parts of a painting or a figure, according to the situation they are in with regard to the point of sight. The design or draught, is a part of the greatest import and extent in painting. It is acquired chiefly by genius and application, rules being of less avail here than in any other branches of the art, as colouring, *&c.* The principal rules that regard design are, that novices accustom themselves to copy good originals at first sight; not to use squares in drawing, lest they stint and confine their judgment; to design well from life, before they practise perspective; to learn to adjust the size of their figures to the visual angle, and the distance of the eye from the model or object; to mark out all the parts of their design before they begin to shade; to make their contours in great pieces, without taking notice of the little muscles, and other breaks; to make themselves masters of the rules of perspective; to observe the perpendicular, parallel, and distance of every stroke; to compare and oppose the parts that meet and traverse the perpendicular, so as to form a kind of square in the mind, which is the great and almost the only rule of designing justly; to have a regard not only to the model, but to the parts already designed, there being no such thing as designing with strict justness, but by comparing and proportioning every part to the first. All the other rules relate to perspective. See PERSPECTIVE.

DESION, the Macedonian name of the month called by the Athenians anthesterion.

DESISE, a town of France, situated on the river Loire, fifteen miles south-east of Nevers: E. long. 3° 32′, N. lat. 46° 48′.

DESPOTICAL, in general, denotes any thing that is uncontrouled and absolute; but is particularly used for an arbitrary government, where the power of the prince is unlimited, and his will a law to his subjects: such are those of Turky, Persia, and most of the eastern governments; and even those of Europe, if we except the republics, our own, and the Swedish government.

DESPOUILLE′, in heraldry, the whole case, skin, or slough of a beast, with the head, feet, tail, and all appurtenances, so that being filled and stuffed it looks like the entire creature.

DESSAW, a city of upper Saxony, in Germany, situated on the river Elbe, sixty miles north west of Dresden, and subject to the prince of Anhalt Dessaw: E. long. 12° 40′, N. lat. 51° 50′.

DESSERT, or DESART, a service of fruits and sweetmeats, usually served up last to table.

DESSICCATIVE, or DESICCATIVE, in pharmacy, an epithet applied to such topical medicines as dry up the humours flowing to a wound or ulcer.

DESTINIES, in mythology. See PARCÆ.

DESTINY, among philosophers and divines. See FATE.

DESTRUCTION, in general, an alteration of any thing from its natural state to one contrary to nature; whereby it is deemed the same with corruption. See CORRUPTION.

A chemical destruction, or corruption, is nothing but a resolution of the whole naturally mixt body into its parts.

DESUDATION, in medicine, a profuse and inordinate sweat, succeeded by an eruption of pustules, called sudamina, or heat pimples.

DETACHMENT, in military affairs, a certain number of soldiers drawn out from several regiments or companies equally, to be employed as the general thinks proper, whether on an attack, at a siege, or in parties to scower the country.

DETERGENTS, in pharmacy, such medicines as are not only softening and adhesive, but also, by a peculiar activity, conjoined with a suitable configuration of parts, are apt to abrade and carry along with them such particles as they lay hold on in their passage.

DETERIORATION, the impairing or rendering a thing worse: it is just the reverse of melioration. See MELIORATION.

DETERMINATION, in mechanics, signifies much the same with the tendency or direction of a body in motion. See MECHANICS.

DETERMINATION, among school-divines, is an act of divine power, limiting the agency of second causes, in every instance, to what the Deity predestinated concerning them. See PREDESTINATION.

DETERSIVES, in pharmacy. See DETERGENTS.

DETHMOLD, a town of Westphalia, in Germany, fifteen miles north of Paderborn: E. long. 8° 35′, N. lat. 52°.

DETINUE, in law, a writ or action that lies against one who has got goods or other things delivered to him to keep, and afterwards refuses to deliver them.

DETONATION, in chemistry, the noise and explosion which any substance makes upon the application of fire to it. It is also called fulmination. See CHEMISTRY.

DETRANCHE′, in heraldry, a line bendwise, proceeding always from the dexter side, but not from the very angle, diagonally athwart the shield.

DETTINGEN, a village of Germany, about nine miles east of Hanau, in the circle of the upper Rhine: E. long. 8° 45, and N. lat. 50° 8′.

DEVA, a port-town of Spain, situated on the bay of Biscay, forty miles east of Bilboa: W. long. 2° 10′, and N. lat. 43° 20′.

DEVENTER, a city of the united Provinces, and province of Overyssel, about eight miles north of Zutphen: E. long. 6°, and N. lat. 52° 20′.

DEVICE, among painters. See DEVISE.

DEVIL, an evil angel, one of thoſe celeſtial ſpirits caſt down from heaven for pretending to equal himſelf with God. The Ethiopians paint the devil white, to be even with the Europeans who paint him black. There is no mention of the word devil in the Old Teſtament, but only of the word Satan and Belial: nor do we meet with it in any heathen authors, in the ſenſe it is taken among Chriſtians, that is, as a creature revolted from God. Their theology went no farther than to evil genii, or dæmons.

Some of the American idolaters have a notion of two collateral independent beings, one of whom is good, and the other evil; which laſt they imagine has the direction and ſuperintendance of this earth, for which reaſon they chiefly worſhip him: whence thoſe that give us an account of the religion of theſe ſavages give out, with ſome impropriety, that they worſhip the devil. The Chaldeans, in like manner, believed both a good principle and an evil one, which laſt they imagined was an enemy to mankind.

Iſaiah, ſpeaking, according to ſome commentators, of the fall of the devil, calls him Lucifer, from his former elevation and ſtate of glory: but others explain this paſſage of Iſaiah in reference to the king of Babylon, who had been precipitated from his throne and glory. The Arabians call Lucifer, Eblis, which ſome think is only a diminutive or corruption of the word Diabolus.

DEVIL-IN-A-BUSH, in botany. See NIGELLA.

DEVIL'S BIT. See SCABIOSA.

DEVINCTION, in antiquity, a kind of love-charm, deſcribed by Virgil in his eighth eclogue: it conſiſted in tying certain knots, and repeating a formula of words.

DEVISE, or DEVICE, in heraldry, painting, and ſculpture, any emblem uſed to repreſent a certain family, perſon, action, or quality; with a ſuitable motto, applied in a figurative ſenſe. See MOTTO.

DEVISE, in law, the act whereby a perſon bequeaths his lands or tenements to another by his laſt will and teſtament.

DEVISES, a borough town in Wiltſhire, eighteen miles north-weſt of Saliſbury: W. long. 2° 6′, and N. lat. 51° 25′. It ſends two members to parliament.

DEUNX, in Roman antiquity, eleven ounces, or $\frac{11}{12}$ parts of the libra. See LIBRA.

DEVOLUTION, in law, a right acquired by ſucceſſion from one to another.

DEVONSHIRE, a county in the weſt of England, bounded by the Briſtol channel, on the north; by Somerſetſhire and Dorſetſhire, on the eaſt; by the Engliſh channel, on the ſouth; and by Cornwal, on the weſt. From this county the noble family of Cavendiſh take the title of duke.

DEVOTION, a ſincere ardent worſhip of the deity. See PRAYER, ADORATION, WORSHIP, &c.

DEUTERONOMY, a canonical book of the Old Teſtament, and the laſt of the pentateuch of Moſes. See BIBLE.

DEUTEROPOTMI, in Grecian antiquity, a deſignation given to ſuch of the Athenians as had been thought dead, and, after the celebration of the funeral rites, unexpectedly recovered. It was unlawful for the deuteropotmi to enter into the temple of the Eumenides, or to be admitted to the holy rites, till after they were purified, by being let through the lap of a woman's gown, that they might ſeem to be new born.

DEUTEROSIS, the Greek name by which the Jews called their Miſchnah, or ſecond law. See MISCHNAH.

DEUX PONTS, a city of Germany, in the palatinate of the Rhine, ſixty miles north-eaſt of Nancy: E. long. 7° 15′, and N. lat. 49° 25′.

DEW, a denſe moiſt vapour, falling on the earth in form of a miſling rain, while the ſun is below the horizon. See PNEUMATICS.

DEW-BORN, in country affairs, a diſtemper in cattle, being a ſwelling in the body, as much as the ſkin can hold, ſo that ſome beaſts are in danger of burſting. This diſtemper proceeds from the greedineſs of a beaſt to feed, when put into a rank paſture: but commonly when the graſs is full of water. In this caſe the beaſt ſhould be ſtirred up and down, and made to purge well: but the proper cure is bleeding in the tail; then take a grated nutmeg, with an egg, and breaking the top of the ſhell, put out ſo much of the white as you may have room to ſlip the nutmeg into the ſhell; mix them together, and then let ſhell and all be put down the beaſt's throat; that done, walk him up and down, and he will ſoon mend.

DEXTANS, in Roman antiquity, ten ounces, or $\frac{10}{12}$ of their libra. See LIBRA.

DEXTER, in heraldry, an appellation given to whatever belongs to the right ſide of a ſhield, or coat of arms: thus we ſay, bend-dexter, dexter-point, &c. See BEND, POINT, &c.

DEXTROCHERE, or DESTROCHERE, in heraldry, is applied to the right arm painted in a ſhield, ſometimes naked, ſometimes cloathed, or adorned with a bracelet; and ſometimes armed, or holding ſome moveable, or member uſed in the arms.

DEY, in matters of government, the ſovereign prince of Algiers, anſwering to the bay of Tunis. See BEY.

DEYNSE, a town of Flanders, nine miles ſouth weſt of Ghent: E. long. 3° 30′, N. lat. 51°.

DIABETES, in phyſic, an exceſſive diſcharge of urine, which comes away crude, and exceeds the quantity of liquids drank. See MEDICINE.

DIABOLUS. See DEVIL.

DIABOLUS MARINUS. See RAIA.

DIABOLUS METELLORUM, a title given by chemiſts to jupiter or tin, becauſe, when incorporated with other metals, it renders them uncapable of reduction, or at leaſt very difficult to undergo that operation.

DIABROSIS, in medicine. See ANABROSIS.

DIACARYON, in pharmacy. See DIANUCUM.

DIACAUSTIC CURVE, a ſpecies of the cauſtic curves formed by refraction.

DIACHYLON, in pharmacy, an emollient digeſtive plaiſter, compoſed of mucilages or viſcid juices drawn from certain plants.

DIACODIUM, in pharmacy, a ſyrup prepared from poppy heads. It is alſo called the ſyrupus de meconio. As it is of conſequence that all the circumſtances in the directions

directions for compounding this medicine, be exactly followed, we here give the method of preparing it from the London Difpenfatory. Take of the heads of dried white poppies without their feeds, three pounds and a half; of water, fix gallons. Slice the heads, and boil them in the water, often ftirring them that they may not burn, till about a third only of the liquor is left, which will be almoft all imbibed by the poppy heads: then take all from the fire, and prefs the liquor ftrongly out from the heads; in the next place, boil the liquor by itfelf, to about two quarts, and ftrain it while hot, firft through a fieve, and then through a thin flannel: fet it by for a night, that what fæces have paffed the ftrainers, may fubfide; next morning pour off the clear liquor, and boil it with fix pounds of double refined fugar, till the whole comes to the weight of nine pounds, or a little more, that it may become a fyrup of a juft confiftence. This fyrup partakes of all the virtues of the poppy.

DIACOUSTICS, called alfo DIAPHONICS, the confideration of the properties of refracted found, as it paffes through different mediums.

DIADELPHIA, in the Linnæan fyftem of botany. See Vol. I. p. 635.

DIADEM, in antiquity, a head-band, or fillet, worn by kings as a badge of their royalty. It was made of filk, thread, or wool, and tied round the temples and forehead, the ends being tied behind, and let fall on the neck. It was ufually white, and quite plain, though fometimes embroidered with gold, and fet with pearls and precious ftones. In latter times, it came to be twifted round crowns, laurels, &c. and even appears to have been worn on divers parts of the body. See CROWN.

DIADEM, in heraldry, is applied to certain circles, or rims, ferving to inclofe the crowns of fovereign princes, and to bear the globe and crofs, or the flower de luces for their creft. The crowns of fovereigns are bound, fome with a greater, and fome with a lefs number of diadems. The bandage about the heads of moors on fhields is alfo called diadem, in blazoning.

DIÆRESIS, in furgery, an operation ferving to divide and feparate the part when the continuity is a hindrance to the cure.

DIÆRESIS, in medicine, is the confuming of the veffels of an animal body, when from fome corroding caufe certain paffages are made, which naturally ought not to have been; or certain natural paffages are dilated beyond their ordinary dimenfions, fo that the humours which ought to have been contained in the veffels extravafate or run out.

DIÆRESIS, in grammar, the divifion of one fyllable into two, which is ufually noted by two points over a letter, as aulaï inftead of aulæ, diffoliienda for diffolvenda.

DIÆTETÆ, in Grecian antiquity, a kind of judges, of which there were two forts, the cleroti and diallacterii. The former were public arbitrators, chofen by lot to determine all caufes exceeding ten drachms, within their own tribe, and from their fentence an appeal lay to the fuperior courts.

The diallacterii, on the contrary, were private arbitrators from whofe fentence there lay no appeal, and accordingly they always took an oath to adminifter juftice without partiality.

DIAGLYPHICE, the art of cutting or engraving figures on metals, fuch as feals, intaglias, matrices of letters, &c. or coins for medals.

DIAGNOSTIC, in medicine, a term given to thofe figns which indicate the prefent ftate of a difeafe, its nature and caufe.

DIAGONAL, in geometry, a right line drawn acrofs a quadrilateral figure, from one angle to another, by fome called the diameter, and by others the diametral of the figure. See GEOMETRY.

DIAGRAM, in geometry, a fcheme for explaining and demonftrating the properties of any figure, whether triangle, fquare, circle, &c. See GEOMETRY.

DIAGRAM, among ancient muficians. See SCALE.

DIAHEXAPLA, or DIAHEXAPTE, among farriers, a compound medicine, fo called from its containing fix ingredients, *viz.* birthwort and gentian roots, juniper-berries, bay-berries, myrrh, and ivory fhavings. It is commended for colds, confumptions, purfinefs, and many other diforders in horfes.

DIAL. A dial is a plane, upon which lines are defcribed in fuch a manner, that the fhadow of a wire, or of the upper edge of another plane, erected perpendicularly on the former, may fhew the true time of the day.

The edge of the plane by which the time of the day is found, is called the ftile of the dial, which muft be parallel to the earth's axis; and the line on which the faid plane is erected, is called the fubftile.

The angle included between the fubftile and ftile, is called the elevation, or height of the ftile.

Thofe dials whofe planes are parallel to the plane of the horizon, are called horizontal dials; and thofe dials whofe planes are perpendicular to the plane of the horizon, are called vertical, or erect dials.

Thofe erect dials, whofe planes directly front the north or fouth, are called direct north or fouth dials; and all other erect dials are called decliners, becaufe their planes are turned away from the north or fouth.

Thofe dials whofe planes are neither parallel nor perpendicular to the plane of the horizon, are called inclining, or reclining dials, according as their planes make acute or obtufe angles with the horizon; and if their planes are alfo turned afide from facing the fouth or north, they are called declining-inclining, or declining-reclining dials.

The interfection of the plane of the dial, with that of the meridian, paffing through the ftile, is called the meridian of the dial, or the hour-line of XII.

Thofe meridians, whofe planes pafs through the ftile, and make angles of 15, 30, 45, 60, 75, and 90 degrees with the meridian of the place (which marks the hour-line of XII.) are called hour-circles; and their interfections with the plane of the dial are called hour-lines.

In all declining dials, the fubftile makes an angle with

with the hour-line of XII; and this angle is called the diſtance of the ſubſtile from the meridian.

The declining plane's difference of longitude, is the angle formed at the interſection of the ſtile and plane of the dial, by two meridians; one of which paſſes through the hour-line of XII. and the other through the ſubſtile.

This much being premiſed concerning dials in general, we ſhall now proceed to explain the different methods of their conſtruction.

If the whole earth *aPcp*, (Plate LXIX. fig. 1.) were it tranſparent, and hollow, like a ſphere of glaſs, and had its equator divided into 24 equal parts by ſo many meridian ſemicircles, *a*, *b*, *c*, *d*, *e*, *f*, *g*, &c. one of which is the geographical meridian of any given place, as London (which is ſuppoſed to be at the point *a*;) and if the hours of XII were marked at the equator, both upon that meridian and the oppoſite one, and all the reſt of the hours in order on the reſt of the meridians, thoſe meridians would be the hour-circles of London: then, if the ſphere had an opake axis, as *P E p*, terminating in the poles *P* and *p*, the ſhadow of the axis would fall upon every particular meridian and hour, when the ſun came to the plane of the oppoſite meridian, and would conſequently ſhew the time at London, and at all other places on the meridian of London.

If this ſphere was cut through the middle by a ſolid plane *ABCD*, in the rational horizon of London, one half of the axis *E P* would be above the plane, and the other half below it; and if ſtraight lines were drawn from the centre of the plane, to thoſe points where its circumference is cut by the hour-circles of the ſphere, thoſe lines would be the hour-lines of a horizontal dial for London: for the ſhadow of the axis would fall upon each particular hour-line of the dial, when it fell upon the like hour-circle of the ſphere.

If the plane which cuts the ſphere be upright, as *AFCG*, fig. 2. touching the given place (London) at *F*, and directly facing the meridian of London, it will then become the plane of an erect direct ſouth dial: and if right lines be drawn from its center *E*, to thoſe points of its circumference where the hour-circles of the ſphere cut it, theſe will be the hour-lines of a vertical or direct ſouth dial for London, to which the hours are to be ſet as in the figure (contrary to thoſe on a horizontal dial), and the lower half *E p* of the axis will caſt a ſhadow on the hour of the day in this dial, at the ſame time that it would fall upon the like hour-circle of the ſphere, if the dial-plane was not in the way.

If the plane (ſtill facing the meridian) be made to incline, or recline, any given number of degrees, the hour-circles of the ſphere will ſtill cut the edge of the plane in thoſe points to which the hour-lines muſt be drawn ſtraight from the center; and the axis of the ſphere will caſt a ſhadow on theſe lines at the reſpective hours. The like will ſtill hold, if the plane be made to decline by any given number of degrees from the meridian toward the eaſt or weſt: provided the declination be leſs than 90 degrees, or the reclination be leſs than the co-latitude of the place: and the axis of the ſphere will be a gnomon, or ſtile, for the dial. But it cannot be a gnomon, when the declination is quite 90 degrees, nor when the reclination is equal to the co-latitude; becauſe in theſe two caſes, the axis has no elevation above the plane of the dial.

And thus it appears, that the plane of every dial repreſents the plane of ſome great circle upon the earth; and the gnomon the earth's axis, whether it be a ſmall wire, as in the above figures, or the edge of a thin plate, as in the common horizontal dials.

The whole earth, as to its bulk, is but a point, if compared to its diſtance from the ſun: and therefore, if a ſmall ſphere of glaſs be placed upon any part of the earth's ſurface, ſo that its axis be parallel to the axis of the earth, and the ſphere have ſuch lines upon it, and ſuch planes within it, as above deſcribed; it will ſhew the hours of the day as truly as if it were placed at the earth's center, and the ſhell of the earth were as tranſparent as glaſs.

But becauſe it is impoſſible to have a hollow ſphere of glaſs perfectly true, blown round a ſolid plane; or if it was, we could not get at the plane within the glaſs to ſet it in any given poſition; we make uſe of a wire-ſphere to explain the principles of dialing, by joining 24 ſemicircles together at the poles, and putting a thin flat plate of braſs within it.

A common globe, of 12 inches diameter, has generally 24 meridian ſemicircles drawn upon it. If ſuch a globe be elevated to the latitude of any given place, and turned about until one of theſe meridians cut the horizon in the north point, where the hour of XII is ſuppoſed to be marked, the reſt of the meridians will cut the horizon at the reſpective diſtances of all the other hours from XII. Then if theſe points of diſtance be marked on the horizon, and the globe be taken out of the horizon, and a flat board or plate be put into its place, even with the ſurface of the horizon; and if ſtraight lines be drawn from the center of the board, to thoſe points of diſtance on the horizon which were cut by the 24 meridian ſemicircles, theſe lines will be the hour-lines of a horizontal dial for that latitude, the edge of whoſe gnomon muſt be in the very ſame ſituation that the axis of the globe was, before it was taken out of the horizon: that is, the gnomon muſt make an angle with the plain of the dial, equal to the latitude of the place for which the dial is made.

If the pole of the globe be elevated to the co-latitude of the given place, and any meridian be brought to the north point of the horizon, the reſt of the meridians will cut the horizon in the reſpective diſtances of all the hours from XII, for a direct ſouth dial, whoſe gnomon muſt be an angle with the plane of the dial, equal to the co-latitude of the place; and the hours muſt be ſet the contrary way on this dial to what they are on the horizontal.

But if your globe have more than 24 meridian ſemicircles upon it, you muſt take the following method for making *horizontal* and *ſouth dials*.

Elevate the pole to the latitude of your place, and turn the globe until any particular meridian (ſuppoſe the firſt) comes to the north point of the horizon, and the oppoſite meridian will cut the horizon in the ſouth. Then, ſet the hour-index to the uppermoſt XII on its circle;

Plate LXIX.

Fig. 1.

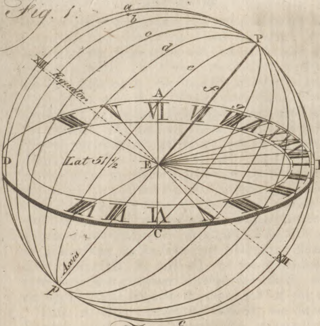


Fig. 2.

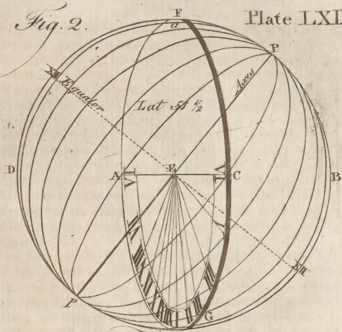


Fig. 3.

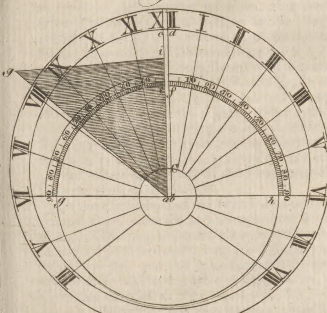


Fig. 4.

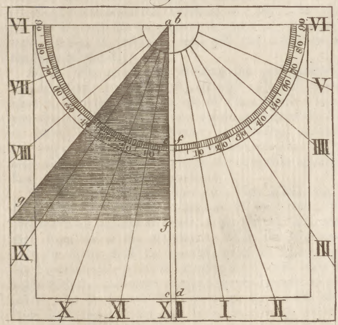


Fig. 5.

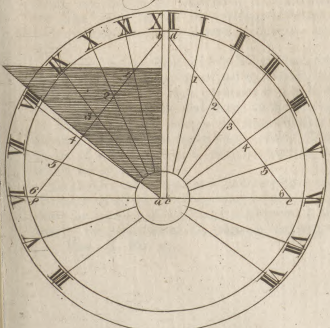
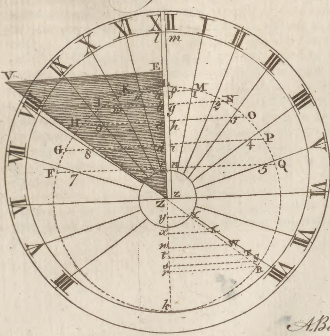


Fig. 6.



A. Bell. Sculp.t

circle; which done, turn the globe westward until 15 degrees of the equator pass under the brasen meridian, and then the hour-index will be at I (for the sun moves 15 degrees every hour) and the first meridian will cut the horizon in the number of degrees from the north point, that I is distant from XII. Turn on, until other 15 degrees of the equator pass under the brasen meridian, and the hour-index will then be at II, and the first meridian will cut the horizon in the number of degrees that II is distant from XII: and so, by making 15 degrees of the equator pass under the brasen meridian for every hour, the first meridian of the globe will cut the horizon in the distances of all the hours from XII to VI, which is distant just 90 degrees; and then you need go no farther, for the distances of XI, X, IX, VIII, VII, and VI, in the forenoon, are the same from XII, as the distances of I, II, III, IIII, V, and VI, in the afternoon: and these hour-lines continued through the center, will give the opposite hour-lines on the other half of the dial.

Thus, to make a horizontal dial for the latitude of London, which is $51\frac{1}{2}$ degrees north, elevate the north pole of the globe $51\frac{1}{2}$ degrees above the north point of the horizon, and then turn the globe, until the first meridian (which is that of London on the English terrestrial globe) cuts the north point of the horizon, and set the hour-index to XII at noon.

Then turning the globe westward until the index points successively to I, II, III, IIII, V, and VI, in the afternoon, or until 15, 30, 45, 60, 75, and 90 degrees of the equator pass under the brasen meridian, you will find that the first meridian of the globe cuts the horizon in the following numbers of degrees from the north towards the east, *viz.* $11\frac{2}{3}$, $24\frac{1}{4}$, $38\frac{1}{12}$, $53\frac{1}{2}$, $71\frac{1}{7}$, and 90; which are the respective distances of the above hours from XII upon the plane of the horizon.

To transfer these, and the rest of the hours, to a horizontal plane, draw the parallel right lines *a c* and *d b*, (Plate LXIX. fig. 3.) upon that plane, as far from each other as is equal to the intended thickness of the gnomon or stile of the dial, and the space included between them will be the meridian or twelve o'clock line on the dial. Cross this meridian at right angles with the six o'clock line *g h*, and setting one foot of your compasses in the intersection *a*, as a center, describe the quadrant *g e* with any convenient radius or opening of the compasses: then, setting one foot in the intersection *b*, as a center, with the same radius describe the quadrant *f h*, and divide each quadrant into 90 equal parts or degrees, as in the figure.

Because the hour-lines are less distant from each other about noon, than in any other part of the dial, it is best to have the centers of these quadrants at a little distance from the center of the dial-plane, on the side opposite to XII, in order to enlarge the hour-distances thereabouts, under the same angles on the plane. Thus, the center of the plane is at *C*, but the centers of the quadrants are at *a* and *b*.

Lay a ruler over the point *b* (and keeping it there for the center of all the afternoon hours in the quadrant *f h*) draw the hour-line of I through $11\frac{2}{3}$ degrees in the quadrant; the hour-line of II, through $24\frac{1}{4}$ degrees; of III, through $38\frac{1}{12}$ degrees; IIII, through $53\frac{1}{2}$; and V, through $71\frac{1}{17}$: and because the sun rises about four in the morning, on the longest days at London, continue the hour-lines of IIII and V in the afternoon through the center *b* to the opposite side of the dial.—This done, lay the ruler to the center *a* of the quadrant *e g*, and through the like divisions or degrees of that quadrant, *viz.* $11\frac{2}{3}$, $24\frac{1}{4}$, $38\frac{1}{12}$, $53\frac{1}{2}$, and $71\frac{1}{17}$, draw the forenoon hour-lines of XI, X, IX, VIII, and VII; and because the sun sets not before eight in the evening on the longest days, continue the hour-lines of VII and VIII in the forenoon, through the center *a*, to VII and VIII in the afternoon; and all the hour-lines will be finished on this dial; to which the hours may be set, as in the figure.

Lastly, through $51\frac{1}{2}$ degrees of either quadrant, and from its center, draw the right line *a g* for the hypothenuse or axis of the gnomon *a g i*; and from *g*, let fall the perpendicular *g i*, upon the meridian line *a i*, and there will be a triangle made, whose sides are *a g*, *g i*, and *i a*. If a plate similar to this triangle be made as thick as the distance between the lines *a c* and *b d*, and set upright between them, touching at *a* and *b*, its hypothenuse *a g* will be parallel to the axis of the world, when the dial is truly set; and will cast a shadow on the hour of the day.

N. B. The trouble of dividing the two quadrants may be saved, if you have a scale with a line of chords upon it, such as that on the top of Plate LXX.: for if you extend the compasses from 0 to 60 degrees of the line of chords, and with that extent, as a radius, describe the two quadrants upon their respective centers, the above distances may be taken with the compasses upon the line, and set off upon the quadrants.

To make an erect direct south dial, Plate LXIX. fig. 4. Elevate the pole to the co-latitude of your place, and proceed in all respects as above taught for the horizontal dial, from VI in the morning to VI in the afternoon, only the hours must be reversed, as in the figure; and the hypothenuse *a g* of the gnomon *a g f*, must make an angle with the dial-plane equal to the co-latitude of the place. As the sun can shine no longer on this dial than from six in the morning until six in the evening, there is no occasion for having any more than twelve hours upon it.

To make an erect dial, declining from the south towards the east or west. Elevate the pole to the latitude of your place, and screw the quadrant of altitude to the zenith. Then, if your dial declines towards the east (which we shall suppose it to do at present) count in the horizon the degrees of declination, from the east point towards the north, and bring the lower end of the quadrant to that degree of declination at which the reckoning ends. This done, bring any particular meridian of your globe (as suppose the first meridian) directly under the graduated edge of the upper part of the brazen meridian, and set the hour-index to XII at noon. Then, keeping the quadrant of altitude at the degree of declination in the horizon, turn the globe eastward on its axis, and observe the degrees cut by the first meridian in the quadrant of altitude (counted from the zenith) as the hour index comes to

to XI, X, IX, &c. in the forenoon, or as 15, 30, 45, &c. degrees of the equator paſs under the brazen meridian at theſe hours reſpectively; and the degrees then cut in the quadrant by the firſt meridian, are the reſpective diſtances of the forenoon hours from XII on the plane of the dial.——Then, for the afternoon hours, turn the quadrant of altitude round the zenith until it comes to the degree in the horizon oppoſite to that where it was placed before: namely, as far from the weſt point of the horizon towards the ſouth, as it was ſet at firſt from the eaſt point towards the north; and turn the globe weſtward on its axis, until the firſt meridian comes to the brazen meridian again, and the hour-index to XII: then, continue to turn the globe weſtward, and as the index points to the afternoon hours I, II, III, &c. or as 15, 30, 45, &c. degrees of the equator paſs under the brazen meridian, the firſt meridian will cut the quadrant of altitude in the reſpective number of degrees from the zenith that each of theſe hours is from XII on the dial.——And note, that when the firſt meridian goes off the quadrant at the horizon in the forenoon, the hour-index ſhews the time when the ſun will come upon this dial: and when it goes off the quadrant in the afternoon, the index will point to the time when the ſun goes off the dial.

Having thus found all the hour-diſtances from XII, lay them down upon your dial plane, either by dividing a ſemicircle into two quadrants of 90 degrees each (beginning at the hour-line of XII) or by the line of chords, as above directed.

In all declining dials, the line on which the ſtile or gnomon ſtands (commonly called the *ſubſtile-line*) makes an angle with the twelve o'clock line, and falls among the forenoon hour-lines, if the dial declines towards the eaſt; and among the afternoon hour-lines, when the dial declines towards the weſt; that is, to the left hand from the twelve o'clock line in the former caſe, and to the right hand from it in the latter.

To find the diſtance of the ſubſtile from the twelve o'clock line; if your dial declines from the ſouth toward the eaſt, count the degrees of that declination in the horizon from the eaſt point toward the north, and bring the lower end of the quadrant of altitude to that degree of declination where the reckoning ends: then, turn the globe until the firſt meridian cuts the horizon in the like number of degrees, counted from the ſouth point toward the eaſt; and the quadrant and firſt meridian will then croſs one another at right angles, and the number of degrees of the quadrant, which are intercepted between the firſt meridian and the zenith, is equal to the diſtance of the ſubſtile line from the twelve o'clock line; and the number of degrees of the firſt meridian, which are intercepted between the quadrant and the north pole, is equal to the elevation of the ſtile above the plane of the dial.

If the dial declines weſtward from the ſouth, count that declination from the eaſt point of the horizon towards the ſouth, and bring the quadrant of altitude to the degree in the horizon at which the reckoning ends; both for finding the forenoon hours, and diſtance of the ſubſtile from the meridian: and for the afternoon hours, bring the quadrant to the oppoſite degree in the horizon, namely, as far from the weſt towards the north, and then proceed in all reſpects as above.

Thus, we have finiſhed our declining dial; and in ſo doing, we made four dials, *viz.*

1. A north dial, declining eaſtward by the ſame number of degrees. 2. A north dial, declining the ſame number weſt. 3. A ſouth dial, declining eaſt. And, 4, a ſouth dial declining weſt. Only, placing the proper number of hours, and the ſtile or gnomon reſpectively, upon each plane. For (as above mentioned) in the ſouth-weſt plane, the ſubſtilar-line falls among the afternoon hours; and in the ſouth-eaſt, of the ſame declination, among the forenoon hours, at equal diſtances from XII. and ſo, in all the morning hours on the weſt decliner, will be like the afternoon hours on the eaſt decliner: the ſouth-eaſt decliner will produce the north-weſt decliner; and the ſouth-weſt decliner, the north-eaſt decliner, by only extending the hour-lines, ſtile and ſubſtile, quite through the center: the axis of the ſtile (or edge that caſts the ſhadow on the hour of the day) being in all dials whatever parallel to the axis of the world, and conſequently pointing towards the north pole of the heaven in north latitudes, and toward the ſouth pole in ſouth latitudes.

But becauſe every one who would like to make a dial, may perhaps not be provided with a globe to aſſiſt him, and may probably not underſtand the method of doing it by logarithmic calculation; we ſhall ſhew how to perform it by the plain dialling lines, or ſcale of latitudes and hours; ſuch as thoſe on the top of Plate LXX. and which may be had on ſcales commonly ſold by the mathematical inſtrument makers.

This is the eaſieſt of all mechanical methods, and by much the beſt, when the lines are truly divided: and not only the half hours and quarters may be laid down by all of them, but every fifth minute by moſt, and every ſingle minute by thoſe where the line of hours is a foot in length.

Having drawn your double meridian line *a b*, *c d*, (Plate LXIX. fig. 5.) on the plane intended for a horizontal dial, and croſſed it at right angles by the ſix o'clock line *f e* (as in fig. 31.) take the latitude of your place with the compaſſes, in the ſcale of latitudes, and ſet that extent from *c* to *e*, and from *a* to *f*, on the ſix o'clock line: then, taking the whole ſix hours between the points of the compaſſes in the ſcale of hours, with that extent ſet one foot in the point *c*, and let the other foot fall where it will upon the meridian line *c d*, as at *d*. Do the ſame from *f* to *b*, and draw the right lines *e d* and *f b*, each of which will be equal in length to the whole ſcale of hours. This done, ſetting one foot of the compaſſes in the beginning of the ſcale at XII, and extending the other to each hour on the ſcale, lay off theſe extents from *d* to *e* for the afternoon hours, and from *b* to *f* for thoſe of the forenoon: this will divide the lines *d e* and *b f* in the ſame manner as the hour-ſcale is divided at 1, 2, 3, 4, and 6; on which the quarters may alſo be laid down, if required. Then, laying a ruler on the point *c*, draw the firſt five hours in the afternoon, from that point, through the dots at the numeral figures 1, 2, 3, 4, 5, on the line *d e*; and continue the lines of IIII and V through the center *c* to the other ſide of the dial, for the like hours of the morning: which done, lay the ruler on the point *a*, and draw the laſt five hours in the forenoon through the dots 5, 4, 3, 2,

2, 1, on the line fb; continuing the hour-lines of VII and VIII through the center a to the other side of the dial, for the like hours of the evening; and set the hours to their respective lines, as in the figure. Lastly, make the gnomon the same way as taught above for the horizontal dial, and the whole will be finished.

To make an erect south dial, take the co-latitude of your place from the scale of latitudes, and then proceed in all respects for the hour-lines, as in the horizontal dial; only reversing the hours, as in fig. 4. and making the angle of the stile's height equal to the co-latitude.

But lest the young dialist should have neither globe nor wooden scale, we shall now shew him how he may make a dial without any of these helps. Only, if he has not a line of chords, he must divide a quadrant into 90 equal parts or degrees for taking the proper angle of the stile's elevation; which is easily done.

With any opening of the compasses, as ZL, describe the two semicircles LFk and LQk, upon the centers Z and z, where the six o'clock line crosses the double meridian line, and divide each semicircle into 12 equal parts, beginning at L (though, strictly speaking, only the quadrants from L to the six o'clock line need be divided;) then connect the divisions which are equidistant from L, by the parallel lines KM, IN, HO, GP, and FQ. Draw VZ for the hypothenuse of the stile, making the angle VZE equal to the latitude of your place; and continue the line VZ to R. Draw the line Rr parallel to the six o'clock line, and set off the distance aK from Z to Y, the distance bI from Z to X, cH from Z to W, dG from Z to T, and eF from Z to S. Then draw the lines Ss, Tt, Ww, Xx, and Yy, each parallel to Rr. Set off the distance yY from a to 11, and from f to 1; the distance xX from b to 10, and from g to 2; wW from c to 9, and from h to 3; tT from d to 8, and from i to 4; sS from e to 7, and from n to 5. Then laying a ruler to the center Z, draw the forenoon hour-lines through the points 11, 10, 9, 8, 7; and laying it to the center z, draw the afternoon lines through the points 1, 2, 3, 4, 5; continuing the forenoon lines of VII and VIII through the center Z, to the opposite side of the dial, for the like afternoon hours; and the afternoon lines IIII and V through the center z, to the opposite side, for the like morning hours. Set the hours to these lines as in the figure, and then erect the stile or gnomon, and the horizontal dial will be finished.

To construct a south dial, draw the line VZ, making an angle with the meridian ZL equal to the co-latitude of your place; and proceed in all respects as in the above horizontal dial for the same latitude, reversing the hours as in fig. 4. and making the elevation of the gnomon equal to the co-latitude.

Perhaps it may not be unacceptable to explain the method of constructing the dialing lines, and some others; which is as follows.

With any opening of the compasses, (Plate LXX. fig. 1.) as EA, according to the intended length of the scale, describe the circle $ADCB$, and cross it at right angles by the diameters CEA and DEB. Divide the quadrant AB first into 9 equal parts, and then each part into 10; so shall the quadrant be divided into 90 equal parts or degrees. Draw the right line AFB for the chord of this quadrant, and setting one foot of the compasses in the point A, extend the other to the several divisions of the quadrant, and transfer these divisions to the line AFB by the arcs 10, 10, 20, 20, &c. and this will be a line of chords, divided into 90 unequal parts; which, if transferred from the line back again to the quadrant, will divide it equally. It is plain by the figure, that the distance from A to 60 in the line of chords, is just equal to AE, the radius of the circle from which that line is made; for if the arc 60, 60 be continued, of which A is the center, it goes exactly through the center E of the arc AB.

And therefore, in laying down any number of degrees on a circle, by the line of chords, you must first open the compasses so, as to take in just 60 degrees upon that line, as from A to 60: and then, with that extent, as a radius, describe a circle, which will be exactly of the same size with that from which the line was divided: which done, set one foot of the compasses in the beginning of the chord line, as at A, and extend the other to the number of degrees you want upon the line; which extent, applied to the circle, will include the like number of degrees upon it.

Divide the quadrant CD into 90 equal parts, and from each point of division draw right lines, as i, k, l, &c. to the line CE; all perpendicular to that line, and parallel to DE, which will divide EC into a line of sines; and although these are seldom put among the dialing lines on a scale, yet they assist in drawing the line of latitudes. For if a ruler be laid upon the point D, and over each division in the line of sines, it will divide the quadrant CB into 90 unequal parts, as Ba, Bb, &c. shewn by the right lines 10a, 20b, 30c, &c. drawn along the edge of the ruler. If the right line BC be drawn, subtending this quadrant, and the nearest distances Ba, Bb, Bc. &c. be taken in the compasses from B, and set upon this line in the same manner as directed for the line of chords, it will make a line of latitudes BC, equal in length to the line of chords AB, and of an equal number of divisions, but very unequal as to their lengths.

Draw the right line DGA, subtending the quadrant DA; and parallel to it, draw the right line rs, touching the quadrant DA at the numeral figure 3. Divide this quadrant into six equal parts, as 1, 2, 3, &c. and through these points of division draw right lines from the centre E to the line rs, which will divide it at the points where the six hours are to be placed, as in the figure. If every sixth part of the quadrant be subdivided into four equal parts, right lines drawn from the centre through these points of division, and continued to the line rs, will divide each hour upon it into quarters.

In Fig. 2. Plate LXX. we have the representation of a portable dial, which may be easily drawn on a card, and carried in a pocket-book. The lines ad, ab, and bc of the gnomon must be cut quite through the card; and as the end ab of the gnomon is raised occasionally above the plane of the dial, it turns upon the uncut line cd as on a hinge. The line dotted AB must be slit quite through the card, and the thread C must be put through the slit, and have a knot tied behind, to keep it from being easily drawn out. On the other end of this thread

thread is a ſmall plummet *D*, and on the middle of it a ſmall bead for ſhewing the hour of the day.

To rectify this dial, ſet the thread in the ſlit right againſt the day of the month, and ſtretch the thread from the day of the month over the angular point where the curve-lines meet at XII; then ſhift the bead to that point on the thread, and the dial will be rectified.

To find the hour of the day, raiſe the gnomon (no matter how much or how little) and hold the edge of the dial next the gnomon towards the ſun, ſo as the uppermoſt edge of the ſhadow of the gnomon may juſt cover the *ſhadow-line;* and the bead then playing freely on the face of the dial, by the weight of the plummet, will ſhew the time of the day among the hour-lines, as it is forenoon or afternoon.

To find the time of ſun-riſing and ſetting, move the thread among the hour-lines, until it either covers ſome one of them, or lies parallel betwixt any two; and then it will cut the time of ſun-riſing among the forenoon hours, and of ſun-ſetting among the afternoon hours, for that day of the year to which the thread is ſet in the ſcale of months.

To find the ſun's declination, ſtretch the thread from the day of the month over the angular point at XII, and it will cut the ſun's declination, as it is north or ſouth, for that day, in the proper ſcale.

To find on what days the ſun enters the ſigns: when the bead, as above rectified, moves along any of the curve-lines which have the ſigns of the zodiac marked upon them, the ſun enters thoſe ſigns on the days pointed out by the thread in the ſcale of months.

The conſtruction of this dial is very eaſy, eſpecially if the reader compares it all along with fig. 3. as he reads the following explanation of that figure.

Draw the occult line, (Plate LXX. fig. 9.) *AB* parallel to the top of the card, and croſs it at right angles with the ſix o'clock line *ECD*; then upon *C*, as a centre, with the radius *CA*, deſcribe the ſemicircle *AEL*, and divide it into 12 equal parts (beginning at *A*) as *Ar*, *As*, &c. and from theſe points of diviſion draw the hour-lines *r*, *s*, *t*, *u*, *v*, *E*, *w*, and *x*, all parallel to the ſix o'clock line *EG*. If each part of the ſemicircle be ſubdivided into four equal parts, they will give the half-hour lines and quarters, as in fig. 2. Draw the right-line *ASDo*, making the angle *SAB* equal to the latitude of your place. Upon the centre *A* deſcribe the arch *RST*, and ſet off upon it the arcs *SR* and *ST*, each equal to $23\frac{1}{2}$ degrees, for the ſun's greateſt declination; and divide them into $23\frac{1}{2}$ equal parts, as in fig. 2. Through the interſection *D* of the lines *ECD* and *ADo*, draw the right line *FDG* at right angles to *ADo*. Lay a ruler to the points *A* and *R*, and draw the line *ARF* through $23\frac{1}{2}$ degrees of ſouth declination in the arc *SR*; and then laying the ruler to the points *A* and *T*, draw the line *ATG* through $23\frac{1}{2}$ degrees of north declination in the arc *ST*: ſo ſhall the lines *ARF* and *ATG* cut the line *FDG* in the proper length for the ſcale of months. Upon the centre *D*, with the radius *DE*, deſcribe the ſemicircle *FoG*; which divide into ſix equal parts, *Fm*, *mn*, *no*, &c. and from theſe points of diviſion draw the right lines *mh*, *ni*, *pk*, and *ql*, each parallel to *oD*. Then ſetting one foot of the compaſſes in the point *F*, extend the other to *A*, and deſcribe the arc *AzH* for the tropic of ♑: with the ſame extent, ſetting one foot in *G*, deſcribe the arc *AEO* for the tropic of ♋. Next ſetting one foot in the point *h*, and extending the other to *A*, deſcribe the arc *ACI* for the beginnings of the ſigns ♒ and ♐; and with the ſame extent, ſetting one foot in the point *l*, deſcribe the arc *AN* for the beginnings of the ſigns ♊ and ♌. Set one foot in the point *i*, and having extended the other to *A*, deſcribe the arc *AK* for the beginnings of the ſigns ♓ and ♏; and with the ſame extent, ſet on foot in *k*, and deſcribe the arc *HM* for the beginnings of the ſigns ♉ and ♍. Then ſetting one foot in the point *D*, and extending the other to *A*, deſcribe the curve *AL* for the beginnings of ♈ and ♎; and the ſigns will be finiſhed. This done, lay a ruler from the point *A* over the ſun's declination in the arch *RST*; and where the ruler cuts the line *FDG*, make marks; and place the days of the months right againſt theſe marks, in the manner ſhewn by fig. 2. Laſtly, draw the ſhadow-line *PQ* parallel to the occult line *AB*; make the gnomon, and ſet the hours to their reſpective lines, as in fig. 2. and the dial will be finiſhed.

There are ſeveral kinds of dials, which are called *univerſal*, becauſe they ſerve for all latitudes. Of theſe, the beſt is Mr Pardie's, (Plate LXX. fig. 4.) which conſiſts of three principal parts; the firſt whereof is called the horizontal plane (*A*), becauſe in practice it muſt be parallel to the horizon. In this plane is fixed an upright pin, which enters into the edge of the ſecond part *BD*, called the meridional plane; which is made of two pieces, the loweſt whereof (*B*) is called the quadrant, becauſe it contains a quarter of a circle, divided into 90 degrees; and it is only into this part, near *B*, that the pin enters. The other piece is a ſemicircle (*D*) adjuſted to the quadrant, and turning in it by a groove, for raiſing or depreſſing the diameter (*EF*) of the ſemicircle, which diameter is called the axis of the inſtrument. The third piece is a circle (*G*), divided on both ſides into 24 equal parts, which are the hours. This circle is put upon the meridional plane ſo, that the axis (*EF*) may be perpendicular to the circle, and the point *C* be the common centre of the circle, ſemicircle, and quadrant. The ſtraight edge of the ſemicircle is chamfered on both ſides to a ſharp edge, which paſſes through the centre of the circle. On one ſide of the chamfered part, the firſt ſix months of the year are laid down, according to the ſun's declination for their reſpective days, and on the other other ſide the laſt ſix months. And againſt the days on which the ſun enters the ſigns, there are ſtraight lines drawn upon the ſemicircle, with the characters of the ſigns marked upon them. There is a black line drawn along the middle of the upright edge of the quadrant, over which hangs a thread (*H*), with its plummet (*I*), for levelling the inſtrument. *N. B.* From the twenty-third of September to the twentieth of March, the upper ſurface of the circle muſt touch both the centre *C* of the ſemicircle, and the line of ♈ and ♎; and from the twentieth of March to the twenty-third of September, the lower ſurface of the circle muſt touch that centre and line.

To

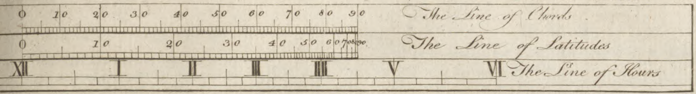


Fig. 2.

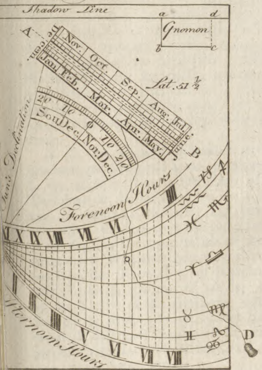


Fig. 1.

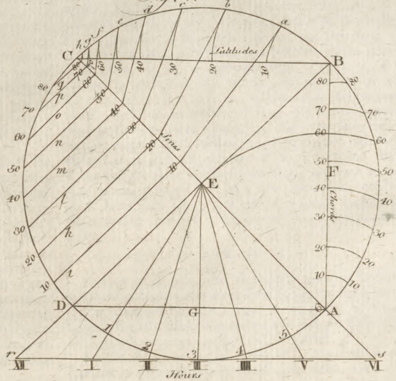


Fig. 6.

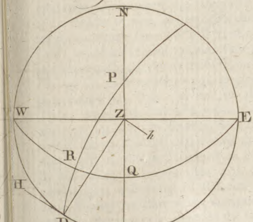


Fig. 4.

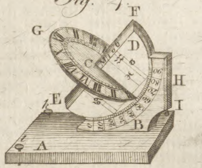


Fig. 3.

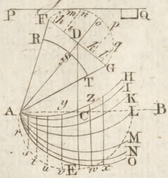


Fig. 7.

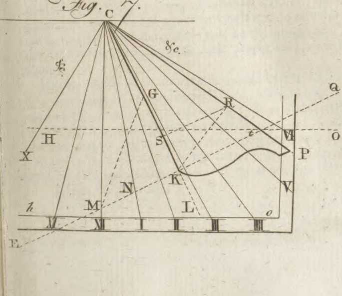
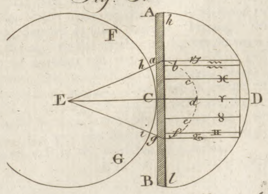


Fig. 5.



A Bell Sc.

To find the time of the day by this dial. Having set it on a level place in sun-shine, and adjusted it by the leveling screws *k* and *l*, until the plumb-line hangs over the black line upon the edge of the quadrant, and parallel to the said edge; move the semicircle in the quadrant, until the line of ♈ and ♎ (where the circle touches) comes to the latitude of your place in the quadrant: then turn the whole meridional plane *BD*, with its circle *G*, upon the horizontal plane *A*, until the edge of the shadow of the circle falls precisely on the day of the month in the semicircle; and then, the meridional plane will be due north and south, the axis *EF* will be parallel to the axis of the world, and will cast a shadow upon the true time of the day, among the hours on the circle.

N. B. As, when the instrument is thus rectified, the quadrant and semicircle are in the plane of the meridian, so the circle is then in the plane of the equinoctial. Therefore, as the sun is above the equinoctial in summer (in northern latitudes) and below it in winter; the axis of the semicircle will cast a shadow on the hour of the day, on the upper surface of the circle, from the twentieth of March to the twenty-third of September: and from the twenty-third of September to the twentieth of March, the hour of the day will be determined by the shadow of the semicircle, upon the lower surface of the circle. In the former case, the shadow of the circle falls upon the day of the month, on the lower part of the diameter of the semicircle; and in the latter case, on the upper part.

The method of laying down the months and signs upon the semicircle is as follows. Draw the right line *ACB*, equal to the diameter of the semicircle *ADB*, and cross it in the middle at right angles with the line *ECD*, equal in length to *ADB*; then *EC* will be the radius of the circle *FCG*, which is the same as that of the semicircle. Upon *E*, as a centre, describe the circle *FCG*, on which set off the arcs *Ch* and *Ci*, each equal to $23\frac{1}{2}$ degrees, and divide them accordingly into that number, for the sun's declination. Then, laying the edge of a ruler over the centre *E*, and also over the sun's declination for every fifth day of each month (as in the card dial) mark the points on the diameter *AB* of the semicircle from *a* to *g*, which are cut by the ruler; and *there* place the days of the months accordingly, answering to the sun's declination. This done, setting one foot of the compasses in *C*, and extending the other to *a* or *g*, describe the semicircle *a b c d e f g*; which divide into six equal parts, and through the points of division draw right lines, parallel to *CD*, for the beginning of the signs (of which one half are on one side of the semicircle, and the other half on the other) and set the characters of the signs to their proper lines, as in the figure.

Having shewn how to make sun-dials by the assistance of a good globe, or of a dialing-scale, we shall now proceed to the method of constructing dials arithmetically; which will be more agreeable to those who have learned the elements of trigonometry, because globes and scales can never be so accurate as the logarithms in finding the angular distances of the hours. Yet, as a globe may be found exact enough for some other requisites in dialing, we shall take it in occasionally.

The construction of sun-dials on all planes whatever, may be included in one general rule: intelligible, if that of a horizontal dial for any given latitude be well understood. For there is no plane, however obliquely situated with respect to any given place, but what is parallel to the horizon of some other place; and therefore, if we can find that other place by a problem on the terrestrial globe, or by a trigonometrical calculation, and construct a horizontal dial for it; that dial, applied to the plane where it is to serve, will be a true dial for that place.——Thus, an erect direct south dial in $51\frac{1}{2}$ degrees north latitude, would be a horizontal dial on the same meridian, 90 degrees southward of $51\frac{1}{2}$ degrees north latitude; which falls in with $38\frac{1}{2}$ degrees of south latitude. But if the upright plane declines from facing the south at the given place, it would still be a horizontal plane 90 degrees from that place, but for a different longitude, which would alter the reckoning of the hours accordingly.

CASE I.

1. Let us suppose, that an upright plane at London declines 36 degrees westward from facing the south; and that it is required to find a place on the globe, to whose horizon the said plane is parallel; and also the difference of longitude between London and that place.

Rectify the globe to the latitude of London, and bring London to the zenith under the brass meridian, then that point of the globe which lies in the horizon at the given degree of inclination (counted westward from the south point of the horizon) is the place at which the above-mentioned plane would be horizontal.——Now, to find the latitude and longitude of that place, keep your eye upon the place, and turn the globe eastward, until it comes under the graduated edge of the brass meridian; then, the degrees of the brass meridian that stands directly over the place, is its latitude; and the number of degrees in the equator, which are intercepted between the meridian of London and the brass meridian, is the place's difference of longitude.

Thus, as the latitude of London is $51\frac{1}{2}$ degrees north, and the declination of the place is 36 degrees west; elevate the north pole $51\frac{1}{2}$ degrees above the horizon, and turn the globe until London comes to the zenith, or under the graduated edge of the meridian; then count 36 degrees on the horizon westward from the south point, and make a mark on that place of the globe over which the reckoning ends, and bringing the mark under the graduated edge of the brass meridian, it will be found to be under $30\frac{1}{4}$ degrees in south latitude: keeping it there, count in the equator the number of degrees between the meridian of London and the brasen meridian (which now becomes the meridian of the required place) and you will find it to be $42\frac{3}{4}$. Therefore an upright plane at London, declining 36 degrees westward from the south, would be a horizontal plane at that place, whose latitude is $30\frac{1}{4}$ degrees south of the equator, and longitude $42\frac{3}{4}$ degrees west of the meridian of London.

Which difference of longitude being converted into time, is 2 hours 51 minutes.

The vertical dial declining weſtward 36 degrees at London, is therefore to be drawn in all reſpects as a horizontal dial for ſouth latitude $30\frac{1}{4}$ degrees; ſave only, that the reckoning of the hours is to anticipate the reckoning on the horizontal dial, by 2 hours 51 minutes: for ſo much ſooner will the ſun come to the meridian of London, than to the meridian of any place whoſe longitude is $42\frac{3}{4}$ degrees weſt from London.

2. But to be more exact than the globe will ſhew us, we ſhall uſe a little trigonometry.

Let $NESW$ (Plate LXX. fig. 6.) be the horizon of London, whoſe zenith is Z, and P the north pole of the ſphere; and let Zh be the poſition of a vertical plane at Z, declining weſtward from S (the ſouth) by an angle of 36 degrees; on which plane an erect dial for London at Z is to be deſcribed. Make the ſemidiameter ZD perpendicular to Zh, and it will cut the horizon in D, 36 degrees weſt of the ſouth S. Then a plane, in the tangent HD, touching the ſphere in D, will be parallel to the plane Zh; and the axis of the ſphere will be equally inclined to both theſe planes.

Let $W\mathfrak{Q}E$ be the equinoctial, whoſe elevation above the horizon of Z (London) is $38\frac{1}{2}$ degrees; and PRD be the meridian of the place D, cutting the equinoctial in R. Then it is evident, that the arc RD is the latitude of the place D (where the plane Zh would be horizontal) and the arc $R\mathfrak{Q}$ is the difference of longitude of the planes Zh and DH.

In the ſpherical triangle WDR, the arc WD is given, for it is the complement of the plane's declination from S to ſouth; which complement is 54° (viz. $90^\circ - 36^\circ$:) the angle at R, in which the meridian of the place D cuts the equator, is a right angle; and the angle RWD meaſures the elevation of the equinoctial above the horizon of Z, namely, $38\frac{1}{2}$ degrees. Say therefore, as radius is to the co-ſine of the plane's declination from the ſouth, ſo is the co-ſine of the latitude of Z to the ſine of RD the latitude of D: which is of a different denomination from the latitude of Z, becauſe Z and D are on different ſides of the equator.

As radius - - - - -		10.00000
To co-ſine $36^\circ\ 0' = R\mathfrak{Q}$		9.90796
So co-ſine $51^\circ\ 30' = \mathfrak{Q}Z$		9.79415

To ſine $30^\circ\ 14' = DR$ (9.70211) = the lat. of D, whoſe horizon is parallel to the vertical plane $Z\ h$ at Z.

N. B. When radius is made the firſt term, it may be omitted, and then, by ſubtracting it mentally from the ſum of the other two, the operation will be ſhortened. Thus, in the preſent caſe,

To the logarithmic ſine of $WR = {}^*\ 54^\circ\ 0'$	9.90796
Add the logarithmic ſine of $RD = \dagger\ 38^\circ\ 30'$	9.79415
Their ſum — radius - - - - - - - -	9.70211

give the ſame ſolution as above. And we ſhall keep to this method in the following part of this article.

To find the difference of longitude of the places D and Z, ſay, as radius is to the co-ſine of $38\frac{1}{2}$ degrees, the height of the equinoctial at Z, ſo is the co-tangent of 36 degrees, the plane's declination, to the co tangent of the difference of longitudes. Thus,

To the logarithmic ſine of * $51^\circ\ 30'$	9.89354
Add the logarithmic tang. of † $54^\circ\ 0'$	10.13874
Their ſum — radius - - - - - - -	10.013228

is the neareſt tangent of $47^\circ\ 8' = WR$; which is the co-tangent of $42^\circ\ 52' = R\mathfrak{Q}$, the difference of longitude ſought. Which difference, being reduced to time, is two hours $51\frac{1}{2}$ minutes.

3. And thus having found the exact latitude and longitude of the place D, to whoſe horizon the vertical plane at Z is parallel, we ſhall proceed to the conſtruction of a horizontal dial for the place D, whoſe latitude is $30^\circ\ 14'$ ſouth; but anticipating the time at D by 2 hours 51 minutes (neglecting the $\frac{1}{2}$ minute in practice) becauſe D is ſo far weſtward in longitude from the meridian of London; and this will be a true vertical dial at London, declining weſtward 36 degrees.

Aſſume any right line CSL, (Plate LXX fig. 7.) for the ſubſtile of the diale, and make the angle KCP equal to the latitude of the place (viz. $30^\circ\ 14'$) To whoſe horizon the plane of the dial is parallel; then CRP will be the axis of the ſtile, or edge that caſts the ſhadow on the hours of the day, in the dial. This done, draw the contingent line $E\mathfrak{Q}$, cutting the ſubſtilar line at right angles in K; and from K make KR perpendicular to the axis CRP. Then KG (=KR) being made radius, that is, equal to the chord of 60° or tangent of 45° on a good ſector, take $42^\circ\ 52'$ (the difference of longitude of the places Z and D) from the tangents, and having ſet it from K to M, draw CM for the hour-line of XII. Take KN, equal to the tangent of an angle leſs by 15° degrees than KM; that is, the tangent $27^\circ\ 52'$; and through the point N draw CN for the hour line of I. The tangent of $12^\circ\ 52'$ (which is 15° leſs than $27^\circ\ 52'$) ſet off the ſame way, will give a point between K and N, through which the hour-line of II is to be drawn. The tangent of $2^\circ\ 8'$ (the difference between 45° and $42^\circ\ 52'$) placed on the other ſide of CL, will determine the point through which the hour-line of III is to be drawn: to which $2^\circ\ 8'$, if the tangent of 15° be added, it will make $17^\circ\ 8'$; and this ſet off from K towards $\mathfrak{Q}$ on the line $E\mathfrak{Q}$, will give a point for the hour-line of IIII: and ſo of the reſt.—The forenoon hour lines are drawn the ſame way, by the continual addition of the tangents 15°, 30°, 45°, &c. to $42^\circ\ 52'$ (=the tangent of KM) for the hours of XI, X, IX, &c. as far as neceſſary; that is, until there be five hours on each ſide of the ſubſtile. The ſixth hour, accounted from that hour or part of the hour on which the ſubſtile falls, will be always in a line perpendicular to the ſubſtile, and drawn through the center C.

4.

* The co-ſine of 36. 0. or of $R\mathfrak{Q}$.
† The co-ſine of 51. 30. or of $\mathfrak{Q}Z$.

* The co-ſine of 38. 30. or of WDR.
† The co-tangent of 36. 0, or of DW.

4. In all erect dials, CM, the hour-line of XII, is perpendicular to the horizon of the place for which the dial is to ferve: for that line is the interfection of a vertical plane with the plane of the meridian of the place, both which are perpendicular to the plane of the horizon: and any line HO, or ho, perpendicular to CM, will be a horizontal line on the plane of the dial, along which line the hours may be numbered; and CM being fet perpendicular to the horizon, the dial will have its true pofition.

5. If the plane of the dial had declined by an equal angle toward the eaft, its defcription would have differed only in this, that the hour-line of XII would have fallen on the other fide of the fubftile CL, and the line HO would have a fubcontrary pofition to what it has in this figure.

6. And thefe two dials, with the upper points of their ftiles turned toward the north pole, will ferve for other two planes parallel to them; the one declining from the north toward the eaft, and the other from the north toward the weft, by the fame quantity of angle. The like holds true of all dials in general, whatever be their declination and obliquity of their planes to the horifon.

CASE II.

7. If the plane of the dial not only *declines*, but alfo *reclins*, or *inclines* Suppofe its declination from fronting the fouth S, (Plate LXXI. fig. 1.) be equal to the arc SD on the horizon; and its reclination be equal to the arc Dd of the vertical circle DZ: then it is plain, that if the quadrant of altitude ZdD on the globe cuts the point D in the horizon, and the reclination is counted upon the quadrant from D to d; the interfection of the hour circle PRd, with the equinoctial WQE, will determine Rd, the latitude of the place d, whofe horizon is parallel to the given plane at Z; and RQ will be the difference in longitude of the planes at d and Z.

Trigonometrically thus: let a great circle pafs through the three points W, d, E; and in the triangle WDd, right-angled at D, the fides WD and Dd are given; and thence the angle DWd is found, and fo is the hypothenufe Wd. Again, the difference, or the fum, of DWd and DWR, the elevation of the equinoctial above the horizon of Z, gives the angle dWR; and the hypothenufe of the triangle WRd was juft now found; whence the fides Rd and WR are found, the former being the latitude of the place d, and the latter the complement of RQ, the difference of longitude fought.

Thus, if the latitude of the place Z be 52° 10′ north; the declination SD of the plane Zh (which would be horizontal at d) be 36°, and the reclination be 15°, or equal to the arc Dd; the fouth latitude of the place d, that is, the arc Rd, will be 15° 9′; and RQ, the difference of longitude, 36° 2′. From thefe data, therefore, let the dial (fig. 2.) be defcribed, as in the former example.

9. There are feveral other things requifite in the practice of dialing; the chief of which fhall be given in the form of arithmetical rules, fimple and eafy to thofe who have learned the elements of trigonometry. For in practical arts of this kind, arithmetick fhould be ufed as far as it can go; and fcales never trufted to, except in the final conftruction, where they are abfolutely neceffary in laying down the calculated hour-diftances on the plain of the dial.

RULE I. *To find the angles which the hour-lines on any dial make with the fubftile.*

To the logarithmic fine of the given latitude, or of the ftile's elevation above the plane of the dial, add the logarithmic tangent of the hour * diftance from the meridian, or from the † fubftile; and the fum *minus* radius will be the logarithmic tangent of the angle fought.

For, in fig. 7. Plate LXX. KC is to KM in the ratio compounded of the ratio of KC to KG ($=KR$) and of KG to KM; which, making CK the radius 10,000000, or 10,0000, or 10, or 1, are the ratio of 10,000000, or of 10,0000, or of 10, or of 1, to $KG \times KM$.

Thus, in a horizontal dial, for latitude 51° 30′, to find the angular diftance of XI in the forenoon, or I in the afternoon, from XII.

To the logarithmic fine of 51° 30′	9.89354 ‡
Add the logarithmic tang. of 15° 0′	9.42805
The fum — radius is - - - - - -	9.32159

=the logarithmic tangent of 11° 50′, or of the angle which the hour-line of XI or I makes with the hour of XII.

And by computing in this manner, with the fine of the latitude, and the tangents of 30, 45, 60, and 75°, for the hours of II, III, IIII, and V in the afternoon; or of X, IX, VIII, and VII in the forenoon; you will find their angular diftances from XII to be 24° 18′, 38° 3′, 53° 35′ and 71° 6′; which are all that there is occafion to compute for.——And thefe diftances may be fet off from XII by a line of chords; or rather, by taking 1000 from a fcale of equal parts, and fetting that extent as a radius from C to XII; and then, taking 209 of the fame parts (which, in the tables, are the natural tangent of 11° 50′) and fetting them from XII to XI and to I, on the line ho, which is perpendicular to CXII: and fo for the reft of the hour-lines, which, in the table of natural tangents, againft the above diftances, are 451, 782, 1355, and 2920, of fuch equal parts from XII, as the radius CXII contains 1000. And laftly, fet off 1257 (the natural tangent of 51° 30′) for the angle of the ftile's height, which is equal to the latitude of the place.

RULE II. *The latitude of the place, the fun's declination, and his hour-diftance from the meridian, being given; to find* (1.) *his altitude*; (2.) *his azimuth.*

1. Let

* That is, of 15, 30, 45, 60, 75°, for the hours of I, II, III, IIII, V in the afternoon; and XI, X, IX, VIII, VII in the afternoon. † In all horizontal dials, and erect north or fouth dials, the fubftile and meridian are the fame: but in all declining dials, the fubftile line makes an angle with the meridian. ‡ In which cafe, the radius CK is fuppofed to be divided into 1000000 equal parts.

1. Let d, (Plate LXXI. fig. 1.) be the ſun's place, dR, his declination; and in the triangle PZd, Pd the ſum, or the difference, of dR, and the quadrant PR, being given by the ſuppoſition, as alſo the complement of the latitude PZ, and the angle dPZ, which meaſures the horary diſtance of d from the meridian; we ſhall (by Caſe 4. of Keill's oblique ſpheric Trigonometry) find the baſe Zd, which is the ſun's diſtance from the zenith, or the complement of his altitude.

And (2.) As ſine Zd: ſine Pd : : $dPZ : dZP$, or of its ſupplement DZS, the azimuthal diſtance from the ſouth.

Or, the practical rule may be as follows.

Write A for the ſign of the ſun's altitude, L and l for the ſine and co-ſine of the latitude, D and d for the ſine and co-ſine of the ſun's declination, and H for the ſine of the horary diſtance from VI.

Then the relation of H to A will have three varieties.

1. When the declination is toward the elevated pole, and the hour of the day is between XII and VI; it is $A = LD + Hld$, and $H = \frac{A - LD}{ld}$

2. When the hour is after VI, it is $A = LD - Hld$ and $\frac{LD + A}{ld}$

3. When the declination is toward the depreſſed pole, we have $A = Hld - LD$, and $H = \frac{A + LD}{ld}$.

Which theorems will be found uſeful, and expeditious enough for ſolving thoſe problems in geography and dialing, which depend on the relation of the ſun's altitude to the hour of the day.

EXAMPLE I.

Suppoſe the latitude of the place to be $51\frac{1}{2}$ degrees north: the time five hours diſtant from XII, that is, an hour after VI in the morning, or before VI in the evening; and the ſun's declination 20° north. *Required the ſun's altitude?*

Then to log. L = log. ſin. 51° 30′	1.89354*	
add log. D = log. ſin. 20° 0′	1.53405	
Their ſum	1.42759	gives

LD = logarithm of 0.267664, in the natural ſines.

And, to log. H = log. ſin. † 15° 0′	1.41300	
add { log. l = log. ſin. ‡ 38° 0′	1.79415	
add { log. d = log. ſin. * 70° 0′	1.97300	
Their ſum	1.18015	gives

Hld = logarithm of 0.151408, in the natural ſines.

And theſe two numbers (0.267664 and 0.151408) make 0.419072 = A; which, in the table, is the neareſt natural ſine of 24° 47′, the ſun's altitude ſought.

The ſame hour-diſtance being aſſumed on the other ſide of VI, then $LD - Hld$ is 0.116256, the ſine of 6° $40'\frac{1}{2}$; which is the ſun's altitude at V in the morning, or VII in the evening, when his north declination is 20°.

But when the declination is 20° ſouth (or towards the depreſſed pole) the difference $Hld - LD$ becomes negative, and thereby ſhews that, an hour before VI in the morning, or paſt VI in the evening, the ſun's center is 6° $40'\frac{1}{2}$ below the horizon.

EXAMPLE II.

From the ſame *data* to find the ſun's *azimuth*.

If H, L and D are given, then (by par. 2. of Rule II.) from H having found the altitude and its complement Zd; and the arc Pd (the diſtance from the pole) being given; ſay, As the co-ſine of the altitude is to the ſine of the diſtance from the pole, ſo is the ſine of the hour-diſtance from the meridian to the ſine of the azimuth diſtance from the meridian.

Let the latitude be 51° 30′ north, the declination 15° 9′ ſouth, and the time II h. 24. m. in the afternoon, when the ſun begins to illuminate a vertical wall, and it is required to find the poſition of the wall.

Then, by the foregoing theorems, the complement of the altitude will be 81° $32'\frac{1}{2}$, and Pd the diſtance from the pole being 109° 5′, and the horary diſtance from the meridian, or the angle dPZ, 36°.

To log. ſin. 74° 51′ - - - -	1.98464
Add log. ſin. 36° 0′ - - - -	1.76922
And from the ſum - - - - -	1.75386
Take the log. ſin. 81° $32'\frac{1}{2}$ - -	1.99525
Remains	1.75861 = log. ſin.

35°, the azimuth diſtance ſought.

When the altitude is given, find from thence the hour, and proceed as above.

This praxis is of ſingular uſe on many occaſions; in finding the declination of vertical planes more exactly than in the common way, eſpecially if the tranſits of the ſun's center is obſerved by applying a ruler with ſights, either plain or teleſcopical, to the wall or plane, whoſe declination is required.—In drawing a meridian line, and finding the magnetic variation —In finding the bearings of places in terreſtrial ſurveys; the tranſits of the ſun over any place, or his horizontal diſtance from it being obſerved, together with the altitude and hour.—And thence determining ſmall differences of longitude.—In obſerving the variation at ſea, *&c.*

Of the double horizontal dial; *and the* Babylonian *and* Italian *dials*.

To the *gnomonic* projection, there is ſometimes added a *ſtereographic* projection of the hour-circles, and the parallels of the ſun's declination, on the ſame horizontal plane; the upright ſide of the gnomon being ſloped into an edge, ſtanding perpendicularly over the center of the projection: ſo that the dial, being in its due poſition, the ſhadow

* Here we conſider the radius as unity, and not 10,00000, by which, inſtead of the index 9, we have—1, as above; which is of no farther uſe, than making the work a little eaſier.

† The diſtance of one hour from VI.

‡ The co-latitude of the place.

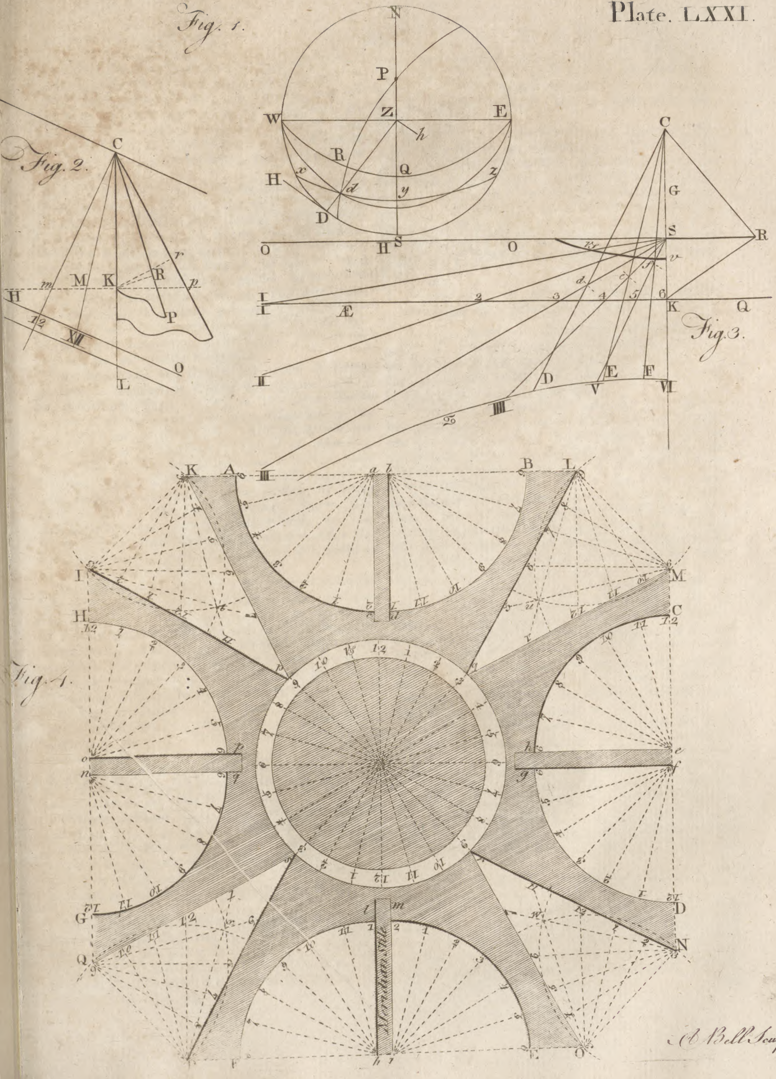
* The co-declination of the ſun.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



A. Bell Sculp.

ſhadow of *that* perpendicular edge is a vertical circle paſſing through the ſun, in the ſtereographic projection.

The months being duly marked on this dial, the ſun's declination, and the length of the day at any time, are had by inſpection (as alſo his altitude, by means of a ſcale of tangents.) But its chief property is, that it may be placed true, whenever the ſun ſhines, without the help of any other inſtrument.

Let d (Plate LXXI. fig. 1.) be the ſun's place in the ſtereographic projection, $x\ d\ y\ z$ the parallel of the ſun's declination. $Z\ d$ a vertical circle through the ſun's center, Pd the hour-circle; and it is evident, that the diameter NS of this projection being placed duly north and ſouth, theſe three circles will paſs through the point d. And therefore, to give the dial its due poſition, we have only to turn its gnomon toward the ſun, on a horizontal plane, until the hour on the common gnomonic projection coincides with that marked by the hour-circle $P\ d$, which paſſes through the interſection of the ſhadow $Z\ d$ with the circle of the ſun's preſent declination.

The *Babylonian* and *Italian* dials reckon the hours, not from the meridian, as with us, but from the ſun's riſing and ſetting. Thus, in *Italy*, an hour before ſun-ſet is reckoned the 23d hour; two hours before ſun-ſet, the 22d hour; and ſo of the reſt. And the ſhadow that marks them on the hour-lines, is *that* of the point of a ſtile. This occaſions a perpetual variation between their dials and clocks, which they muſt correct from time to time, before it ariſes to any ſenſible quantity, by ſetting their clocks ſo much faſter or ſlower. And in *Italy*, they begin their day, and regulate their clocks, not from ſun-ſet, but from about mid-twilight, when the *Ave Maria* is ſaid; which corrects the difference that would otherwiſe be betwcen the clock and the dial.

The improvements which have been made in all ſorts of inſtruments and machines for meaſuring time, have rendered ſuch dials of little acconnt. Yet, as the theory of them is ingenious, and they are really, in ſome reſpects, the beſt contrived of any for vulgar uſe, a general idea of their deſcription may not be unacceptable.

Let fig. 5. repreſent an erect ſouth wall, on which a *Babylonian dial* is to be drawn, ſhewing the hours from ſun-riſing; the latitude of the place, whoſe horizon is parallel to the wall, being equal to the angle KCR. Make, as for a common dial, $KG=KR$ (which is perpendicular to CR) the radius of the equinoctial $Æ\mathcal{Q}$, and draw RS perpendicular to $C\ K$ for the ſtile of the dial; the ſhadow of whoſe point R is to mark the hours, when $S\ R$ is ſet upright on the plane of the dial.

Then it is evident, that, in the contingent line $Æ\mathcal{Q}$, the ſpaces K 1, K 2, K 3, &c. being taken equal to the tangents of the hour-diſtances from the meridian, to the radius KG, one, two, three, &c. hours after ſun-riſing, on the equinoctial day; the ſhadow of the point R will be found, at theſe times, reſpectively in the points, 1, 2, 3, &c.

Draw, for the like hours after ſun-riſing, when the ſun is in the tropic of Capricorn ♑ V, the like common lines CD, CE, CF, &c. and at theſe hours the ſhadow of the point R will be found in thoſe lines reſpectively. Find the ſun's altitudes above the plane of the dial at theſe hours, and with their co-tangents $S\ d$, $S\ e$, $S\ f$, &c. to radius $S\ R$, deſcribe arcs interſecting the hour-lines in the points d, e, f, &c. ſo ſhall the right lines 1 d, 2 e, 3 f, &c. be the lines of I, II, III, &c. hours after ſun-riſing.

The conſtruction is the ſame in every other caſe, due regard being had to the difference of longitude of the place at which the dial would be horizontal, and the place for which it is to ſerve: And likewiſe, taking care to draw no lines but what are neceſſary; which may be done partly by the rules already given for determining the time that the ſun ſhines on any plane; and partly from this, that on the tropical days, the hyperbola deſcribed by the ſhadow of the point R limits the extent of all the hour-lines.

Of the right placing of dials, and having a true meridian line for the regulating of clocks and watches.

The plane on which the dial is to reſt being duly prepared, and every thing neceſſary for fixing it, you may find the hour tolerably exact by a large equinoctial ring-dial, and ſet your watch to it. And then the dial may be fixed by the watch at your leiſure.

If you would be more exact, take the ſun's altitude by a good quadrant, noting the preciſe time of obſervation by a clock or watch. Then compute the time for the altitude obſerved, and ſet the watch to agree with that time, according to the ſun. A *Hadley*'s quadrant is very convenient for this purpoſe; for, by it you may take the angle between the ſun and his image reflected from a baſon of water; the half of which angle, ſubtracting the refraction, is the altitude required. This is beſt done in ſummer, and the nearer the ſun is to the prime vertical (the eaſt or weſt azimuth) when the obſervation is made, ſo much the better.

Or, in ſummer, take two equal altitudes of the ſun in the ſame day; one any time between 7 and 10 in the morning, the other between 2 and 5 in the afternoon; noting the moments of theſe two obſervations by a clock or watch: and if the watch ſhews the obſervations to be at equal diſtances from noon, it agrees exactly with the ſun: if not, the watch muſt be corrected by half the difference of the forenoon and afternoon intervals; and then the dial may be ſet true by the watch.

Thus, for example, ſuppoſe you had taken the ſun's altitude when it was 20 minutes paſt VIII in the morning by the watch; and found, by obſerving in the afternoon, that the ſun had the ſame altitude 10 minutes before IIII; then it is plain, that the watch was 5 minutes too faſt for the ſun: for 5 minutes after XII is the middle time between VIII h. 20 m. in the morning, and III h. 50 m. in the afternoon; and therefore, to make the watch agree with the ſun, it muſt be ſet back five minutes.

A good *meridian line*, for regulating clocks or watches, may be had by the following method.

Make a round hole, almoſt a quarter of an inch diameter, in a thin plate of metal; and fix the plate in the top of a ſouth window, in ſuch a manner, that it may recline from the zenith at an angle equal to the co-latitude of your place, as nearly as you can gueſs: for then the

the plate will face the sun directly at noon on the equinoctial days. Let the sun shine freely through the hole into the room; and hang a plumb-line to the cieling of the room, at least five or six feet from the window, in such a place as that the sun's rays, transmitted through the hole, may fall upon the line when it is noon by the clock; and having marked the said place on the cieling, take away the line.

Having adjusted a sliding bar to a dove-tail groove, in a piece of wood about 18 inches long, and fixed a hook into the middle of the bar, nail the wood to the above-mentioned place on the cieling, parallel to the side of the room in which the window is; the groove and bar being towards the floor. Then, hang the plumb-line upon the hook in the bar, the weight or plummet reaching almost to the floor; and the whole will be prepared for farther and proper adjustment.

This done, find the true solar time by either of the two last methods, and thereby regulate your clock. Then, at the moment of next noon by the clock, when the sun shines, move the sliding-bar in the groove, until the shadow of the plumb-line bisects the image of the sun (made by his rays transmitted through the hole) on the floor, wall, or on a white screen placed on the north side of the line; the plummet or weight at the end of the line hanging freely in a pail of water placed below it on the floor.—But because this may not be quite correct for the first time, on account that the plummet will not settle immediately, even in water; it may be farther corrected on the following days, by the above method, with the sun and clock; and so brought to a very great exactness.

N.B. The rays transmitted through the hole, will cast but a faint image of the sun, even on a white screen, unless the room be so darkened that no sunshine may be allowed to enter, but what comes through the small hole in the plate. And always, for some time before the observation is made, the plummet ought to be immersed in a jar of water, where it may hang freely; by which means the line will soon become steady, which otherwise would be apt to continue swinging.

An universal dial, shewing the hours of the day by a terrestrial globe, and by the shadows of several gnomons, at the same time: together with all the places of the earth which are then enlightened by the sun; and those to which the sun is then rising, or on the meridian, or setting.

This dial (see Plate LXXII.) is made of a thick square piece of wood, or hollow metal. The sides are cut into semicircular hollows, in which the hours are placed; the stile of each hollow coming out from the bottom thereof, as far as the ends of the hollows project. The corners are cut out into angles, in the insides of which the hours are also marked; and the edge of the end of each side of the angle serves as a stile for casting a shadow on the hours marked on the other side.

In the middle of the uppermost side, or plane, there is an equinoctial dial; in the centre whereof an upright wire is fixt, for casting a shadow on the hours of that dial, and supporting a small terrestrial globe on its top.

The whole dial stands on a pillar, in the middle of a round horizontal board, in which there is a compass and magnetic needle, for placing the *meridian* stile toward the south. The pillar has a joint with a quadrant upon it, divided into 90 degrees (supposed to be hid from sight under the dial in the figure) for setting it to the latitude of any given place; the same way as already described in the dial on the cross.

The equator of the globe is divided into 24 equal parts, and the hours are laid down upon it at these parts. The time of the day may be known by these hours, when the sun shines upon the globe.

To rectify and use this dial, set it on a level table, or sole of the window, where the sun shines, placing the meridian stile due south, by means of the needle; which will be, when the needle points as far from the north fleur-de-lis toward the west, as it declines westward, at your place. Then bend the pillar in the joint, till the black line on the pillar comes to the latitude of your place in the quadrant.

The machine being thus rectified, the plane of its dial-part will be parallel to the equator, the wire or axis that supports the globe will be parallel to the earth's axis, and the north pole of the globe will point toward the north pole of the heavens.

The same hour will then be shewn in several of the hollows, by the ends of the shadows of their respective stiles: the axis of the globe will cast a shadow on the same hour of the day, in the equinoctial dial, in the centre of which it is placed, from the 20th of March to the 23d of September; and, if the meridian of your place on the globe be set even with the meridian stile, all the parts of the globe that the sun shines upon, will answer to those places of the real earth which are then enlightened by the sun. The places where the shade is just coming upon the globe, answer to all those places of the earth to which the sun is then setting; as the places where it is going off, and the light coming on, answer to all the places of the earth where the sun is then rising. And lastly, if the hour of VI be marked on the equator in the meridian of your place (as it is marked on the meridian of London in the figure) the division of the light and shade on the globe will shew the time of the day.

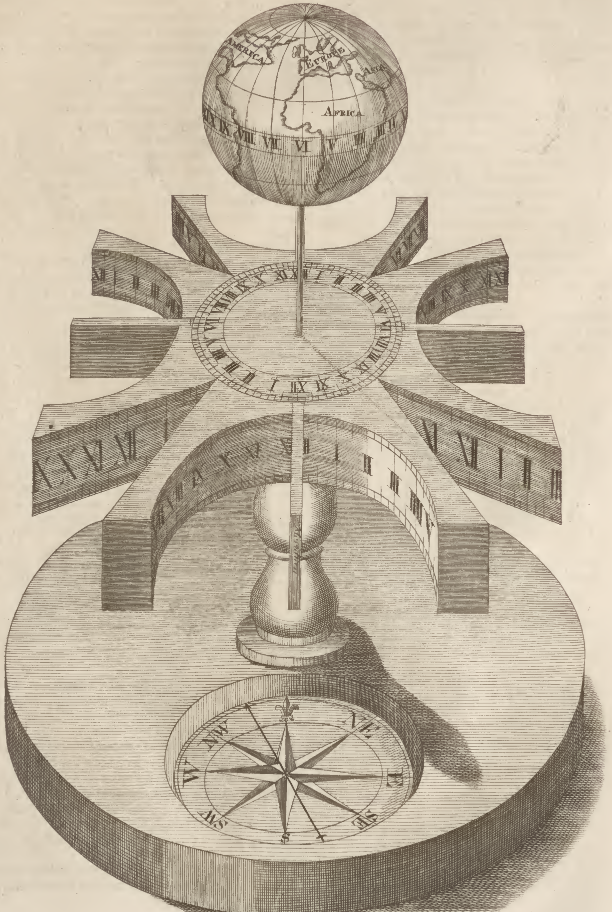
The northern stile of the dial (opposite to the southern or meridian one) is hid from sight in the figure, by the axis of the globe. The hours in the hollow to which that stile belongs, are also supposed to be hid by the oblique view of the figure: but they are the same as the hours in the front-hollow. Those also in the right and left hand semicircular hollows are mostly hid from sight; and so also are all those on the sides next the eye of the four acute angles.

The construction of this dial is as follows: (See Plate LXXI. fig. 4.)

On a thick square piece of wood, or metal, draw the lines *a c* and *b d*, as far from each other as you intend for the thickness of the stile *a b c d*; and in the same manner, draw the like thickness of the other three stiles, *e f g h*, *i k l m*, and *n o p q*, all standing outright as from the centre.

With any convenient opening of the compasses, as *a A* (so as to leave proper strength of stuff when *K I* is equal to

Plate LXXII.



A. Bell. sc.

to $a\ A$) ſet one foot in a, as a centre, and with the other foot deſcribe the quadrantal arc Ac. Then, without altering the compaſſes, ſet one foot in b as a centre, and with the other foot deſcribe the quadrant dB. All the other quadrants in the figure muſt be deſcribed in the ſame manner, and with the ſame opening of the compaſſes, on their centres e, f; i, k; and n, o: and each quadrant divided into ſix equal parts, for ſo many hours, as in the figure; each of which parts muſt be ſubdivided into 4, for the half hours and quarters.

At equal diſtances from each corner, draw the right lines Ip and Kp, Lq and Mq, Nr and Or, Ps and Qs; to form the four angular hollows IpK, LqM, NrO, and PsQ; making the diſtances between the tips of theſe hollows, as IK, LM, NO, and PQ, each equal to the radius of the quadrants; and leaving ſufficient room within the angular points $p\ q\ r$ and s, for the equinoctial dial in the middle.

To divide the inſides of theſe angles properly, for the hour-ſpaces thereon; take the following method.

Set one foot of the compaſſes in the point I, as a centre, and open the other to K; and with that opening deſcribe the arc Kt: then, without altering the compaſſes, ſet one foot in K, and with the other foot deſcribe the arc It. Divide each of theſe arcs, from I and K to their interſection at t, into four equal parts; and from their centres I and K, through the points of diviſion, draw the right lines $I3$, $I4$, $I5$, $I6$, $I7$; and $K2$, $K1$, $K12$, $K11$; and they will meet the ſides Kp and Ip of the angle IpK where the hours thereon muſt be placed. And theſe hour-ſpaces in the arcs muſt be ſubdivided into four equal parts, for the half-hours and quarters.—Do the like for the other three angles, and draw the dotted lines, and ſet the hours in the inſides where thoſe lines meet them, as in the figure: and the like hour-lines will be parallel to each other in all the quadrants and in all the angles.

Mark points for all theſe hours on the upper ſide; and cut out all the angular hollows, and the quadrantal ones quite through the places where their four gnomons muſt ſtand; and lay down the hours on their inſides, as in Plate LXXII. and then ſet in their gnomons, which muſt be as broad as the dial is thick; and this breadth and thickneſs muſt be large enough to keep the ſhadows of the gnomons from ever falling quite out at the ſides of the hollows, even when the ſun's declination is at the greateſt.

Laſtly, draw the equinoctial dial in the middle, all the hours of which are equidiſtant from each other: and the dial will be finiſhed.

As the ſun goes round, the broad end of the ſhadow of the ſtile *acbd* will ſhew the hours in the quadrant Ac, from ſun-riſe till VI in the morning; the ſhadow from the end M will ſhew the hours on the ſide Lq from V to IX in the morning; the ſhadow of the ſtile *egfh* in the quadrant Dg (in the the long days) will ſhow the hours from ſun-riſe till VI in the morning; and the ſhadow of the end N will ſhew the morning hours, on the ſide Or, from III to VII.

Juſt as the ſhadow of the northern ſtile *abcd* goes off the quadrant Ac, the ſhadow of the ſouthern ſtile *iklm* begins to fall within the quadrant Fl, at VI in the morning; and ſhews the time, in that quadrant, from VI till XII at noon; and from noon till VI in the evening in the quadrant mE. And the ſhadow of the end O, ſhews the time from XI in the forenoon till III in the afternoon, on the ſide rN; as the ſhadow of the end P ſhews the time from IX in the morning till I o'clock in the afternoon, on the ſide Qs.

At noon, when the ſhadow of the eaſtern ſtile *efgh* goes off the quadrant hC (in which it ſhewed the time from VI in the morning till noon, as it did in the quadrant gD from ſun-riſe till VI in the morning) the ſhadow of the weſtern ſtile *nopq* begins to enter the quadrant Hp; and ſhews the hours thereon from XII at noon till VI in the evening; and after *that* till ſun-ſet, in the quadrant qG:, and the end Q caſts a ſhadow on the ſide Ps from V in the evening till IX at night, if the ſun be not ſet before that time.

The ſhadow of the end I ſhews the time on the ſide Kp from III till VII in the afternoon; and the ſhadow of the ſtile *abcd* ſhews the time from VI in the evening till the ſun ſets.

The ſhadow of the upright central wire, that ſupports the globe at top, ſhews the time of the day, in the middle or equinoctial dial, all the ſummer half year, when the ſun is on the north ſide of the equator.

DIALECT, an appellation given to the language of a province, in ſo far as it differs from that of the whole kingdom. The term, however, is more particularly uſed in ſpeaking of the ancient Greek, whereof there were four dialects, the Attic, Ionic, Æolic, and Doric, each of which was a perfect language in its kind, that took place in certain countries, and had peculiar beauties.

DIALOGISM, in rhetoric, is uſed for the ſoliloquy of perſons deliberating with themſelves. See SOLILOQUY.

DIALOGUE, in matters of literature, a converſation between two or more perſons, either by writing or by word of mouth.

Dialogue appears to be the moſt ancient form of writing, and is greatly recommended by ſeveral authors. The archbiſhop of Cambray, at the head of his paſtoral inſtruction, gives an account of the advantages of dialogue.

DIALTHÆA, in pharmacy, an unguent much uſed as a reſolvent, ſo called from althæa, or marſh-mallows, which is the principal ingredient in it. See ALTHÆA.

DIALYSIS, in grammar, a mark or character, conſiſting of two points, ¨, placed over two vowels of a word, in order to ſeparate them, becauſe otherwiſe they would make a diphthong, as Moſaïc, *&c.* See DIÆRESIS.

DIAMETER, in geometry, a right line paſſing through the center of a circle, and terminated at each ſide by the circumference thereof. See GEOMETRY.

DIAMOND, in natural hiſtory, a genus of precious ſtones, of a fine pellucid ſubſtance, of great hardneſs, never fouled by any admixture of earthy or any other coarſe matter, ſuſceptible of elegant tinges from metal-line

line particles, giving fire with ſteel, not fermenting with acid menſtruums, ſcarcely calcinable by any degree of fire, and of one ſimple and permanent appearance in all lights.

This is the moſt valuable and hardeſt of all gems; and though found of different ſhapes, and ſometimes accidentally tinged to ſeveral colours, yet ever carries the ſame diſtinguiſhing characters, and is very evidently in all thoſe ſtates the ſame body. It is, when pure, perfectly clear and pellucid as the pureſt water, and is eminently diſtinguiſhed from all other ſubſtances, by its vivid ſplendor, and the brightneſs of its reflections. It is extremely various in ſhape and ſize, being found in the greateſt quantity very ſmall, and the larger ones extremely ſeldom met with; the largeſt diamond certainly known ever to have been found is that in the poſſeſſion of the Great Mogul, which weighs 279 carats, and is computed to be worth 779,244 l.

The diamond has certainly one proper and determinate figure, into which it naturally muſt concrete, when in a ſtate of reſt and impeded by no other accident in its formation: the true figure then is an equilateral octohedron; and where ever it has concreted in a perfect manner, and without any interrupting accidents, it has always formed itſelf into this figure; and often in this its ſeveral ſurfaces are as bright as if poliſhed by art: but, as in common ſalt, though its figure be pyramidal, yet very eaſy accidents can determine it into cubes and parallellopipeds; ſo the diamond has often, in the ſtate of formation, been thrown into two other figures, both alſo ſeeming regular ones; the one a priſmatic columnar one of ſix angles ſomewhat emulating the figure of cryſtal, the other an oblong quadrilateral column with two truncated ends: theſe ſeem the only regular figures of this gem; but beſides theſe, it is every day found in numberleſs other misſhapen forms, often roundiſh, emulating the ſhape of pebbles, but full of ſmall flat planes or faces; frequently oblong, very often flat, and as often tapering, either from one end to the other, or elſe from the middle to both ends. A diamond bears the force of the ſtrongeſt fire, except the concentrated ſolar rays, without hurt; and even that infinitely fierceſt of all fires does it no injury, unleſs directed to its weaker parts.

It is a common thing for diamonds to be too thick or deep for the extent of their ſurface, and there is a certain proportion of depth, beyond which the gem ſhould not be allowed: in this caſe two diamonds are often made, by the regularly dividing one: this, when the maſs is of an angular figure, is done by cutting it through with a wire, wetted with oil, and covered with diamond-powder; but in the flat or more common maſſes, it is done much more expeditiouſly by finding the grain of the ſtone, and introducing the point of a fine flat chiſſel between them. This is not the only uſe of the ſplitting; for when a diamond has a flaw or blemiſh in it, which greatly debaſes its value, the plates may be ſeparated at a proper breadth, and the flaw removed; in which caſe the thinner cruſt, ſtruck off, is of value in proportion to its ſize, and the remainder, being now freed from its flaw, is of much more value than it was at firſt. The places whence we have the diamonds are the Eaſt-Indies, in the iſland of Borneo, and in the kingdoms of Viſapour, Golconda, Bengal; and the Brazils in the Weſt-Indies. They are not unfrequently found yellowiſh, blueiſh, and reddiſh, but more rarely greeniſh.

Valuation of DIAMONDS, among jewellers, is thus calculated: they ſuppoſe the value of a rough diamond to be 2 l. per carat; then to find the value of thoſe of greater weight, they multiply the ſquare of their weight by 2, and this laſt product is the value of the diamonds in their rough ſtate: thus, the value of a rough diamond weighing 4 carats, is equal $4\times4\times2=16\times2=32$ l. and ſo in other caſes. Again, to find the value of wrought diamonds, they ſuppoſe half their weight loſt in the manufacturing them, and therefore multiply the ſquare of double their weight by 2; thus the value of a wrought diamond, weighing 3 carrats, is equal $6\times6\times2=36\times2=72$ l.

Roſe-DIAMOND is that quite flat underneath, with its upper part cut in divers little faces, uſually triangles, the uppermoſt of which terminate in a point.

Table-DIAMOND is that which has a large ſquare face at top, encompaſſed with four leſſer.

Brilliant DIAMOND is that cut in faces both at top and bottom; and whoſe table, or principal face at top, is flat.

DIAMOND, in the glaſs-trade, an inſtrument uſed for ſquaring the large plates or pieces; and, among glaziers, for cuting their glaſs.

Theſe ſort of diamonds are differently fitted up; that uſed for large pieces, as looking-glaſſes, *&c.* is ſet in an iron ferril, about two inches long, and a quarter of an inch in diameter; the cavity of the ferril being filled up with lead, to keep the diamond firm: there is alſo a handle of box, or ebony, fitted to the ferril, for holding it by.

DIAMOND, in heraldry, a term uſed for expreſſing the black colour in the atchievements of peerage.

Guillim does not approve of blazoning the coats of peers by precious ſtones inſtead of metals and colours; but the Engliſh practice allows it. Morgan ſays the diamond is an emblem of fortitude.

DIANÆ ARBOR, or ARBOR LUNÆ, in chemiſtry, the beautiful cryſtallizations of ſilver, diſſolved in aqua fortis, to which ſome quickſilver is added: and ſo called from their reſembling the trunk, branches, leaves, *&c.* of a tree. See CHEMISTRY.

DIANDRIA, in the Linnæan ſyſtem of botany. See BOTANY, p. 635.

DIANO, a town of the Genoeſe, about three miles from the ſea. The country about produces great numbers of olives.

DIANTHERA, in botany, a genus of the diandria monogynia claſs. The corolla is ringent; and the capſule has two elaſtic valves. There are two ſpecies, both natives of America.

DIANTHUS, in botany, a genus of the decandria digynia claſs. The calix is cylindrical, and conſiſts of one leaf, with four ſcales at the baſe; the corolla conſiſts of five clawed petals; and the capſule is cylindrical,

and

and has but one cell. There are feventeen fpecies, five of which are natives of Britain, *viz.* the armeria, or Deptford pink; the prolifer, or limewort; the deltoides, or maiden pinks; the glaucus, or mountain pink; and the arenarius, or ftone pink.

DIAPASON, in mufic, a mufical interval, by which moft authors, who have wrote upon the theory of mufic, ufe to exprefs the octave of the Greeks. See OCTAVE.

DIAPASON, among the mufical-inftrument makers, a kind of rule or fcale, whereby they adjuft the pipes of their organs, and cut the holes in their flutes, hautboys, *&c.* in due proportion, for performing the tones, femitones, and concords juft.

DAPASON DIAEX, in mufic, a kind of compound concord, whereof there are two forts; the greater, which is in the proportion of 10 : 3; and the leffer, in that of 16 : 5.

DIAPASON DIAPENTE, in mufic, a compound confonance in a triple ratio, as 3 : 9. This interval, fays Martianus Capella, confifts of nine tones and a femitone, nineteen femitones, and thirty eight diefes. It is a fymphony made when the voice proceeds from the firft to the twelfth found.

DIAPASON DIATESSARON, in mufic, a compound concord, founded on the proportion of 8 : 3. To this interval Martianus Capella allows eight tones and a femitone, feventeen femitones, and thirty-four diefes.

This is when the voice proceeds from its firft to its eleventh found. The moderns would rather call it the eleventh.

DIAPASON DITONE, in mufic, a compound concord, whofe terms are as 10 : 4, or 5 : 2.

DIAPASON SEMIDITONE, in mufic, a compound concord, whofe terms are in the proportion of 12 : 5.

DIAPEDESIS, in medicine, a tranfudation of the fluids through the fides of the veffels that contain them, occafioned by the blood's becoming too much attenuated, or the pores becoming too patent.

DIAPENSIA, in botany, a genus of the pentandria-monogynia clafs. The calix confifts of five leaves, imbricated with three fmaller ones; the ftamina arife from the tube of the corolla; and the capfule has three cells; there are three fpecies, none of them natives of Britain.

DIAPENTE, in the ancient mufic, an interval marking the fecond of the concords; and with the diateffaron, an octave. This is what in the modern mufic is called a fifth.

DIAPHANOUS, an appellation given to all tranfparent bodies, or fuch as tranfmit the rays of light. See OPTICS.

DIAPHOENICUM, in pharmacy, a fort of medicine or electuary chiefly made of dates. It purges ferofities, and excites the menfes. It is alfo ufed in dropfies, lethargies, apoplexies, and palfies.

DIAPHORESIS, in medicine, an elimination of the humours in any part of the body through the pores of the fkin. See PERSPIRATION.

DIAPHORETICS, among phyficians, all medicines which promote perfpiration.

DIAPHRAGM, in anatomy. See Vol. I. p. 213.

DIAPORESIS, in rhetoric, a figure of oratory, expreffing the uncertainty of the fpeaker how he fhall proceed in his difcourfe.

DIARBEC, or DIARBECK, the capital of a province of the fame name, anfwering to the ancient Mefopotamia: it is fituated on the river Tigris, near its fource, in 42° E. long. and 37° 30′ N. lat.

DIARRHOEA, or LOOSENESS, in medicine, is a frequent and copious evacuation of liquid excrement, by ftool. See MEDICINE.

DIARTHROSIS, in anatomy. See Vol. I. p. 148.

DIARY, among traders, denotes a day-book containing the proceedings of one day.

DIACHISM, among muficians, denotes the difference between the comma and enharmonic diefis, commonly called the leffer comma.

DIASCORDIUM, in pharmacy, a celebrated compofition, fo called from fcordium, one of its ingredients. It is otherwife termed *confectio fracaftorii*, and is thus directed by the college.

Take of cinnamon and caffia-wood, of each half an ounce; of true fcordium, one ounce; of Cretan dittany, tormentil, biftort, galbanum, and gum-arabic, of each half an ounce; of ftorax, four drams and an half; of opium, and feeds of forrel, of each one dram and an half; of gentian, half an ounce; of American bole, one ounce and an half; of Lemnian fealed earth, half an ounce; of long pepper and ginger, of each two drams; of clarified honey, two pounds and an half; of fugar of rofes, one pound; of generous canary, eight ounces; make into an electuary. It is excellent in all kinds of fluxes, and a great ftrengthener both of the ftomach and bowels.

DIASEBESTEN, in pharmacy, a foft purgative electuary, whereof febeftens are the principal ingredients. The other ingredients are prunes, tamarinds, juices of iris, anguria and mercurialis, penidies, fimple diaprunum, violet feeds, and diagrydium. It is good in remitting and continued fevers, *&c.*

DIASENNA, in pharmacy, the name of a medicine in which fenna is the principal ingredient.

The other ingredients are fugar-candy, cinnamon, lapis lazuli, filk, cloves, galanga minor, black pepper, nardus indica, feed of bafilicum, flowers of cloves, cardamoms, faffron, ginger, zedoary, *&c.*

This electuary is taken againft melancholy and fpleen, and againft difeafes arifing from an atrabilis.

DIASTOLE, among phyficians, fignifies the dilatation of the heart, auricles and arteries; and ftands oppofed to the fyftole, or contraction of the fame parts. See CIRCULATION.

DIASTOLE, in grammar, a figure of profody, whereby a fyllable naturally fhort is made long: fuch is the firft fyllable of Priamides, in the following verfe of Virgil.

Atque hic Priamides! nihil ô tibi, amice, relictum.

DIASYRMUS, in rhetoric, a kind of hyperbole, being an exaggeration of fome low ridiculous thing.

DIATESSARON, among ancient muficians, a concord, or harmonical interval, compofed of a greater tone, a lefs

lefs tone, and one greater femi-tone: its proportion in numbers is as 4 : 3.

Diatessaron, in pharmacy, the name of a compofition fo called, from the four ingredients it comprehends: it is prepared thus.

Take of gentian root, bay-berries, myrrh, and roots of birthwort, of each two ounces; of honey, two pounds; mix them into an electuary. This, with the addition of the fhavings of ivory, two ounces, is entitled diapente, or a compofition of five ingredients

DIATONIC, an epithet given to mufic, as it proceeds by tones and femi-tones, both afcending and defcending. See Music.

DIATRAGACANTH, in pharmacy, a name applied to certain powders, whereof gum tragacanth is the principal ingredient; of which there are two kinds, the cold and the hot: the cold is directed thus: take of gum tragacanth, two ounces; of gum arabic, an ounce and two drams; of ftarch, half an ounce; of liquorice, and the feeds of melons and white poppies, of each two drams; of fugar-candy, three ounces; mix them into a powder. This is frequently prefcribed in hectical heats, in choleric conftitutions, in diftempers of the breaft, in ftranguries, heat of urine, and the pungency of venereal gleets.

Powder of hot diatragacanth is compofed of gum tragacanth, cinnamon, hyffop, almonds, linfeed, fenugreek, liquorice, and ginger, It is good againft afthmas, to promote expectoration, ftrengthen the ftomach, and affift digeftion.

DIAUGOPHRAGMIA, in natural hiftory, a genus of foffils of the order of feptariæ, whofe partitions, or fepta, confift of fpar with an admixture of cryftal. Of this genus there are three fpecies. 1. A red kind, with brownifh yellow partitions. 2. A brownifh yellow kind, with whitifh partitions. 3. A bluifh-white kind, with ftraw-coloured partitions.

DICE, among gamfters, certain cubical pieces of bone or ivory, marked with dots on each of their faces, from one to fix, according to the number of faces.

Sharpers have feveral ways of falfifying dice. 1. By fticking a hog's briftle in them, fo as to make them run high or low, as they pleafe. 2. By drilling and loading them with quickfilver; which cheat is found out by holding them gently by two diagonal corners; for if falfe, the heavy fides will turn always down. 3. By filling and rounding them. But all thefe ways fall far fhort of the art of the dice-makers; fome of whom are fo dextrous this way, that your fharping gamfters will give any money for them.

Dice formerly paid 5 s. every pair imported, with an additional duty of 4 s. $9\frac{45}{100}$d. for every 20 s. value upon oath; but are now prohibited to be imported.

DICHOTOMY, a term ufed by aftronomers for that phafis, or appearance of the moon, wherein fhe is biffected, or fhews juft half her difk. In this fituation the moon is faid to be in a quadrate afpect, or to be in her quadrature.

Dichotomy, in botany. See Botany, p. 641.

DICHOTOPHYLLUM, it botany. See Ceratophyllum.

DICKER, in old writers, denotes the quantity of ten hides of fkins, whereof twenty made a laft: alfo ten pair of gloves, ten bars of iron, and the like, are fometimes expreffed by the term dicker.

DICTAMUS, dittany, in botany, a genus of the decandria monogynia clafs. The calix confifts of five leaves, and the corolla of five open petals; the filaments have many glandular points; and the five capfules are united. There is but one fpecies, *viz.* the oblus, a native of Italy. The root is faid to be alexipharmic, but is not regarded in practice.

DICTATOR, in the policy of the ancient Romans, a magiftrate invefted with fovereign and even arbitrary power.

He had power of life and death; alfo to raife and difband troops, make war or peace, and that without the confent either of the fenate or people, or being accountable for his proceedings. He was elected by one of the confuls in the night-time, on the frontiers of the commonwealth, and nowhere elfe; and the ordinary duration of his office was only for fix months, during which time all other magiftracies ceafed, the tribunefhip excepted. Whenever he appeared in public, he was attended by twenty-four lictors, or double the number allowed a conful. However, notwithftanding all this power, he could not go out of Italy, or even ride on horfeback during a march, without leave from the people.

This office was accounted the fafeguard of the commonwealth for four hundred years together, till Sylla and Cæfar, by affuming the title of perpetual dictators, converted it into tyranny, and rendered the very name odious.

DICTION, the phrafe, elocution, or ftyle of a writer or fpeaker. See Composition,

DICTIONARY, in its original acceptation, is the arranging all the words of a language according to the order of the alphabet, and annexing a definition or explanation to each word. When arts and fciences began to be improved and extended, the multiplicity of technical terms rendered it neceffary to compile dictionaries either of fcience in general, or of particular fciences, according to the views of the compiler. For further particulars concerning dictionaries of this kind, fee the *Preface.*

Dictionary *of the Englifh language.* The only attempt which has hitherto been made towards forming a regular dictionary of the Englifh language, is that of the learned Dr Samuel Johnfon. But although it is executed in a mafterly manner, yet as it cannot be expected that an undertaking of this nature could be brought to perfection by one man, we fhall venture to fuggeft a few circumftances which, if duely attended to, may perhaps be of fome utility.

The defign of every dictionary of language, is to explain in the moft accurate manner, the meaning of every word, and to fhow the various ways in which it can be combined with others, in as far as this tends to alter its meaning. The dictionary which does

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this in the moſt accurate manner, is the moſt complete. Therefore the principal ſtudy of a lexicographer ought to be, to diſcover a method which will be beſt adapted for that purpoſe. Dr Johnſon, with great labour, has collected the various meanings of every word, and quoted the authorities: But, would it not have been an improvement if he had given an accurate definition of the preciſe meaning of every word; pointed out the way in which it ought to be employed with the greateſt propriety; ſhewed the various deviations from that original meaning, which cuſtom had ſo far eſtabliſhed as to render allowable; and fixed the preciſe limits beyond which it could not be employed without becoming a vicious expreſſion? With this view, it would have been neceſſary to exhibit the nice diſtinctions that take place between words which are nearly ſynonymous. Without this, many words can only be defined in ſuch a manner, as that they muſt be conſidered as exactly ſynonymous. We omit giving any quotations from Johnſon to point out theſe defects; but ſhall content ourſelves with giving a few examples, to ſhew how, according to our idea, a dictionary of the Engliſh language ought to be compiled.

IMMEDIATELY. *adv. of time.*

1. Inſtantly, without delay. Always employed to denote future time, and never paſt. Thus, we may ſay, *I will come immediately*; but not, *I am immediately come from ſuch a place.* See PRESENTLY.
2. Without the intervention of any cauſe or event; as oppoſed to mediately.

PRESENTLY. *adj. of time.*

1. Inſtantly, without delay. Exactly ſynonymous with *immediately*; being never with propriety employed to denote any thing but future time.
2. Formerly it was employed to expreſs preſent time: Thus, *The houſe preſently poſſeſſed by ſuch a one*, was often uſed; but this is now become a vicious expreſſion and we ought to ſay, *The houſe poſſeſſed at preſent.* It differs from *immediately*, in this, that even in the moſt corrupt phraſes it never can denote paſt time.

FORM. *ſubſt.* The external appearance of any object, when conſidered only with reſpect to ſhape or figure. This term therefore, in the literal ſenſe, can only be applied to the objects of the ſight and touch; and is nearly ſynonymous with figure; but they differ in ſome reſpects. *Form* may be employed to denote more rude and unfiniſhed ſhapes; *figure*, thoſe which are more perfect and regular. *Form* can never be employed without denoting matter; whereas *figure* may be employed in the abſtract: Thus, we ſay a ſquare or a triangular *figure*; but not a ſquare or triangular *form.* And in the ſame manner we ſay, the *figure* of a houſe: but we muſt denote the ſubſtance which forms that figure, if we uſe the word *form*; as, *a cloud of the form of a houſe, &c.* See FIGURE.

2. In contraſt to irregularity, or confuſion. As beauty cannot exiſt without order, it is by a figure of ſpeech employed to denote beauty, order, *&c.*
3. As *form* regards only the external appearance of bodies, without regard to their internal qualities, it is by a figure of ſpeech, employed in contraſt to theſe qualities, to denote empty ſhew, without eſſential qualities. In this ſenſe it is often taken when applied to religious ceremonies, *&c.*
4. As *form* is employed to denote the external appearance of bodies; ſo, in a figurative ſenſe it is applied to reaſoning, denoting the particular mode or manner in which this is conducted; as, *the form of a ſyllogiſm*, &c.
5. In the ſame manner it is employed to denote the particular mode of procedure eſtabliſhed in courts of law; as. *the forms of law, religion*, &c.
6. *Form* is ſometimes, although improperly, uſed to denote the different circumſtances of the ſame body; as, *water in a fluid or a ſolid form.* But as this phraſe regards the internal qualities rather than the external figure, it is improper, and ought to be, *water in a fluid, or a ſolid ſtate.*
7. But when bodies of different kinds are compared with one another, this term may be employed to denote other circumſtances than ſhape or figure; for we may ſay, *a juice exſuding from a tree in in the form of wax or reſin*; although, in this caſe, the conſiſtence, colour, *&c.* and not the external arrangement of parts, conſtitutes the reſemblance.
8. From the regular appearance of a number of perſons arranged in one long ſeat, ſuch perſons ſo arranged are ſometimes called a *form*; as, *a form of ſtudents*, &c. And,
9. By an eaſy tranſition, the ſeat itſelf has alſo acquired that name.

GREAT. *adj.* A relative term, denoting largeneſs of quantity, number, *&c.* ſerving to augment the value of thoſe terms with which it is combined, and oppoſed to *ſmall* or *little.* The principal circumſtances in which this term can be employed, are the following:

1. When merely inanimate objects are conſidered with regard to quantity, *great* is with propriety employed, to denote that the quantity is conſiderable; as, *a great mountain, a great houſe*, &c. and it is here contraſted with *ſmall.* When *great* is thus employed, we have no other word that is exactly ſynonymous.
2. When inanimate objects are conſidered with regard to their extent, this term is ſometimes employed, although with leſs propriety; as, *a great plain, a great field*, &c. and in this ſenſe it is nearly ſynonymous with *large*; and they are often uſed indiſcriminately, but with ſome difference of meaning: for, as *large* is a term chiefly employed to denote extent of ſuperficies, and as *great* more particularly regards the quantity of matter; therefore, when *large* is applied to any object which is not merely ſuperficial, it denotes that it is the extent of ſurface that is there meant to be conſidered, without regard to the other dimenſions; whereas when the term *great* is employed, it has a reference to the whole contents. If, therefore, we ſay, *a large houſe*, or *a large river*, we expreſs that the houſe, the river, have

have a furface of great extent, without having any neceffary connection with the fize in other refpects. But if we fay, *a great houfe*, or *a great river*, it at once denotes that they have not only a large furface, but are alfo of great fize in every refpect.

3. *Great*, when applied to the human fpecies, never denotes the fize or largenefs of body, but is applied folely to the qualities of the mind. Thus, when we fay, that *Socrates was a great man*, we do not mean that he was a man of great fize, but that he was a man who excelled in the endowments of the mind. The terms which denote largenefs of fize in the human body are, *big*, *bulky*, *huge*, &c.

4. *Great* is fometimes applied to the human fpecies, as denoting high rank. In this cafe it is oftener ufed in the plural number than otherwife. Thus we fay fimply, *the great*, meaning the whole body of men in high ftation, as oppofed to *mean*. It fhould feldom be employed in this fenfe, as it tends to confound dignity of rank with elevation of mind.

5. As this is a general term of augmentation, it may be joined with all nouns which denote *quantity*, *quality*, *number*, *excellence*, or *defects*; or fuch as imply *praife*, *blame*, *anger*, *contempt*, or any other affection of the mind.

6. It is employed to denote every ftep of afcending or defcending confanguinity; as, *great-grandfather*, *great-grandfon*, &c.

HIGH. *adj*. Exalted in a perpendicular direction at a diftance from the furface of the earth. Oppofed to *low*.

1. *High* is a term altogether indefinite, and is employed to exprefs the degree of elevation of any inanimate body. Thus, we fay, *a high mountain*, *a high houfe*, *fteeple*, *tower*, *pillar*, &c. nor is there any other word that can here be confidered as fynonymous; *lofty* being employed only to denote a very eminent degree of elevation.

2. To exprefs the perpendicular elevation of vegetables, either *high* or *tall* may be employed, as being in this cafe nearly fynonymous, we may therefore fay, a *high* or *tall tree*, a *high* or *tall maft*, &c. but with this difference between thefe two expreffions, that *tall* can be more properly applied to thofe that are much elevated and of fmall dimenfions; and *high*, to fuch as are more bulky, and of greater fize.

3. The perpendicular height of man can never be expreffed by the word *high*; *tall* being here the proper expreffion. And although *high* is fometimes ufed to exprefs the height of other animals, yet it feems to be an improper expreffion. See TALL.

4. *High*, when applied to the human fpecies, always refers to the mind; and denotes *haughtinefs*, *ftatelinefs*, *pride*, &c.; and, when combined with the expreffions of any energy of the mind, it denotes that in a higher degree. In this fenfe, it is oppofed to *meannefs*, *abjectnefs*, and *humility*.

5. As this is an indefinite term, tending to denote any thing that is elevated above us, it may be combined with almoft every noun which admits of this elevation. And as objects high above us are always out of our reach, it is in a metaphorical fenfe ufed to denote any thing that feems to be above the ordinary condition of mankind; or thofe qualities or endowments of mind that are not eafily acquired; as, *dignity* or *elevation of fentiment*; *dignity of rank*; *acutenefs in reafoning on difficult fubjects*; *pride*, *haughtinefs*, or any other quality which feems beyond the ordinary level of mankind; *dearnefs of price*, &c.

6. In the fame manner we employ this term to time; which having a metaphorical refemblance to a river, flowing on with an unceafing current through all fucceffive ages, any thing of remote antiquity is denoted by the term *high*.

7. Likewife thofe degrees of latitude far removed from the line, where the pole becomes more elevated.

8. And to fome particular crimes, as being attended with peculiar degrees of guilt; as, *high treafon*.

TALL. *adj*. Something elevated to a confiderable degree in a perpendicular direction. Oppofed to *low*

1. This term is chiefly employed to exprefs the height of man, and other animals; and is applied to denote the height of the body only, without having any reference to the mind. When applied to man, no other word can be fubftituted in its ftead: when applied to other animals, *high* is fometimes confidered as nearly fynonymous. See HIGH.

2. It is likewife employed to denote the perpendicular height of vegetables; and in this cafe it is nearly fynonymous with *high*. See HIGH.

3. It can in no cafe be employed to exprefs the height of merely inanimate objects; as we can never fay a *tall fteeple*, *tower*, or *pillar*, but a *high fteeple*, &c. For the diftinctions in thefe cafes, fee HIGH.

LONG. *adj*. A relative term, denoting the diftance between the extremes of any body, which is extended more in one of its geometrical dimenfions than another. Oppofed to *fhort*.

1. This term may be applied to all inanimate objects, of whatever kind, whofe dimenfions in one way exceeds the other, and when not in an erect pofture, whatever be the other circumftances attending them; whether it relates to fuperficies alone, or to folid bodies; whether thefe be bounded or open, ftraight or crooked, flexible or rigid, or in any other circumftances whatever; thus we fay *a long* or *fhort line*, *a long* or *fhort ridge*, *ftreet*, *ditch*, *rope*, *chain*, *ftaff*, &c. But it is to be obferved, that although *long* is, in the ftrict fenfe only, oppofed to *fhort*; yet as it expreffes the extenfion of matter in one of its geometrical proportions, it is often contrafted by thofe words which exprefs the other proportions when we mean only to defcribe the feveral proportions; as, *a table long and broad*: and as thefe feveral dimenfions are expreffed by different words, according to the various forms, modifications, and circumftances, in which bodies are found; therefore it is in this fenfe contrafted by a great diverfity of terms; as, *a long*

and

and broad, or *wide*, *narrow*, or *ſtrait ſtreet* or *lane*, *a long and thick*, or *ſmall rope*, *chain*, *ſtaff*, &c. For the diſtinctions in theſe caſes, ſee Broad, Wide, *&c.*

2. Objects neceſſarily fixed in an erect poſition can never have this term applied to them; and therefore we cannot ſay *a long*, but *a high tower* or *ſteeple*. And for the ſame reaſon, while trees are growing and fixed in an erect poſition, we cannot apply this term to them; but when they are felled and laid upon the ground, it is quite proper and neceſſary. Thus, we do not ſay *a long*, but *a tall* or *high tree*, while it is growing; but we ſay *a long*, not *a tall log of wood:* and in the ſame manner we ſay *a tall maſt*, when it is fixed in the ſhip; but *a long maſt*, while it lies upon the beech. See Tall and High.
3. Thoſe vegetables which are of a tender pliant nature, or ſo weak as not to be able to retain a fixt poſition, being conſidered as of a middle nature between erect and proſtrate bodies, admit of either of the terms *long*, *tall*, or *high;* as, *a long* or *tall ruſh* or *willow wand*, or *a long*, *tall*, or *high ſtalk of corn*. See High and Tall.
4. The parts of vegetables, when conſidered as diſtinct from the whole, even when growing and erect, aſſume the term *long*: for we no not ſay *a tall*, but *a long ſhoot of a tree;* and *a tree with a long ſtem*, in preference to *a tree with a high ſtem*.
5. For the ſame reaſon, a ſtaff, and pole, even when fixed in a perpendicular direction, aſſume the word *long*, in preference to *tall* or *high*.
6. With regard to animals, the general rule is applied, without any exceptions; *tall*, and not *long*, being employed to denote the height of the human body, when in an erect poſture; and *long* and not *tall*, to denote its length when in an incumbent ſituation. *Long*, applied to all other animals which do not walk erect, always denotes their greateſt length in a horizontal poſition from head to tail.
7. In a figurative ſenſe, it denotes, with regard to time, any thing at a great diſtance from us.
8. As alſo, any thing that takes up much time before it is finiſhed; as, *a long diſcourſe*, *a protracted note in muſic*, &c.

BROAD. *adj*. The diſtance between the two neareſt ſides of any body, whoſe geometrical dimenſions are larger in one direction than in another; and has a reference to ſuperficies only, and never to the ſolid contents. Oppoſed to *narrow*.

1. *Broad*, in the ſtricteſt acceptation, is applied to denote thoſe bodies only whoſe ſides are altogether open and unconfined; as, *a broad table*, *a broad wheel*, &c and in theſe caſes it is invariably contraſted by the word *narrow;* nor is there any other word which in theſe caſes can be conſidered as ſynonymous with it, or uſed in its ſtead.
2. When any object is in ſome ſort bounded on the ſides, although not quite cloſed up, as a road, ſtreet, ditch, *&c.* either *broad* or *wide* may be employed, but with ſome difference of ſignification; *broad* being moſt properly uſed for thoſe that are more open, and *wide* to thoſe which are more confined; nor can this term be ever applied to ſuch objects as are cloſe bounded all around, as a houſe, church, &c. *wide* being here employed. For the more accurate diſtinctions in theſe caſes, ſee the article Wide.

WIDE. *adj*. A term employed to denote relative extent in certain circumſtances. Oppoſed to *narrow* and *ſtrait*.

1. This term is in its proper ſenſe applied only to denote the ſpace contained within any body cloſed all round on every ſide, as a houſe, gait, *&c.* and differs from *broad* in this, that it never relates to the ſuperficies of ſolid objects, but is employed to expreſs the capaciouſneſs of any body which containeth vacant ſpace; nor can capaciouſneſs in this ſenſe be expreſſed by any other word but *wide*.
2. As many bodies may be conſidered either with reſpect to their capaciouſneſs, or ſuperficial extent; in all theſe caſes, either the term *broad* or *wide* may be uſed; as, *a broad* or *wide ſtreet* or *ditch*, *&c.* but with a greater or leſs degree of propriety, according to the circumſtances of the object, or the idea we wiſh to convey. In a ſtreet where the houſes are low, and the boundaries open, or in a ditch of ſmall depth and large ſuperficies, as this largeneſs of ſuperficies bears the principal proportion, *broad* would be more proper; but if the houſes are of great height, or the ditch of great depth, and capaciouſneſs is the principal property that affects the mind, we would naturally ſay *a wide ſtreet* or *ditch*; and the ſame may be ſaid of all ſimilar caſes: but there are ſome caſes in which both theſe terms are applied, with a greater difference of meaning; thus we ſay, *a broad*, or *a wide gate*; but as the gate is employed to denote either the aperture in the wall, or the matter which cloſes that aperture, theſe terms are each of them uſed to denote that particular quality to which they are generally applied: and as the opening itſelf can never be conſidered as a ſuperficies, the term *wide*, in this caſe, denotes the diſtance between the ſides of the aperture; while, on the contrary, *broad* denotes the extent of matter fitted to cloſe that aperture; nor can theſe two terms in any caſe be ſubſtituted for one another.
3. As a figurative expreſſion, it is uſed as a cant phraſe for a miſtake; as, *you are wide of the mark*; that is, not near the truth.

NARROW. *adj*. A relative term, denoting a proportional ſmallneſs of diſtance between the ſides of the ſuperficies of plain bodies. Oppoſed to *broad*.

1. As this is only applied to ſuperficies, it is exactly contraſted by *broad*, and is applied in all caſes where the term *broad* can be uſed, (ſee Broad); and in no other caſe but as a contraſt to it, except the following.
2. It ſometimes is employed to deſcribe the ſmallneſs of ſpace circumſcribed between certain boundaries, as oppoſed to *wide*, and nearly ſynonymous with *ſtrait*;

ſtrait ; as we ſay *a wide* or *a narrow houſe*, *church*, &c. For the neceſſary diſtinctions here, ſee the article STRAIT.

3. In a figurative ſenſe it dénotes *parſimony*, *poverty*, *confined ſentiments*, &c.

STRAIT. *adj.* A relative term, denoting the extent of ſpace in certain circumſtances. Oppoſed to *wide*, ſee WIDE.

1. This term is employed, in its proper ſenſe, to denote only ſpace, as contained between ſurrounding bodies in ſuch circumſtances as to denote ſome degree of confinement; and is exactly oppoſed to *wide;* as, *a wide* or *a ſtrait gate*, &c. See WIDE.

2. So neceſſary is it that the idea of confinement ſhould be connected with this word, that in all thoſe caſes where the ſpace contained is large, as in a church or houſe, we cannot expreſs a ſmaller proportional width by this term. And as we have no other word to expreſs ſpace in theſe circumſtances, we have been obliged to force the word *narrow* from its natural ſignification, and make it expreſs this. See NARROW.

3. In ſome particular caſes *narrow* or *ſtrait* may be employed to the ſame object; as, *a narrow* or *a ſtrait lane :* but here *ſtrait* is never employed but where an idea of confinement is ſuggeſted, and where it is exactly contraſted to *wide*; nor can *narrow* be employed but in ſuch circumſtances where *broad* would be a perfect contraſt to it. Therefore theſe two terms may be always employed in the ſame circumſtances as thoſe which contraſt them may be. For an account of which, ſee WIDE.

3. The term *ſtrait* is likewiſe in a peculiar manner uſed to denote the ſmallneſs of the internal diameter of thoſe ſmall bodies which are fitted to receive or contain others as, any kind of bag, tube, body-cloaths, mortoiſes, and others of the ſame kind ; and in all theſe caſes this term may be employed to denote the ſmallneſs of their leſſer diameter, and never the term *narrow*. But in certain circumſtances the word *tight* may be ſubſtituted for it. See TIGHT.

4. *Strait*, in a figurative ſenſe, denotes any ſort of confinement of ſentiment or diſpoſition.

TIGHT. *adj.* A term employed in certain circumſtances to denote the internal capacity of particular bodies. Nearly ſynonymous with *ſtrait*.

This term is confined entirely to denote the ſmallneſs of the internal dimenſions of ſuch objects as are formed to cover or to receive or contain other ſolid bodies, and can be employed in no other caſe. And although it agrees with *ſtrait*, in always denoting confinement, and by being applicable to the ſame ſpecies of objects, yet it differs in the the following reſpects : 1. If there be any difference of the diameter of the objects to which the term *ſtrait* can be employed, it always has reference to the ſmaller; yet *tight* may be employed to any ſort of confinement, whether it regards the length or breadth. 2. *Strait* can be applied to all bodies of capacity when of ſmall diameter, without any ſort of reference to the nature of the ſubſtance which it may be capable of containing. For we can ſay *a ſtrait bag*, *a ſtrait ſleeve*, *a ſtrait mortoiſe*, *a ſtrait gate*, &c. whereas *tight* can only be applied to any body when it is conſidered as having reference to another body which is intended to be contained in it and is pinched for want of room. Thus, we ſay, *the ſleeve of a coat is too tight for the arm*, *the mortoiſe is too tight for the tenon*, &c. but we cannot ſay, *the bag*, *or the gate is too tight*, becauſe theſe are fitted to receive any ſort of objects. And hence it happens, that, in many caſes, the dimenſions of the ſame body may be expreſſed by *tight* or *ſtrait* when conſidered in different circumſtances. Thus, we may ſay, *this ſleeve is too ſtrait*, when we look at a coat when lying on the table, and conſider its proportions ; but it is not till we have tried it upon the arm that it is intended to cover, that we call it *tight*. And we may ſay, *a gate is too ſtrait*, or *too tight*; but in the firſt caſe we conſider it as being too confined for admitting objects to paſs through it, and in the laſt as being too confined with reſpect to the leaves that are to ſhut the aperture, not allowing them ſpace to move with freedom.

Theſe examples may ſerve to give ſome idea of the plan of an Engliſh dictionary compoſed upon philoſophical principles: But, beſides the circumſtances above enumerated, there are many others which would require particular attention in the execution of a work of this kind. In the Engliſh language, a great variety of terms occur, which denote matter under certain general forms or circumſtances, without regarding the minute diverſities that may take place; as the word *cloth*, which denotes matter as manufactured into a particular form, including under it all the variety of ſtuffs manufactured in that particular way, of whatever materials, colours, texture, or fineneſs they may be. The ſame may be ſaid of *wood*, *iron*, *yarn*, and a great variety of terms of the ſame nature, ſome of which cannot aſſume any plural; while others admit of it in all caſes; and others admit or refuſe it according to the different circumſtances in which they are conſidered. In a dictionary, therefore, all this variety of caſes ought to be clearly and diſtinctly pointed out under each particular article : this is the more neceſſary, as ſome of theſe words have others formed from them, which might be readily miſtaken for their plurals, although they have a very different ſignification; as *cloaths* which does not denote any number of pieces or different kinds of *cloth*, but *wearing apparel*. The following example will illuſtrate this head.

WOOD. *ſub.* A ſolid ſubſtance of which the trunks and branches of trees conſiſt.

1. This term is allowed to denote the ſolid parts of vegetables of all kinds, in whatever form or circumſtances they are found. Nor does this term admit of plural with propriety, unleſs in the circumſtances after mentioned : for we ſay, *many different kinds of wood*, in preference to *many kinds of woods*; or, we ſay, *oak*, *aſh*, or *elm wood ;* not *woods*.

2. But where we want to contraſt *wood* of one quality,

lity or country with that of another, it admits of a plural; for we ſay, *white woods are in general ſofter than red*; or *Weſt-Indian woods are in general of greater ſpecific gravity than the European woods*: But unleſs where the colour, or ſome quality which diſtinguiſhes it from growing wood, is mentioned, this plural ought as much as poſſible to be avoided, as it always ſuggeſts an idea of growing wood.

3. *Wood* likewiſe denotes a number of trees growing near one another; being nearly ſynonymous with *foreſt*: See FOREST. In this ſenſe it always admits of a plural; as, *Ye woods and wilds whoſe ſolitary gloom*, &c.

A dictionary cannot be reckoned complete without explaining obſolete words; and if the terms of the ſeveral provincial provincial dialects were likewiſe given, it would be of great utility: nor would this take much time; becauſe a number of theſe words need no other explanation than to mark along with them the words which had come in their place, when there happened to be one perfectly ſynonymous: and in theſe caſes where the ſame idea could not be expreſſed in modern language without a periphraſis, it would be of uſe to explain them diſtinctly; ſo that, when a writer found himſelf at a loſs for a term, and obliged to ſearch for one beyond the bounds of our own language, he might take one of theſe, when he found that it was expreſſive and energetic, in preference to another drawn from a foreign language. This would at leaſt have one good effect: it would make our language more fixed and ſtable; not to ſay more accurate and preciſe, than by borrowing from foreign languages. The following examples may ſerve to give ſome idea of the manner of treating this part of the work.

MOE, or MO. *adj*. An obſolete term ſtill employed in the Scotch dialect, and by them pronounced *mae*: denoting a greater number, and nearly ſynonymous with *more*; but it differs in this reſpect, that, in the Scotch dialect, *mae* and *mair* (Engliſh, *more*) are each employed in their diſtinct ſphere, without encroaching upon one another; *mae* being employed to denote number, but never quantity or quality; and *mair*, to denote quantity and quality, but never number: thus they ſay *mae*, not *mair apples*, *men*, &c. and they ſay *mair*, not *mae cloth*, *earth*, *courage*, &c. See MAIR. Both of theſe terms are ſupplied by the word *more*; which, in the Engliſh language, is applied indiſcriminately to denote quantity, quality, and number. See MORE.

THIR. *pron*. Obſolete; ſtill employed in the Scotch dialect: the plural of *this*; and contraſted to *theſe*, in the ſame manner as *that* is to *this*.

As there is no word in the Engliſh language equivalent to this, we thus ſhew the manner in which it is employed. In the Engliſh language we ſay, *that ſtone* or *houſe*, pointing at one at a diſtance, *is larger or more commodious than this ſtone* or *this houſe*, which is ſuppoſed to be at hand. In the ſame manner, in the Scotch dialect, they ſay, *theſe* (or as it is pronounced, *thae*) *ſtones are whiter than thir ſtones*; denoting, that the former are at a diſtance, and the latter at hand. And, in the ſame manner, it is invariably applied to denote any preſent object in the plural number, as oppoſed to *theſe*; as *theſe* or *thir apples*, as at hand or at a diſtance; *theſe* or *thir trees*, &c.; but never in the ſingular number, as it is always *this* or *that tree*, *hoſe*, &c.

As the Engliſh language is ſo exceedingly irregular in the pronunciation, the ſame letter in the ſame ſituation often aſſuming ſounds totally different in different words, it is impoſſible to eſtabliſh any general rules on this ſubject, which do not admit of many exceptions: therefore, a dictionary is the beſt means of aſcertaining and pointing out the proper pronunciation of words. For, if the writer firſt pointed out all the different ſounds that the ſame letter could ever be made to expreſs, and aſſigned to every particular ſound which each letter could be made to aſſume, a particular mark, which was appropriated to denote that particular ſound of the letter whenever it occurred; by placing theſe particular marks above the letters in the dictionary, the ſound of each letter would be pointed out in all caſes with the utmoſt certainty. It would be impoſſible for us to illuſtrate this by examples, without firſt aſcertaining all the ſounds of each letter; which would lead us into a diſcuſſion too long for this place; and this is at preſent the more unneceſſary, as the public have been long in expectation of a dictionary, by a very able hand, in which this particular will be attended to.

We ſhall only further obſerve, that, beſides having the accented ſyllable of every word *properly* diſtinguiſhed in a dictionary to aſſiſt in the pronunciation, the Engliſh language requires another eſſential improvement, *viz*. the uſe of accents to diſtinguiſh the meaning of *words* and *phraſes*; which, although it is not ſo properly confined to a lexicographer, yet it is not quite without his ſphere. Thus the word *as* admits of two very different ſounds, as well as different ſignifications; as in this example, "Cicero was nearly *as* eloquent *as* Demoſthenes:" in which the firſt *as* is pronounced *aſs*, and the laſt is pronounced *az*. Now, it often happens, that, in reading, the particular way in which it ought to be underſtood is not pointed out by the context, till after the word itſelf is pronounced, which has an equal chance at leaſt of being pronounced wrong; whereas, if it were always accented when employed in the one ſenſe, and not in the other, it would free the reader from this perplexity. There are other caſes in which the uſe of proper accents in writing would be of great conſequence; as at the beginning of a ſentence, when it was put as a queſtion, or uſed ironically, *&c*. the want of which every one muſt have obſerved. But as this does not ſo properly belong to the lexicographer as the grammarian, we ſhall here take no further notice of it.

The above examples, we hope, will be ſufficient to give the reader ſome idea of the plan that we would propoſe; and enable him to determine, whether or not a dictionary, executed upon this plan, would convey to his mind a more perfect knowledge of the Engliſh language, than thoſe dictionaries that have been hitherto publiſhed.

Theſe

Theſe examples were given rather with a view to ſhew the manner in which a work of this kind might be conducted, than as perfect and unexceptionable explanations of the ſeveral articles there enumerated; and therefore we did not think it neceſſary to produce any authorities, although we are ſenſible that they would be neceſſary in a work of this kind.

DIDACTIC, in the ſchools, ſignifies the manner of ſpeaking, or writing, adapted to teach or explain the nature of things.

DIDAPPER, in ornithology, See COLYMBUS.

DIDELPHIS, in zoology, a genus of quadrupeds belonging to the order of feræ, the characters of which are theſe: they have ten foreteeth in the upper-jaw, and eight in the under one; the dog-teeth are long; the tongue is ſomewhat ciliated; and they have a pocket, formed by a duplicature of the ſkin of the belly, in which the dugs are included. There are five ſpecies, *viz.* 1. The marſupialis, with eight dugs incloſed in the abdominal pocket. He is about ſixteen inches long from the ſnout to the root of the tail, which is about twelves inches long: he has five toes on the fore-feet, with crooked claws and five toes on the hind-feet, only four of them furniſhed with claws; the fifth, which is a kind of thumb, is at a diſtance from the others, and has no claw; the tail is bare from a little below the root: The ears and legs are likewiſe bare; the eyes are ſmall, prominent, of a black colour, and very lively. The body is of a greyiſh colour, with ſome ſmall tufts of black and white hairs upon the back and ſides. Under the belly of the female there is a large bag or pocket, formed by a remarkable duplicature of the ſkin, in which the dugs are contained. This pocket the animal can ſhut or open at pleaſure, by means of a couple of muſcles and two bones which are placed before the os pubis, and are peculiar to the didelphis. The interior ſide of this pocket is full of ſmall glands, which ſecrete a yellowiſh ſtinking ſubſtance, which diffuſes its odour through the whole body of the animal: but this ſubſtance, when dried, loſes its diſagreeable odour, and acquires a ſmell like that of muſk.—This animal is originally a native of South America. Moſt authors affirm that they bring forth five or ſix young ones at a time. As ſoon as they are brought forth, they creep into the pocket of the mother, where the dugs are ſituate, and continue there ſucking till they be able to run about. When alarmed or frightened, they run into the mother's pocket, and ſhe makes off with them in this ſituation. The didelphis is an animal of ſlow motion; a man can eaſily out run him; but then, he takes to a tree, which he mounts with great facility, and conceals himſelf among the leaves, or ſuſpends himſelf by twiſting his tail round a branch. Although a carnivorous animal, he is fond of the ſugar cane, potatoes, *&c.* See Plate LXVIII fig. 3.

The ſecond ſpecies is the philander, with four dugs, pendulous ears, and a tail buſhy at the baſe. 3. The opoſſum, with two dugs, and a leſs buſhy tail. 4. The murina, with ſix dugs. 5. The dorſigera, with the tail buſhy at the baſe, and longer than the body. The females of this ſpecies carry their young on their backs, the young having their tails twiſted about the tail of the mother. The above four are natives of America.

DIDUS, in ornithology, a genus belonging to the order of gallinæ. The bill is contracted in the middle by two tranſverſe rugæ; each mandible is inflected at the point; and the face is bare behind the eyes. The body is blackiſh and cloudy; the tail is very ſhort; and the upper part of the bill is red. It is a native of India, and is incapable of flying, becauſe the wings are not furniſhed with feathers ſufficient for that purpoſe.

DIDYNAMIA, in the Linnæan ſyſtem of botany. See OTANY, p. 635.

DIE, in geography, a town of France, in the province of Dauphiny, ſituated on the river Drome, twenty-two miles ſouth of Grenoble: E. long. 5° 20′, N. lat. 44°. 50′.

DIEGEM, a town of the Auſtrian Netherlands, in the province of Brabant, about three miles north of Bruſſels: E. long. 4° 20′, and N. lat. 51°.

DIEPE, a port-town of France, ſituated on the Britiſh channel, about thirty miles north of Rouen, and oppoſite to port Rye in England: E. long. 1° 15′, and N. lat. 49° 55′.

DIEPHOLT, a city of Weſtphalia in Germany, ſituated at the north end of the Dummer-lake, thirty-five miles ſouth of Bremen: E. long. 8°, N. lat 53°.

It is ſubject to the king of Great Britain, as elector of Hanover.

DIERVILLA, in botany. See LANICERA.

DIES MARCHIÆ, was the day of congreſs, or meeting of the Engliſh and Scotch, annually appointed to be held on the marches, or borders, in order to adjuſt all differences between them.

DIESIS, in muſic, is the diviſion of a tone leſs than a ſemi-tone; or an interval conſiſting of a leſs or imperfect ſemi-tone.

Dieſis is the ſmalleſt and ſofteſt change or inflexion of the voice imaginable: it is called a faint, expreſſed thus X, by a St Andrew's croſs, or ſaltier.

DIET, in medicine, according to ſome, comprehends the whole regimen, or rule of life, with regard to the ſix non-naturals, air, meats and drinks, ſleep and watching, motion and reſt, paſſions of the mind, retentions and excretions.

The more accurate writers, however, reſtrain the term of diet to what regards eating and drinking, or ſolid aliments and drinks. See MEDICINE.

DIET-DRINKS, a form in phyſic, including all the medicated wines, ales, and wheys, uſed in chronic caſes. They require a courſe or continuation to anſwer any intention of moment.

DIET *of appearance*, in Scots law, the day to which a defender is cited to appear in court, and every other day to which the court ſhall afterwards adjourn the conſideration of the queſtion.

DIET, or DYET, in matters of policy, is uſed for the general

general aſſembly of the ſtates, or circles of the empire of Germany, and of Poland, to deliberate and concert meaſures proper to be taken for the good of the public.

The general diet of the empire is uſually held at Ratiſbon: it conſiſts of the emperor, the nine electors, and the eccleſiaſtical princes; *viz.* the archbiſhops, biſhops, abbots, and abbeſſes; the ſecular princes, who are dukes, marquiſſes, counts, viſcounts, or barons; and the repreſentatives of the imperial cities. It meets on the emperor's ſummons, and any of the princes may ſend their deputies thither in their ſtead. The diet makes laws, raiſes taxes, determines differences between the ſeveral princes and ſtates, and can relieve the ſubjects from the oppreſſions of their ſovereigns.

The diet of Poland, or the aſſembly of the ſtates, conſiſts of the ſenate and deputies, or repreſentative of every palatinate or county and city, and meet uſually every two years, and oftener upon extraordinary occaſions, if ſummoned by the king, or, in his abſence, by the archbiſhop of Gneſna. The general diet of Poland ſits but ſix weeks, and often breaks up in a tumult much ſooner: for one diſſenting voice prevents their paſſing any laws, or coming to any reſolutions on what is propoſed to them from the throne. Switzerland has alſo a general diet, which is uſually held every year at Baden, and repreſents the whole Helvetic body: it ſeldom laſts longer than a month. Beſides this general diet, there are diets of the proteſtant cantons, and diets of the catholic ones; the firſt aſſemble at Araw, and are convoked by the canton of Zurich; the ſecond at Lucern, convoked by the canton of that name.

DIETETIC, denotes ſomething belonging to diet, but particularly that part of phyſic which treats of this ſubject.

DIETS, a town in the circle of the Upper Rhine in Germany, ſituated on the river Lohn, twenty miles north of Mentz, and ſubject to the houſe of Naſſau-Orange: E. long. 7° 40′, and N. lat. 50 28′.

DIEU ET MON DROIT, i. e. *God and my right*, the motto of the royal arms of England, firſt aſſumed by king Richard I. to intimate that he did not hold his empire in vaſſalage of any mortal.

It was afterwards taken up by Edward III. and was continued without interruption to the time of the late king William, who uſed the motto *Je main-tiendray*, though the former was ſtill retained upon the great ſeal. After him queen Anne uſed the motto *Semper eadem*, which had been before uſed by queen Elizabeth; but ever ſince queen Anne, *Dieu et mon droit* continues to be the royal motto.

DIEXAHEDRIA, in natural hiſtory, a genus of pellucid and cryſtalliform ſpars, compoſed of two pyramids, joined baſe to baſe, without any intermediate column: the diexahedria are dodecahedral, or compoſed of two hexangular pyramids.

DIFFUSE, an epithet applied to ſuch writings as are wrote in a prolix manner. Among hiſtorians, Salluſt is reckoned ſententious, and Livy diffuſe. Thus alſo among the orators, Demoſthenes is cloſe and conciſe; Cicero, on the other hand, is diffuſe.

DIFFUSION, the diſperſion of the ſubtile effluvia of bodies into a kind of atmoſphere all round them. Thus the light diffuſed by the rays of the ſun, iſſues all round from that amazing body of fire.

DIGASTRICUS, in anatomy. See Vol. I. p. 222.

DIGEST, in matters of literature, a collection of the deciſions of the Roman lawyers properly digeſted, or arranged under diſtinct heads, by order of the emperor Juſtinian. It conſtitutes the firſt part or volume of the civil law.

DIGESTION, in medicine, is the diſſolution of the aliments into ſuch minute parts as are fit to enter the lacteal veſſels, and circulate with the maſs of blood.

Various are the ſyſtems and hypotheſes framed by phyſicians and philoſophers to account for digeſtion. Some contend, that it is done by a kind of elixation of the ſolid and groſſer parts of the food in the liquid by the heat of the ſtomach, and of the adjacent parts, the liver, ſpleen, *&c.* Others will have it done by attrition, as if the ſtomach, by thoſe repeated motions, which are the effects of reſpiration, rubbed off the minuter particles from the groſſer matters, and agitating the reſt againſt each other, attenuated and diſſolved them.

Others think the bilious juice, others the ſpirits, chiefly concerned in digeſtion.

Others will have the food diſſolved by a menſtruum; but then they are greatly divided as to the nature and origin of this menſtruum; ſome ſuppoſing it an acid furniſhed by the glands of the ſtomach; others, a nitro-aerial ſpirit, which, by penetrating the maſs of food, breaks the connexion of the moſt ſolid parts: and others, a ſaline juice, which divides and volatilizes the parts of the food. Others, again, ſuppoſe digeſtion to be performed by means of a ferment or leaven, which mixing with the aliment, excites an inteſtine motion in the parts thereof, by which means the parts are attenuated and diſſolved. But theſe likewiſe differ in their opinion of this ferment; ſome taking it to be the remains of the food laſt digeſted, which, by its continuance in the ſtomach, has contracted an acid quality and become a ferment: others take the principles of fermentation to be contained in the aliment itſelf, which when incloſed in the ſtomach, heated there, and put in motion, enters on its office of fermentation: others ſuppoſe the matter of the ferment ſupplied by the glands of the ſtomach; and laſtly, others contend for the ſaliva, and make that the ferment ſerving principally for the digeſtion of the food.

Some ſuppoſe digeſtion owing to gentle heat and motion. By this heat and motion, ſay they, the texture of the nouriſhment is changed in the bodies of animals; and then the conſtituent ſolid parts are indued with peculiar attractive powers of certain magnitudes, by which they draw, out of the fluids moving through them, like parts in certain quantities, and thereby preſerve their forms and juſt magnitudes.

 And,

And, to mention no more, Boerhaave afcribes digeftion to the joint action of feveral of the above-mentioned caufes, aided by the expanfion of the air contained in the aliments.

Want of DIGESTION, a difeafe attended with pain, and a fenfe of weight, with eructations and copious flatulences from corrupt humours in the ftomach.

DIGESTIVE, in medicine, fuch remedies as ftrengthen and increafe the tone of the ftomach, and affift in the digeftion of foods. To this clafs belong all ftomachics and ftrengtheners, or corroborants.

DIGIT, in aftronomy, the twelfth part of the diameter of the fun or moon, is ufed to exprefs the quantity of an eclipfe. Thus an eclipfe is faid to be of fix digits, when fix of thefe parts are hid.

DIGITS, or MONADES, in arithmetic, fignify any integer under 10; as 1, 2, 3, 4, 5, 6, 7, 8, 9.

DIGIT is alfo a meafure taken from the breadth of the finger. It is properly $\frac{3}{4}$ of an inch, and contains the meafure of four barley-corns laid breadth-wife.

DIGITALIS, or FOX-GLOVE, in botany, a genus of the didynamia angiofpermia clafs. The calix is divided into five fegments; the corolla is bell-fhaped, ventricofe, and has five divifions; and the capfule is oval, and has two cells. There are fix fpecies, only one of which, *viz.* the purpurea, or purple fox-glove, is a native of Britain. The leaves are faid to be emetic and vulnerary, but are little ufed.

DIGITATED, among botanifts. See Vol. I. p. 640.

DIGITUS, in anatomy. See Vol. I. p. 181.

DIGLYPH, in architecture, a kind of imperfect triglyph, confole, or the like, with two channels or engravings, either circular or angular.

DIGNE, a city and bifhop's fee of Provence in France, fifty-five miles north of Toulon: E. long. 6° 5′, and N. lat. 44° 6′.

DIGNITARY, in the canon law, a perfon who holds a dignity, that is, a benefice which gives him fome pre-eminence over mere priefts and canons. Such is a bifhop, dean, arch-deacon, prebendary, *&c.*

DIGNITY, as applied to the titles of noblemen, fignifies honour and authority.

DIJON, the capital of the province of Burgundy, in France, fituated on the river Ouche, 140 miles fouth-eaft of Paris: E. long. 5° 5′, and N. lat. 47° 15′.

DILATATION, in phyfics, a motion of the parts of any body, by which it is fo expanded as to occupy a greater fpace. This expanfive motion depends upon the elaftic power of the body, whence it appears that dilatation is different from rarefaction, this laft being produced by the means of heat. See MECHANICS.

DILATATORES, in anatomy, a name given to feveral mufcles in the human body. See ANATOMY, Part II.

DILEMMA, in logic, an argument confifting of two or more propofitions, which divides the whole into all its parts, or members, by a disjunctive propofition, and then infers fomething concerning each part, which is finally referred to concerning the whole. See LOGIC.

DILIGENCE, in Scots law, fignifies either that care and attention which parties are bound to give, in implementing certain contracts or trufts, and which varies according to the nature of the contract; as to which, fee SCOTS LAW, title 7. 20. and 28.: Or it fignifies certain forms of law, whereby the creditor endeavours to operate his payment, either by affecting the perfon or eftate of the debtor; fee title 18.

DILL, in botany. See ANETHUM.

DILLEMBURG, a city of the circle of the Upper Rhine in Germany, about forty miles north of Francfort, and fubject to the houfe of Naffau: E. long. 8° 8′, and N. lat. 50° 45′.

DILLENGEN, a city of Swabia, in Germany, fituated on the Danube, about twenty miles north-eaft of Ulm: E. long. 10° 20′, and N. lat. 48° 40′.

DILLENIA, in botany, a genus of the polyandria polygynia clafs. The calix confifts of five leaves, and the corolla of five petals; and the capfule contains many feeds. There is but one fpecies, a native of Malabar.

DILUTE. To dilute a body is to render it liquid; or, if it were liquid before, to render it more fo, by the addition of a thinner thereto. Thefe things thus added, are called diluents, or dilutors.

DIMENSION, in geometry, is either length, breadth, or thicknefs; hence, a line hath one dimenfion, *viz.* length; a fuperficies two, *viz.* length and breadth; and a body, or folid, has three, *viz.* length, breadth, and thicknefs.

DIMINUTIVE, in grammar, a word formed from fome other, to foften or diminifh the force of it, or to fignify a thing is little in its kind. Thus, cellule is a diminutive of cell, globule of globe, hillock of hill.

DIMORPHOTHECA, in botany. See CALENDULA.

DINANT, a town of Germany in the bifhopric of Liege, fituated on the river Maefe, about twelve miles fouth of Namur: E. long. 4° 50′, and N. lat. 50° 18′.

DINGWEL, or DINGWAL, a parliament-town of Scotland, fituated at the weft end of the Cromarty-bay, in the county of Rofs: W long. 4° 15′, and N. lat. 57° 56′. It claffes with Dornock, Wick, and Kirkwall.

DINKELSPIEL, a city of Swabia, about forty miles north of Ulm, E. long. 10° 12′, and N. lat. 49°.

DIOCESE, denotes a particular diftrict, or divifion, under the direction and government of a bifhop.

DIOCTAHEDRIA, in natural hiftory, a genus of pellucid and cryftalliform fpars, compofed of two octangular pyramids, joined bafe to bafe, without any intermediate column. Of thefe fome have long pyramids, others fhort and fharp-pointed ones, and others fhort and obtufe pointed ones; the two former fpecies being found in the hartz-foreft, and the laft in the mines of Cornwall.

DIODIA, in botany, a genus of the tetrandria monogynia clafs. The corolla confifts of one tunnel-fhaped petal; and the capfule has two cells, containing as many feeds. There is but one fpecies, a native of Virginia.

DIODON, in ichthyology, a genus belonging to the order of amphibia nantes. The jaws are bony, ftretched out, and undivided; the aperture or mouth is a

tranfverfe

transverse line. The body is every way beset with sharp moveable prickles. It has no belly-fins. There are two species, *viz.* 1. The atringa, which is spherical, and has triangular prickles. It is a native of India. 2. The trystrix, which is oblong, with cylindrical prickles, and is a native of the Cape of Good Hope.

DIOMEDEA, in ornithology, a genus belonging to the order of anseres. The bill is strait; the superior mandible is crooked at the point, and the lower one is truncated; the nostrils are oval, open, a little prominent, and placed on the sides. There are two species, *viz.* 1. The exulans, has pennated wings, and three toes on each foot. It is the abbatros of Edwards, and is found in the ocean betwixt the tropics, and at the Cape of Good Hope. It flies pretty high, feeds upon flying fish, and is about the size of a pelican. 2. The demersa, has no quill-feathers on the wings; and the feet have four toes, connected together by a membrane. It is the black penguin of Edwards, about the size of a goose, and is found at the Cape of Good Hope.

DIONYSIA, in Grecian antiquity, solemnities in honour of Bacchus, sometimes called by the general name of orgia; and by the Romans bacchanalia, and liberalia. See BACCHANALIA.

DIOECIA, in the Linnæan system of botany. See Vol. I. p. 635.

DIOMEDIS AVIS, in ornithology. See PROCELLARIA.

DIOPTRICS, the science of refractive vision. See OPTICS.

DIOSCOREA, in botany, a genus of the dioecia hexandria class. The calix both of the male and female consists of six segments, and they have no corolla. The female has three styli; the capsule is compressed, has three cells, and contains two membranaceous seeds. There are eight species, none of them natives of Britain.

DIOSMA, in botany, a genus of the pentandria monogynia class. The corolla has five petals; and the nectarium is shaped like a crown, is divided into five segments, and situate above the germen; it has five united capsules; and the seeds are furnished with calyptræ. There are nine species, none of them natives of Britain.

DIOSPYROS, in botany, a genus of the polygamia dioecia class. The calix of the hermaphrodite has four segments, and the corolla is unceolated, and has four segments; it has eight stamina, and a quadrifid stylus; and the berry contains eight seeds. The calix, *&c.* of the male are the same with the above. There are two species, none of them natives of Britain.

DIOTOTHECA, in botany. See MORINA.

DIPHTHONG, in grammar, a double vowel, or the mixture of two vowels pronounced together, so as to make one syllable. See GRAMMAR.

DIPHYES, among natural historians, an appellation given to stones resembling the male and female parts of generation in mankind.

DIPLOE, in anatomy, the soft meditullium, or medullary substance, which lies between the two laminæ of the bones of the cranium. See ANATOMY, Part I.

DIPLOMA, an instrument or licence given by colleges, societies, *&c.* to a clergyman to exercise the ministerial function, or to a physician to practise the profession, *&c.* after passing examination, or admitting him to a degree.

DIPLOMA, in chemistry, *&c.* a double vessel. To boil in diplomate, is to set one vessel, containing the ingredients intended to be acted upon, in another larger vessel full of water, and to this last the fire is to be applied.

DIPONDIUS, in the scripture-language, is used by St Luke to signify a certain coin, which was of very little value: our translation of the passage is, *Are not two sparrows sold for two farthings?* In St Matthew, who relates the same thing, we read, *Are not two sparrows sold for a farthing?*

DIPPING, among miners, signifies the interruption, or breaking off, of the veins of ore; an accident that gives them a great deal of trouble before they can discover the ore again.

DIPSACUS, or TEASEL, in botany, a genus of the tetrandria monogynia class. The common calix consists of many leaves, and the proper one is above the fruit; and the receptacle is paleaceous. There are three species, all natives of Britain, *viz.* the fullonum, or manured teasel; the sylvestris, or wild teasel; and the pilosus, or small wild teasel.

DIPSAS, in zoology. See COLUBER.

DIPTOTES, in grammar, are such nouns as have only two cases, as *suppetiæ*, *suppetias*, &c.

DIPTYCHS, in antiquity, a public register, in which were written the names of the consuls and other magistrates among the heathens; and among the Christians, they were a sort of tablets, on one of which were written the names of the deceased, and on the other those of the living patriarchs, bishops, *&c.* or those who had done any service to the church, for whom prayers were offered, the deacon reading the names at mass.

DIRECTION, in mechanics, signifies the line or path of a body's motion, along which it endeavours to proceed, according to the force impressed upon it. See MECHANICS.

DIRECTOR, in commercial polity, a person who has the management of the affairs of a trading company: thus we say, the directors of the India-company, South-sea-company, *&c.* See COMPANY.

The directors are considerable proprietors in the stocks of their respective companies, being chosen by plurality of votes from among the body of proprietors. The Dutch East-India company have sixty such directors; that of France, twenty-one; the British East-India company has twenty-four, including the chairman, who may be re-elected for four years successively. These last have salaries of 150l. a-year each, and the chairman 200l. They meet at least once a week, and commonly oftener, being summoned as occasion requires.

DIRECTOR, in surgery, a grooved probe, to direct the edge

edge of the knife or ſciſſars, in opening ſinuſes, or fiſtulæ, that by this means the adjacent veſſels, nerves, and tendons may remain unhurt. See SURGERY.

DIRIGENT, or DIRECTRIX, a term in geometry, ſignifying the line of motion, along which the deſcribent line or ſurface is carried in the geneſis of any plane or ſolid figure.

DIS, an inſeparable article prefixed to divers words, the effect whereof is either to give them a ſignification contrary to what the ſimple words have, as *diſoblige*, *diſobey*, &c. or to ſignify a ſeparation, detachment, &c. as *diſpoſing*, *diſtributing*.

DISC, in antiquity, a quoit made of ſtone, iron, or copper, five or ſix fingers broad, and more than a foot long, inclining to an oval figure, which they hurled in form of a bowl, to a vaſt diſtance, by the help of a leathern thong tied round the perſon's hand who threw it, and put through a hole in the middle. Homer has made Ajax and Ulyſſes great artiſts at this ſport.

DISC, in aſtronomy, the body and face of the ſun and moon, ſuch as it appears to us on the earth; or the body or face of the earth, ſuch as it appears to a ſpectator in the moon.

DISC, in optics, is the width of the aperture of teleſcopic glaſſes, whatever their form be, whether plain, convex, concave, *&c.*

DISCERNING, or DISCERNMENT, among logicians, a faculty of the mind, whereby it diſtinguiſhes between ideas.

DISCIPLE, one who learns any thing from another: thus, the followers of any teacher, philoſopher, *&c.* are called diſciples. In the Chriſtian ſenſe, they were followers of Jeſus Chriſt, in general; but in a more reſtrained ſenſe, the diſciples denote thoſe alone who were the immediate followers and attendants on his perſon, of which there were ſeventy or ſeventy-two. The names *diſciple* and *apoſtle* are often ſynonymouſly uſed in the goſpel-hiſtory; but ſometimes the apoſtles are diſtinguiſhed from diſciples, as perſons ſelected out of the number of diſciples, to be the principal miniſters of his religion; of theſe there were only twelve. The Latins kept the feſtival of the ſeventy or ſeventy-two diſciples on July 15th, and the Greeks on January 4th.

DISCIPLINE, in a general ſenſe, denotes inſtruction and government; as military diſcipline, eccleſiaſtical diſcipline, *&c.*

DISCLAMATION, in Scots law, is that caſualty whereby a vaſſal forfeited his feu to his ſuperior, by diſowning or diſclaiming him as ſuch without ſufficient reaſon. See SCOTS LAW, title 12.

DISCORD, in muſic, the relation of two ſounds which are always and of themſelves diſagreeable, whether applied in ſucceſſion or conſonance.

DISCOUNT, in commerce, a term among traders, merchants, and bankers. It is uſed by the two former on occaſion of their buying commodities on the uſual time of credit, with a condition that the ſeller ſhall allow the buyer a certain diſcount at the rate of ſo much *per cent. per annum*, for the time for which the credit is generally given, upon condition that the buyer pays ready money for ſuch commodities, inſtead of taking the time of credit.

DISCRETE, or DISJUNCT PROPORTION, is when the ratio of two or more pairs of numbers or quantities is the ſame, but there is not the ſame proportion between all the four numbers. Thus if the numbers 3 : 6 : : 8 : 16 be conſidered, the ratio between 3 : 6, is the ſame as that between 8 : 16, and therefore the numbers are proportional; but it is only diſcretely or diſjunctly, for 3 is not to 6 as 6 to 8; that is, the proportion is broken off between 8 and 3, and is not continued as in the following continual proportionals, 3 : 6 : : 12 : 24.

DISCUS, in antiquity. See DISC.

DISCUSSION, in matters of literature, ſignifies the clear treating or handling of any particular point, or problem, ſo as to ſhake off the difficulties with which it is embaraſſed: thus we ſay, ſuch a point was well diſcuſſed, when it was well treated of and cleared up.

DISCUTIENTS, in medicine, are ſuch remedies, as, by their ſubtilty, diſſolve a ſtagnating or coagulated fluid, and diſſipate the ſame without an external ſolution of continuity.

DISDIAPASON, or BISDIAPASON, in muſic, a compound concord, deſcribed by F. Parran, in the quadruple ratio of 4 : 1, or 8 : 2.

DISDIAPASON-DIAPENTE, a concord in a ſextuple ratio of 1 : 6.

DISDIAPASON-SEMI-DIAPENTE, a compound concord in the proportion of 16 : 3.

DISDIAPASON-DITONE, a compound conſonance in the proportion of 10 : 2.

DISDIAPASON-SEMI-DITONE, a compound concord in the proportion of 24 : 5.

DISEASE, in medicine, that ſtate of a living body, wherein it is deprived of the exerciſe of any of its functions, whether vital, natural, or animal. See MEDICINE.

DISFRANCHISING, among civilians, ſignifies the depriving a perſon of the rights and privileges of a free citizen or ſubject.

DISJUNCTIVE, ſomething that ſeparates or disjoins. Thus, *or*, *neither*, *&c.* which in connecting a diſcourſe yet ſeparates the parts of it, are called disjunctive conjunctions.

DISLOCATION, in ſurgery. See LUXATION.

DISMA, a town of Japan, ſeparated from Nanqueſacque, only by a narrow canal. The Dutch have a very fine magazine there.

DISPENSARY, or DISPENSATORY, denotes a book containing the method of preparing the various kinds of medicines uſed in pharmacy. Such are thoſe of Bauderon, Quercetan, Zwelfer, Charas, Bates, Meſue, Salmon, Lemery, Quincy, *&c.* but the lateſt and moſt eſteemed are the Edinburgh and London Diſpenſatories.

DISPENSARY, or DISPENSATORY, is likewiſe a magazine or office for ſelling medicines at prime coſt to the poor.

DISPENSATION, in law, the granting a licenſe of doing ſome certain action that otherwiſe is not permitted.

DISPLAYED, in heraldry, is underſtood of the poſition of an eagle, or any other bird, when it is erect, with its wings expanded or ſpread forth. See Plate LXVIII. fig. 8.

DISPONDEE, in the Greek and Latin poetry, a double ſpondee or foot, conſiſting of four long ſyllables, as māēcēnātēs cōnclūdēntēs.

DISPOSITION, in Scots law, is that deed or writing which contains the ſale or grant of any ſubject: when applied to herit•ble ſubjects, it in ſome caſes gets the name of charter, which differs from a diſpoſition in nothing elſe than a few immaterial forms. See CHARTER.

DISPOSITION, in rhetoric, the placing words in ſuch an order as contributes moſt to the beauty and ſometimes even to the ſtrength of a diſcourſe.

DISQUISITION, a ſerious and exact examination into the circumſtances of any affair, in order to diſcourſe clearly about it.

DISS, a market-town of Norfolk, on the river Wavency, ſixteen miles ſouth of Norwich.

DISSECTION, in anatomy, the cutting up a body, with a view of examining the ſtructure and uſe of the parts. See ANATOMY.

DISSEISIN, in law, an unlawful diſpoſſeſſing a perſon of his lands or tenements.

DISSENTERS, ſeparatiſts from the ſervice and worſhip of any eſtabliſhed church.

DISSIPATION, in phyſics, an inſenſible loſs or conſumption of the minute parts of the body; or, that flux whereby they fly off, and are loſt.

Circle of DISSIPATION, in optics, is uſed for that circular ſpace upon the retina, which is taken up by one of the extreme pencils or rays iſſuing from an object. See OPTICS.

DISSOLVENT, in general, whatever diſſolves or reduces a ſolid body into ſuch minute parts as to be ſuſtained in a fluid. See CHEMISTRY.

DISSONANCE, in muſic. See DISCORD.

DISSYLLABLE, among grammarians, a word conſiſting only of two ſyllables: ſuch are nature, ſcience, *&c.*

DISTAFF, an inſtrument about which flax is tied in order to be ſpun.

DISTANCE, in general, an interval between two things, either with regard to time or place.

Acceſſible DISTANCES, in geometry, are ſuch as may be meaſured by the chain, *&c.* See GEOMETRY.

Inacceſſible DISTANCES, are ſuch as cannot be meaſured by the chain, *&c.* by reaſon of ſome river, or the like, which obſtructs our paſſing from one object to another. See GEOMETRY.

DISTASTE properly ſignifies an averſion or diſlike to certain foods; and may be either conſtitutional, or owing to ſome diſorder of the ſtomach.

DISTEMPER, among phyſicians, the ſame with diſeaſe. See DISEASE.

DISTEMPER, in painting, a term uſed for the working up of colours with ſomething beſides water or oil. If the colours are prepared with water, that kind of painting is called limning; and if with oil, it is called painting in oil, and ſimply painting. If the colours are mixed with ſize, whites of eggs, or any ſuch proper glutinous or unctuous matter, and not with oil, then they ſay it is done in diſtemper.

DISTENSION, in general, ſignifies the ſtretching or extending a thing to its full length or breadth.

DISTICH, a couplet of verſes making a complete ſenſe. Thus hexameter and pentameter verſes are diſpoſed in diſtichs.

DISTICHIASIS, in ſurgery, a diſeaſe of the eye-lids, when under the ordinary eye-laſhes there grows another extraordinary row of hair, which frequently eradicates the former, and pricking the membrane of the eye, excites pain, and brings on a defluxion.

DISTILLATION, in chemiſtry, the act of drawing off the ſpiritous, aqueous, oleaginous, or ſaline parts of a mixed body from the groſſer and more terreſtrial parts by means of fire, and collecting and condenſing them again by cold. The end of diſtillation is of two kinds: the firſt, and by far the moſt general, is for the ſeparation of ſome acquired bodies from others with which they were mixed, as in the caſe of vinous and volatile ſpirits, and eſſential oils: the other is for the quicker and more effectual combination of ſuch bodies, whoſe mixture is aſſiſted by a boiling heat, as in the caſe of ſpir. nitr. dulc. See CHEMISTRY.

The method of diſtilling malt-waſh, or a fermented mixture of meal and malt, for ſpirit. Fill two thirds of a ſtill, firſt moiſtened by the ſteam of boiling water, with malt-waſh; immediately clap on the head, and lute it down; there will ſoon run a ſpirituous inflammable liquor. Thus is obtained what the malt-diſtillers call a malt low-wine; what comes over after the ſpirit falls off from being proof, is called faints. This experiment may be rendered general, with ſlight variation; for if any wine, beer, or fermented liquor from ſugar, treacle, or fruits, *&c.* be thus treated, it affords a ſpirit differing only according to the nature of the ſubject; but none of them will afford the leaſt inflammable ſpirit without a previous fermentation. The requiſite cautions for ſucceſs are, 1. That the fermentation be well performed. 2. That it be gently diſtilled, with a ſoft well regulated fire. 3. That the groſſer oil, apt to riſe along with the ſpirit, be let out by flannel under the noſe of the worm. Theſe cautions obſerved, the low-wines will be pure and vinous.

The method of diſtilling the lower wines into proof ſpirits for ſale. The lower wines of the laſt proceſs, diſtilled in a bath-heat, give a higher rectified ſpirit than before, which being let down with fair water to a certain ſize or ſtandard, called proof, is what the malt-diſtillers underſtand by proof-goods, or their rectified malt-ſpirit.

The inconveniencies of this art, on account of the many large veſſels required, which increaſe the labour and price of the commodity, might perhaps be remedied by the introduction of a new art, ſubſervient to the malt-diſtillers, and confined to the boiling down the malt-wort to a rob; wherefore it were to be wiſhed, that thoſe who were ſkilled in this branch of diſtil-

lation would try whether a ſpirit ſuperior to that of treacle may not be procured from the rob of malt, prudently prepared and fermented. See CHEMISTRY.

DISTINCT BASE, in optics, is that diſtance from the pole of a convex glaſs, in which objects beheld through it appear diſtinct and well deſcribed; ſo that it is the ſame with the focus. See OPTICS.

DISTINCTION, in logic, is an aſſemblage of two or more words, whereby diſparate things, or their conceptions, are denoted.

DISTORTION, in medicine, a contraction of one ſide of the mouth, occaſioned by a convulſion of the muſcles of one ſide of the face: and it is likewiſe uſed to denote any part of an animal body when it is ill placed or ill favoured.

DISTRESS, in Scots law. When a perſon makes payment of a debt not voluntarily, but in obedience to legal diligence, he is ſaid to have paid in diſtreſs.

DISTRIBUTION, in printing, the taking a form aſunder, ſeparating the letters, and diſpoſing them in the caſes again, each in its proper box. See PRINTING.

DISTRICT, in geography, a part of a province, diſtinguiſhed by peculiar magiſtrates, or certain privileges, in which ſenſe it is ſynonymous with hundred. See HUNDRED.

DISTRINGAS, in law, a writ commanding the ſheriff, or other officer, that he diſtrain a perſon for debt to the king, &c. or for his appearance at a certain day.

DISTRINGAS JURATORES, a writ directed to the ſheriff, whereby he is commanded to diſtrain upon a jury to appear, and to return iſſues on their lands, &c. for non-appearance. This writ of diſtringas juratores iſſues for the ſheriff to have their bodies in court, &c. at the return of the writ.

DITHYRAMBUS, in ancient poetry, a hymn in honour of Bacchus, full of tranſport and poetical rage.

DITONE, in muſic, an interval comprehending two tones. The proportion of the ſounds that form the ditone is 4 : 5, and that of the ſemiditone is 5 : 6.

DITRIHEDRIA, in mineralogy, a genus of ſpars with twice three ſides, or ſix planes, being formed of two trigonal pyramids joined baſe to baſe, without any intermediate column. See SPAR.

The ſpecies of ditrihedria are diſtinguiſhed by the different figures of theſe pyramids.

DITTANY, in botany. See DICTAMNUS.

DITTO, uſually written D°, in books of accounts, an Italian word, ſignifying *the aforementioned.*

DIVAL, in heraldry, the herb nightſhade, uſed by ſuch as blazon by flowers and herbs, inſtead of colours and metals, for ſable, or black.

DIVALLIA. See ANGERONALIA.

DIU, a little iſland and town on the coaſt of Guzurat, in the hither India, and ſubject to Portugal: E. long. 69°, N. lat. 21° 15′.

DIU is alſo a town of Bulgaria, upon the Danube.

DIVAN, a council-chamber, or court of juſtice, among the eaſtern nations, particularly the Turks.

DIVAN-BEGHI, the ſuperintendant of juſtice in Perſia, whoſe place is the laſt of the ſix miniſters of the ſecond rank, who are all under the athemadauler, or firſt miniſter. To this tribunal of the divan-beghi he appeals from ſentences paſſed by the governors: he has a fixed ſtipend of 50,000 crowns for adminiſtring juſtice: all the ſerjeants, uſhers, &c. of the court, are in his ſervice: he takes cognizance of the criminal cauſes of the chams, governors, and other great lords of Perſia, when accuſed of any fault. There are divan-beghis not only at court and in the capital, but alſo in the provinces and other cities of the empire. The alcoran is the ſole rule of his adminiſtration of juſtice, which alſo he interprets at pleaſure. He takes no cognizance of civil cauſes, but all differences ariſing between the officers of the king's houſhold, and between foreign miniſters, are determined by him.

DIVANDUROW, the name of ſeven iſlands which lie a league north of the Maldives, and twenty-four from the coaſt of Malabar, almoſt oppoſite to Cananor.

DIVER, in ornithology. See COLYMBUS.

DIVERGENT, or DIVERGING LINES, in geometry, are thoſe which conſtantly recede from each other.

DIVERGENT RAYS, in optics, are thoſe which going from a point of the viſible object, are diſperſed, and continually depart one from another, in proportion as they are removed from the object: in which ſenſe it is oppoſed to convergent. See OPTICS.

DIVERSION, in military affairs, is, when an enemy is attacked in one place where they are weak and unprovided, in order to draw off their forces from another place where they have made or intend to make an irruption. Thus the Romans had no other way in their power of driving Hanibal out of Italy, but by making a diverſion in attacking Carthage.

DIVESTING, or DIVESTITURE, in law, is uſed for the act of ſurrendering one's effects.

DIVIDEND, in arithmetic, the number propoſed to be divided into equal parts. See ARITHMETIC.

DIVIDEND *of ſtocks*, is a ſhare or proportion of the intereſt of ſtocks erected on public funds, as the ſouth-ſea, &c. divided among and paid to the adventurers half yearly.

DIVINATION, the knowledge of things obſcure, or future, which cannot be attained by any natural means.

It was a received opinion among the heathens, that the gods were wont to converſe familiarly with ſome men, whom they endowed with extraordinary powers, and admitted to the knowledge of their councils and deſigns. Plato, Ariſtotle, Plutarch, Cicero, and others, divide divination into two ſorts or ſpecies, *viz.* natural and artificial. The former was ſo called, becauſe not attained by any rules or precepts of art, but infuſed or inſpired into the diviner, without his taking any further care about it, than to purify and prepare himſelf for the reception of the divine afflatus. Of this kind were all thoſe who delivered oracles, and foretold future events by inſpiration, without obſerving external ſigns or accidents. The ſecond ſpecies of divination was called artificial, becauſe it was not obtained by immediate inſpiration, but was the effect of experience and obſervation.

obſervation. Such was ſouthſaying, as depending upon human art and invention, which however was ſuppoſed not to be altogether deſtitute of divine direction and concurrence, and ſuch was divination by lots. Of this ſort there were various kinds, as by ſacrifices, entrails, flame, cakes, flour, wine, water, augury, birds, lots, verſes, omens, *&c.*

DIVINE, ſomething relating to God.

DIVING, the art of deſcending under water, to conſiderable depths, and abiding there a competent time; the uſes of which are conſiderable, particularly in fiſhing for pearls, corals, ſponges, wrecks of ſhips, *&c.* See PNEUMATICS.

DIVINITY, properly ſignifies the nature, quality, and eſſence of God.

DIVINITY is alſo uſed in the ſame ſenſe with theology.

DIVISIBILITY, that property by which the particles of matter in all bodies are capable of ſeparation or diſunion from each other. See MECHANICS.

DIVISION, in general, is the ſeparating a thing into two or more parts.

DIVISION, in arithmetic. See Vol. I. p. 376.

DIVISION, in algebra. See Vol. I. p. 82.

DIVISOR, in arithmetic. See Vol. I. p. 376.

DIUL, a port-town of Aſia, ſituated on the Indian ocean, weſtward of the river Indus, and ſixty miles weſt of the city of Tatta: E. long. 67°, and N. lat. 25° 15′.

DIVORCE, is the legal diſſolution of a marriage which can be obtained at the ſuit of the injured party, upon the grounds of adultery or wilful deſertion proved againſt the other. See SCOTS LAW, title 6.

DIURESIS, in medicine, an excretion of urine: whence,

DIURETICS, in pharmacy, ſuch ſimples as increaſe the diſcharge of urine; or which are ſuppoſed to have a power of removing obſtructions in the urinary paſſages.

DIURNAL, in aſtronomy, ſomething relating to the day; in oppoſition to nocturnal, which regards the night.

DIZIER, or St DIZIER, a city of Champaign in France, ſituated on the river Marne, about forty-five miles north-eaſt of Troyes: E. long. 5°, and N. lat. 48° 32′.

DIZOSTOS, in botany. See EUPHORBIA.

DIZZINESS, in medicine, See VERTIGO.

DO, in muſic, a note of the Italian ſcale, correſponding to *ut* of the common gamut. See MUSIC.

DOB-CHICK, in ornithology. See COLYMBUS.

DOBLAC, a town of the Tyroleſe, in Germany, ſituated at the foot of the Alps, about two miles north of the frontiers of the ſtate of Venice.

DOCIMASIA, in Greek antiquity, a probation of the magiſtrates and perſons employed in public buſineſs at Athens. It was performed publicly in the forum, where they were obliged to give account of themſelves and their paſt life before certain judges. Among ſeveral queſtions propoſed to them, we find the following, whether they had been dutiful to their parents, had ſerved in the wars, and had a competent eſtate.

DOCK, in botany. See LAPATHUM.

DOCK, in maritime affairs, is a pit, great pond, or creek, by the ſide of an harbour, made convenient either for the building or repairing of ſhips.

DOCK-YARDS, in ſhip-building, are magazines of all ſorts of naval ſtores. The principal ones in England are thoſe of Chatham, Portſmouth, Plymouth, Woolwich, Deptford, and Sheerneſs. In time of peace, ſhips of war are laid up in theſe docks; thoſe of the firſt-rates moſtly at Chatham, where, and at other yards, they receive from time to time ſuch repairs as are neceſſary. Theſe yards are generally ſupplied from the northern crowns with hemp, pitch, tar, roſin, *&c.* but as for maſts, particularly thoſe of the larger ſize, they are brought from New England.

DOCTOR, a perſon who has paſſed all the degrees of a faculty, and is impowered to teach or practiſe the ſame: thus we ſay, doctor in divinity, doctor in phyſic, doctor of laws.

The title of doctor ſeems to have been created in the XIIth century, inſtead of *maſter*, and eſtabliſhed with the other ſcholaſtic degrees of batchelors and licentiates, by Peter Lombard and Gilbert Porreus, then the chief divines of the univerſity of Paris. Gratian did the ſame thing, at the ſame time, in the univerſity of Bologna.

DOCTOR *of the law*, a title of honour among the Jews. The inveſtiture, if we may ſo ſay, of this order was performed by putting a key and table book in their hands, which is what ſome authors imagine our Saviour had in view, Luke xi. 52. when ſpeaking of the doctors of the law, he ſays, "Wo unto you, doctors of the law, for you have taken away the key of knowledge: you entered not in yourſelves, and them that were entering you hindered."

DOCTORS-COMMONS. See COLLEGE *of civilians*.

DOCUMENT, in law, ſome written monument produced in proof of any thing aſſerted.

DODARTIA, in botany, a genus of the didynamia angioſpermia claſs. The calix has five teeth; the inferior labium is much leſs than the ſuperior; and the capſule is roundiſh, and has two cells. There are two ſpecies, none of them natives of Britain.

DODDER, in botany. See CUSCUTA.

DODECAGON, in geometry, a regular polygon conſiſting of twelve equal ſides and angles.

DODECAHEDRON, in geometry, one of the platonic bodies, or regular ſolids, contained under twelve equal and regular pentagons.

DODECANDRIA, in the Linnæan ſyſtem of botany. See Vol. I. p. 635.

DODO, in ornithology. See DIDUS.

DODONÆA, in botany. See PTELEA.

DODRANS, in antiquity, three fourths of the as. See AS.

DOESBURG, a town of the United Netherlands, in the province of Guelderland, ſituated on the river Yſſel, about nine miles ſouth of Zutphen: E. long. 6°, and N. lat. 52°.

DOG, in zoology. See CANIS.

DOG'S BANE, in botany. See APOCYNUM.

DOG-DAYS. See CANICULAR.

DOG'S FENNEL, in botany. See COTULA.

DOG'S MERCURY, in botany. See MERCURIALIS.

DOG'S ROSE. See ROSA.

DOG'S STONES, in botany. See ORCHIS.

DOG'S TAIL, in botany. See CYNOSURUS.

DOG'S TONGUE, in botany. See CYNOGLOSSUM.

DOG'S TOOTH, in botany. See ERYTHRONIUM.

DOGE, the chief magiſtrate in the republics of Venice and Genoa.

This dignity is elective in both places; at Venice it continues for life; at Genoa, it is only for two years. His title is Serenity: he is chief of the council, and mouth of the republic, he being to anſwer for her. The Venetians do not go into mourning at his death, being only the phantom of majeſty, as all the authority is veſted in the republic; the doge only lends his name to the ſenate; the power is diffuſed through the whole body; though anſwers to foreign ambaſſadors, *&c.* are made in the name of the doge. The money is ſtruck in his name, but does not bear his arms. All the magiſtrates riſe and ſalute him when he comes into the council: but he riſes to none but foreign ambaſſadors. He muſt not ſtir out of Venice, without leave of the counſellors, *&c.*

DOGGERS, a name uſed for fiſhing veſſels; whence, in ſome of our old ſtatutes, we meet with dogger-men, denoting the fiſhermen of thoſe veſſels.

DOGMA, a principle, maxim, tenet, or ſettled opinion, particularly with regard to matters of faith and philoſophy.

DOGMATICAL, ſomething belonging to a doctrine or opinion. A dogmatical philoſopher is one who aſſerts things poſitively; in oppoſition to a ſceptic, who doubts of every thing.

DOGMATISTS, a ſect of ancient phyſicians, of which Hippocrates was the firſt author. They are alſo called *logici*, logicians, from their uſing the rules of logic in ſubjects of their profeſſion. They laid down definitions and diviſions reducing diſeaſes to certain genera, and thoſe genera to ſpecies, and furniſhing remedies for them all; ſuppoſing principles, drawing concluſions, and applying thoſe principles and concluſions to particular diſeaſes under conſideration: in which ſenſe the dogmatiſts ſtand contradiſtinguiſhed from empirics and methodiſts. They reject all medicinal virtues that they think not reducible to manifeſt qualities: but Galen hath long ago obſerved of ſuch men, that they muſt either deny plain matter of fact, or aſſign but very poor reaſons and cauſes of many effects they pretend to explain.

DOLE, in our ancient cuſtoms, ſignified a part or portion, moſt commonly of a meadow, where ſeveral perſons have ſhares. It alſo ſtill ſignifies a diſtribution or dealing of alms, or a liberal gift made by a great man to the people.

DOLE, in Scots law, ſignifies a malevolent intention. It is eſſential in all crimes that it be committed intentionally, or by an act of the will; hence the rule, *Crimen dolo contrahitur.* See SCOTS LAW, title 33.

DOLICHOS, in botany, a genus of the diadelphia decandria claſs of plants, the corolla of which is papilionaceous; the vexillum is roundiſh, large, emarginated, and wholly reflected; the fruit is a large, acuminated, oblong pod, compoſed of two valves, and containing two cells; the ſeeds are numerous, elliptical, and frequently compreſſed. There are twenty-five ſpecies, none of them natives of Britain.

DOLLAR, a ſilver coin current in ſeveral parts of Germany and Holland. There are various ſpecies of dollars, as the rix-dollar, the ſemi-dollar, the quarter-dollar, *&c.*

DOLPHIN, in ichthyology. See DELPHINUS.

DOM, or DON, a title of honour, invented and chiefly uſed by the Spaniards, ſignifying, ſir, or lord.

This title, it ſeems, was firſt given to Pelayo, in the beginning of the VIIIth century. In Portugal no perſon can aſſume the title of don, without the permiſſion of the king, ſince it is looked upon as a mark of honour and nobility.

DOMAIN, the inheritance, eſtate, or poſſeſſion of any one. See DEMESNE.

DOME, in architecture, a ſpherical roof, or a roof of a ſpherical form, raiſed over the middle of a building, as a church, hall, pavillion, veſtible, ſtair-caſe, *&c.* by way of crowning.

DOME, or DOOM, ſignifies alſo a ſentence, judgment, or decree.

DOMESDAY, or DOOMSDAY-BOOK, a very ancient record made in the time of William the Conqueror, which now remains in the exchequer, and conſiſts of two volumes, a greater and a leſs; the greater contains a ſurvey of all the lands in moſt of the counties in England, and the leſs comprehends ſome counties that were then ſurveyed. The book of domeſday was begun by five juſtices, aſſigned for that purpoſe in each county, in the year 1081, and finiſhed in 1086. It was of that authority, that the conqueror himſelf ſubmitted, in ſome caſes wherein he was concerned, to be determined by it. Camden calls this book the tax-book of king William; and it was farther called Magna rolla.

There is likewiſe a third book of Domeſday, made by command of the conqueror; and alſo a fourth, being an abridgment of the other books.

DOMESTIC, any man who acts under another, ſerving to compoſe his family; in which he lives, or is ſuppoſed to live, as a chaplain, ſecretary, *&c.* Sometimes domeſtic is applied to the wife and children, but very ſeldom to ſervants, ſuch as footmen, lacquies, porters, *&c.*

DOMICILE, in Scots law, is the dwelling place where a perſon lives with an intention to remain. See SCOTS LAW, title 2.

DOMIFYING, in aſtrology, the dividing or diſtributing the heavens into twelve houſes, in order to erect a theme, or horoſcope, by means of ſix great circles, called circles of poſition.

There are various ways of domifying: that of regiomontanus, which is the moſt common, makes the circles

circles of poſition paſs through the interſections of the meridian and the horizon; others make them paſs through the poles of the zodiac.

DOMINATION, in theology, the fourth order of angels, or bleſſed ſpirits, in the hierarchy, reckoning from the ſeraphim.

DOMINGO, or ST DOMINGO, the capital of the iſland of Hiſpaniola, the ſee of an archbiſhop, and the moſt ancient royal audience in America: W. long. 70°, N. lat. 18° 20′.

DOMINICA, one of the Caribbee-iſlands, ſubject to Britain: W. long. 61° 20′, N. lat. 16°.

DOMINICAL LETTER. See ASTRONOMY, p. 495.

DOMINICANS, an order of religious, called in France Jacobins, and in England Black-friers, or preaching-friers. This order founded by St Dominic, a native of Spain, was approved of by Innocent III. in 1215, and confirmed by a bull of Honorius III. in 1216. The deſign of their inſtitution was to preach the goſpel, convert heretics, defend the faith, and propagate Chriſtianity. They embraced the rule of St Auguſtine, to which they added ſtatutes and conſtitutions, which had formerly been obſerved either by the Carthuſian or Præmonſtratenſes. The principal articles enjoined perpetual ſilence, abſtinence from fleſh at all times, wearing of woollen, rigorous poverty, and ſeveral other auſterities. This order has ſpread into all the parts of the world. It has produced a great number of martyrs, confeſſors, biſhops; and they reckon three popes, ſixty cardinals, 150 archbiſhops, and 800 biſhops of their order, beſides the maſters of the ſacred palace, who have always been Dominicans. They are inquiſitors in many places.

DOMINION, in the civil law, ſignifies the power to uſe or diſpoſe of a thing as we pleaſe.

DOMINIUM *eminens*, in Scots law, that power which the ſtate or ſovereign has over private property, by which the proprietor may be compelled to ſell it for an adequate price where public utility requires. See SCOTS LAW, title 8.

DOMINIUM *directum*, in Scots law, the right which a ſuperior retains in the lands, notwithſtanding the feudal grant to his vaſſal. See SCOTS LAW, title 12.

DOMINIUM *utile*, in Scots law, the right which the vaſſal acquires in the lands by the feudal grant from his ſuperior. See SCOTS LAW, title 13.

DON, the name of two rivers; one very large, which, after dividing Aſia from Europe, falls into the Palus Meotis; the other in the county of Aberdeen in Scotland.

DONATION, in Scots law, ſignifies a voluntary gift. Donation betwixt huſband and wife; ſee SCOTS LAW, title 6.—When revocable; Not preſumed *in dubio*;—Donations *mortis cauſa*: See title 22.

DONATISTS, Chriſtian ſchiſmatics in Africa, who took their name from their leader Donatus. A ſecret hatred againſt Cæcilian, elected biſhop of Carthage about the year 311, excited Donatus to form this ſect. He accuſed Cæcilian of having delivered up the ſacred books to the Pagans, and pretended that his election was void, and all his adherents heretics. He taught that baptiſm adminiſtered by heretics was null, that every church but the African was become proſtituted, and that he was to be the reſtorer of religion. Some accuſe the Donatiſts of Arianiſm. Conſtantius and Honorius made laws for their baniſhment, and Theodoſius and Honorius condemned them to grievous mulcts.

DONATIVE, a gratuity, or preſent made to any perſon.

Donative among the Romans was properly a gift made to the ſoldiers, as congiarium was that made to the people.

DONATORY, in Scots law, that perſon to whom the king beſtows his right to any forfeiture that has fallen to the crown.

DONAWERT, a city of Bavaria in Germany, forty miles north-weſt of Ulm: E. long. 10° 40′, N. lat. 48° 40′.

DONAX, a genus of inſects belonging to the order of vermes teſtacea. It is an animal of the oyſter kind; and the ſhell has two valves, with a very obtuſe margin in the fore part. There are ten ſpecies, principally diſtinguiſhed by the figure of their ſhells.

DONCASTER a market-town of Yorkſhire, thirty miles ſouth of York. See YORK.

DONOR, in law, the perſon who gives lands or tenements to another in tail, *&c.* as he to whom ſuch lands, *&c.* are given is the donee.

DONZY, a town of France in the Orleannois: E. long. 3° 16′, N. lat. 47° 17′.

DOOR, in architecture. See ARCHITECTURE, p. 356.

DORCHESTER, the capital of Dorſetſhire, ſituated on the river Froom, ſix miles north of Weymouth: W. long. 2° 35′, and N. lat 50° 40′. It gives the title of marquis to the noble family of Pierpoint, dukes of Kingſton, and ſends two members to parliament.

DORDONNE, a river of France, which runs through the province of Guienne, and falls into the Garonne, twelve miles below Bourdeaux.

DOREE, or JOHN DOREE, in ichthyology. See ZEUS.

DORIA, in botany. See SOLIDAGO.

DORIC, in general, any thing belonging to the Dorians, an ancient people of Greece, inhabiting near mount Parnaſſus.

DORIC ORDER in architecture. See Vol. I. p. 351.

DORIC DIALECT, one of the five dialects, or manners of ſpeaking which were principally in uſe among the Greeks.

It was firſt uſed by the Lacedemonians, particularly thoſe of Argos; afterwards it paſſed into Epirus, Lybia, Sicily, and the iſlands of Rhodes, Crete, *&c.*

DORIC MODE, in muſic, the firſt of the authentic modes of the ancients; its character is to be ſevere, tempered with gravity and joy; and is proper upon religious occaſions, as alſo to be uſed in war. It begins *D, la, ſol, re.* Plato admires the muſic of the doric mode, and judges it proper to preſerve good manners, as being

ing mafculine; and on this account allows it in his commonwealth. The ancients had likewife their fubdoric or hypodoric mode, which was one of the plagal modes. Its character was to be very grave and folemn: it began with *re*, a fourth lower than the doric.

DORMANT, in heraldry, is ufed for the pofture of a lion, or any other beaft, lying along in a fleeping attitude, with the head on the fore-paws; by which it is diftinguifhed from the couchant, where though the beaft be lying, yet he holds up his head.

DORMER, in architecture, fignifies a window made in the roof of an houfe, or above the entablature, being raifed upon the rafters.

DORMITORY, a gallery in convents or religious houfes, divided into feveral cells, in which the religious fleep or lodge.

DORONICIS AFFINIS, in botany. See GERBERA.

DORONICUM, LEOPARD'S BANE, in botany, a genus of the fyngenefia polygamia fuperflua clafs. The receptacle is naked; the pappus is fimple; the fcales of the calix are equal, and longer than the difc; and the feeds in the radius are naked, and have no pappus. There are three fpecies, none of them natives of Britain.

DORPT, or DORPAT, a city of Livonia, about fifty miles fouth of Narva: E. long. 27° 25′, and N. lat. 58°.

DORSAL, an appellation given to whatever belongs to the back. See DORSUM.

DORSAL MUSCLES. See ANAT. Part. II.

DORSIFEROUS PLANTS, among botanifts, fuch as are of the capillary kind, without ftalks, and which bear their feeds on the back-fide of their leaves.

DORSTENIA, in botany, a genus of the tetrandria monogynia clafs. The common receptacle confifts of one flefhy leaf, in which the folitary feeds are contained. There are four fpecies, none of them natives of Britain.

DORSUM, BACK, in anatomy, comprehends all the pofterior part of the trunk of the body, from the neck to the buttocks. See ANATOMY.

DORT, a city of the United Provinces, fituated in that of Holland, on an ifland in the river Maefe, about ten miles eaft of Rotterdam: E. long. 4° 40′, and N. lat. 51° 47′.

DORTMONT, a city of Weftphalia in Germany, about thirty miles north-eaft of Dufeldorp: E. long 6° 50′, and N. lat. 51° 25′. It is an imperial city, and conftitutes a fovereign ftate.

DORTMANNA, in botany. See LOBELIA.

DORYCNIUM, in botany. See CONVOLVULUS.

DORYPHORI, in antiquity, an appellation given to the life guard men of the Roman emperors.

DOSITHEANS, in church-hiftory, a fect among the Hebrews, being one of the branches of the Samaritans. See SAMARITANS.

They abftained from eating any creature that had life, and were fo fuperftitious in keeping the fabbath, that they remained in the fame place and pofture wherein that day furprifed them, without ftirring till the next day. They married but once, and a great number never married. Dofitheus, their founder, being diffatiffied among the Jews, retired to the Samaritans, who were reputed heretics, and invented another fect; and to make it more authentic, he went into a cave, where, by too long abftinence, he killed himfelf. The name of Dofitheans was alfo given to fome of the difciples of Simon Magus.

DOTTEREL, in ornithology. See CHARADRIUS.

DOUAY, a fortified city of the French Netherlands, fituated on the river Scrape, about fifteen miles fouth of Lifle: E. lon. 3°, and N. lat. 50° 25′.

DOUBLE FICHY, or FICHE′, in heraldry, the denomination of a crofs, when the extremity has two points, in contradiftinction to fiché, where the extremity is fharpened away to one point. See Plate LXVIII. fig. 8.

DOUBLETS, a game on dice within tables: the men, which are only fifteen, being placed thus; upon the fice, cinque, and quater points, there ftand three men a-piece; and upon the trey, duce, and ace, only two. He that throws higheft hath the benefit of throwing firft, and what he throws he lays down, and fo doth the other: what the one throws, and hath not, the other lays down for him, but on his own account; and thus they do till all the men are down, and then they bear. He that is down firft bears firft, and will doubtlefs win the game, if the other throws not doublets to overtake him; which he is fure to do, fince he advances or bears as many as the doublets make, *viz*. eight for two fours.

DOUBLING, in the military art, is the putting two ranks or files of foldiers into one. Thus, when the word of command is, *double your ranks*, the fecond, fourth, and fixth ranks march into the firft, third, and fifth, fo that the fix ranks are reduced to three, and the intervals between the ranks become double what they were before.

DOUBLING, among hunters, who fay that a hare doubles, when fhe keeps in plain fields, and winds about to deceive the hounds.

DOUBLING, in the menage, a term ufed of a horfe, who is faid to double his reins, when he leaps feveral times together, to throw his rider: thus we fay, the ramingue doubles his reins, and makes pontlevis.

DOUBLING *a cape or point*, in navigation, fignifies the coming up with it, paffing by it, and leaving it behind the fhip.

DOUBLINGS, in heraldry, the linings of robes and mantles of ftate, or of the mantlings in atchievments.

DOUBLON, or DUBLOON, a Spanifh and Portuguefe coin, being the double of a piftole. See PISTOLE.

DOUBTING, the act of with-holding our affent from any propofition, on fufpicion that we are not thoroughly apprifed of the merits thereof; or from not being able peremptorily to decide between the reafons for and againft it.

DOUCINE, in architecture, a moulding concave above and convex below, ferving commonly as a cymatium to a delicate corniche. It is likewife called gula.

DOVE, in ornithology. See COLUMBA.

DOVE, in geography, the name of a river dividing Derbyfhire

byſhire from Staffordſhire: alſo of a town of the Orleanois, in France, about twenty miles ſouth-eaſt of Angers.

DOVE-TAILING, in carpentry, is the manner of faſtening boards together by letting one piece into another, in the form of the tail of a dove. The dove-tail is the ſtrongeſt of the aſſemblages or jointings, becauſe the tenon, or piece of wood which is put into the other, goes widening to the extreme, ſo that it cannot be drawn out again, by reaſon the extreme or tip is bigger than the hole.

DOVER, a borough and port-town of Kent, ſituated on a rock, oppoſite to Calais in France, with a ſtrong caſtle: E. long. 25′, and N. lat. 51° 10′.

Dover gives the title of duke to the dukes of Queenſbury, a branch of the noble family of Douglas; and ſends two members to parliament, ſtyled barons of the cinque ports, whereof Dover is the chief.

DOUGLAS, a port-town, and the beſt harbour in the Iſle of Man: W. long. 4° 25′, and N. lat. 54° 7′.

DOWAGER, a widow endowed, is a title applied to the widows of princes, dukes, earls, and perſons of high rank only.

DOWER, that portion which the law allows a widow out of the lands of her huſband, after his deceaſe.

DOWN, in geography, the capital of a county of the ſame name in the province of Ulſter, in Ireland: W. long. 5° 50′, and N. lat. 54° 23′.

DOWNETON, or DUNKTON, a borough-town of Wiltſhire, five miles ſouth of Saliſbury. It ſends two members to parliament.

DOWNHAM, a market-town of Norfolk, ten miles ſouth of Lynn, famous for its good butter; there being a thouſand, and ſometimes two thouſand firkins bought here every Monday, and ſent up the river Ouſe to Cambridge, from whence it is conveyed to London, in the Cambridge waggons.

DOWNS, a famous road near Deal, in Kent, where both the outward and homeward bound ſhips frequently make ſome ſtay; and ſquadrons of men of war rendezvous in time of war.

It affords excellent anchorage, and is defended by the caſtles of Deal, Dover, and Sandwich.

DOWRY, the money or fortune which the wife brings her huſband in marriage: It is otherwiſe called *maritagium*, marriage-goods, and differs from dower.

DOXOLOGY, an hymn uſed in praiſe of the Almighty, diſtinguiſhed by the title of greater and leſſer.

The leſſer doxology was anciently only a ſingle ſentence, without reſponſe, running in theſe words, *Glory be to the Father, and to the Son, and to the Holy Ghoſt, world without end, amen.* Part of the latter clauſe, *As it was in the beginning, is now, and ever ſhall be,* was inſerted ſome time after the firſt compoſition. Some read this ancient hymn, *Glory be to the Father, and to the Son with the Holy Ghoſt.* Others, *Glory be to the Father in or by the Son, and by the Holy Ghoſt.* This difference of expreſſion occaſioned no diſputes in the church, till the riſe of the Arian hereſy; but when the followers of Arius began to make uſe of the latter as a diſtinguiſhing character of their party, it was entirely laid aſide by the catholics, and the uſe of it was enough to bring any one under ſuſpicion of heterodoxy. The doxology was uſed at the cloſe of every ſolemn office. The weſtern church repeated it at the end of every pſalm, and the eaſtern church at the end of the laſt pſalm. Many of their prayers were alſo concluded with it, particularly the ſolemn thankſgiving, or conſecration prayer at the euchariſt. It was alſo the ordinary concluſion of their ſermons.

The greater doxology, or angelic hymn, was likewiſe of great note in the ancient church. It began with theſe words, which the angels ſung at our Saviour's birth, *Glory be to God on high*, &c. It was chiefly uſed in communion ſervice, and in mens private devotions. Both the doxologies have a place in the church of England, the former being repeated after every pſalm, and the latter uſed in the communion ſervice.

DRABA, in botany, a genus of the tetradynamia ſiliculoſa claſs. The pod is entire and ſomewhat oval, with plain valves, and a parallel diſſepimentum; it has no ſtylus. There are ſix ſpecies, three of them natives of Britain, *viz.* the verna, or common whitlow-graſs; the muralis, or ſpeedwell-leaved whitlow-graſs; and the incana, or wreathen-poded whitlow-graſs.

DRABS, in the ſalt-works, a kind of wooden boxes for holding the ſalt when taken out of the boiling pan, the bottoms of which are made ſhelving or inclining forwards, that the briny moiſture of the ſalt may drain off.

DRACHM, a Grecian coin of the value of ſeven-pence three-farthings.

DRACO, the DRAGON, in zoology, a genus belonging to the order of amphibia reptilia. The characters of which are theſe: It has four legs, a cylindrical tail, and two membranaceous wings, radiated like the fins of a fiſh, by which he is enabled to fly, but not to any great diſtance at a time There are two ſpecies, 1. The volans, or flying dragon, with the wings entirely diſtinct from the fore-legs; it is found in Africa and the Eaſt Indies. 2. The præpos, with the wings fixed to the fore-legs; it is a native of America. They are both harmleſs creatures, and feed upon flies, ants, and ſmall inſects.

DRACO VOLANS, in meteorology, a fiery exhalation, frequent in marſhy and cold countries.

It is moſt common in ſummer, and though principally ſeen playing near the banks of rivers, or in boggy places, yet ſometimes mounts up to a conſiderable height in the air, to the no ſmall terror of the amazed beholders; its appearance being that of an oblong, ſometimes roundiſh, fiery body, with a long tail. It is entirely harmleſs, frequently ſticking to the hands and cloaths of people without injuring them in the leaſt.

DRACO, in aſtronomy, a conſtellation of the northern hemiſphere. See ASTRONOMY, p 486.

DRACOCEPHALUM, DRAGON'S HEAD, in botany, a genus of the didynamia gymnoſpermia claſs. The

faux of the corolla is inflated, and the fuperior labium is concave. There are 13 fpecies, none of them natives of Britain.

DRACONTIC MONTH, the time of one revolution of the moon, from her afcending node, called caput draconis, to her return thither.

DRACONTIUM, DRAGONS, in botany, a genus of the gynandria polyandria clafs. The fpatha is fhaped like a boat; the fpadix is covered; it has no calix; the corolla confifts of five petals; and the berry contains many feeds There are five fpecies, all natives of the Indies.

DRACUNCULI, in medicine, fmall long worms, which breed in the mufcular parts of the arms and legs, called Guinea worms See MEDICINE.

DRACUNCULUS, in botany. See ARUM.

DRACUNCULUS, in ichthyology. See CALLIONYMUS.

DRAGOMAN, DROGMAN, or DRUGGERMAN, a name given in the Levant to the interpreters kept by the ambaffadors of Chriftian nations, refiding at the Porte, to affift them in treating of their mafter's affairs.

DRAGON, in zoology. See DRACO.

DRAGON'S BLOOD, in pharmacy, a refin brought from the Eaft-Indies, either in oval drops, wrapped up in flag leaves, or in large maffes compofed of fmaller tears. The fine dragon's blood of either fort breaks fmooth, free from any vifible impurities, of a dark red colour, which changes upon being powdered into an elegant bright crimfon. It diffolves in pure fpirit, and tinges a large quantity of the menftruum of a deep red colour; it is alfo foluble in oils. It is ufually looked upon as a gentle aftringent, and is fometimes prefcribed againft feminal gleets, the fluor albus, and other fluxes.

DRAGON-FLY. See LIBELLA.

DRAGON-SHELL. See PATELLA.

DRAGONS, in botany. See DRACONTIUM.

DRAGONNE'E, in heraldry; a lion dragonnée is where the upper half refembles a lion, the other half going off like the hinder part of a dragon. The fame may be faid of any other beaft as well as a lion.

DRAGOON, in military affairs, a mufqueteer, mounted on horfeback, who fometimes fights or marches on foot, as occafion requires.

Dragoons are divided into brigades, as the cavalry, and each regiment into troops; each troop having a captain, lieutenant, cornet, quarter-mafter, two ferjeants, three corporals, and two drums. Some regiments have hautboys: they are very ufeful on any expedition that requires difpatch, for they can keep pace with the cavalry, and do the duty of infantry: they encamp generally on the wings of the army, or at the paffes leading to the camp; and fometimes they are brought to cover the general's quarters: they do duty on the generals of horfe and dragoons, and march in the front and rear of the army.

DRAGS, in the fea-language, are whatever hangs over the fhip in the fea, as fhirts, coats, or the like; and boats, when towed, or whatever elfe that, after this manner, may hinder the fhip's way when fhe fails, are called drags.

DRAINS, a name given, in the fen countries, to certain large cuts or ditchesof twenty, thirty, nay fometimes forty foot wide, carried through the marfhy ground to fome river or other place capable of difcharging the water they carry out of the fen-lands. See AGRICULTURE.

DRAKE, in ornithology, the male of the duck-kind. See ANAS.

DRAMA, a poem containing fome certain action, and reprefenting a true picture of human life, for the delight and improvement of mankind.

The principal fpecies of the drama are two, comedy and tragedy. Some others there are of lefs note, as paftoral, fatire, tragi-comedy, opera, *&c.* See COMPOSITION.

DRAMATIC, an epithet given to pieces written for the ftage. See COMPOSITION.

DRANK, among farmers, a term ufed to denote wild oats, which never fail to infeft worn-out lands; fo that when plowed lands run to thefe weeds and thiftles, the farmer knows it is high time to fallow them, or elfe to fow them with hay-feed, and make pafture of them.

DRAPERY, in fculpture and painting, fignifies the reprefentation of the clothing of human figures, and alfo hangings, tapeftry, curtains, and moft other things that are not carnations or landfcapes. See PAINTING.

DRAUGHT, in trade, called alfo CLOFF or CLOUCH, is a fmall allowance on weighable goods, made by the king to the importer, or by the feller to the buyer, that the weight may hold out when the goods are weighed again.

The king allows 1 ℔ draught for goods weighing no lefs than 1 Cwt. 2 ℔ for goods weighing between 1 and 2 Cwt. 3 ℔ for goods weighing between 2 and 3 Cwt. 4 ℔ from 3 to 10 cwt. 7 ℔ from 10 to 18 Cwt. 9 ℔ from 18 to 30, or upwards.

DRAUGT HOOKS, are large hooks of iron, fixed on the cheeks of a cannon-carriage, two on each fide, one near the trunnion hole, and the other at the train, diftinguifhed by the name of fore and hind draught-hooks. Large guns have draught-hooks near the middle tranfom, to which are fixed the chains that ferve to keep the fhafts of the limbers on a march. The fore and hind hooks are ufed for drawing a gun backwards or forwards, by men with ftrong ropes, called draught-ropes, fixed to thefe hooks.

DRAUGHT-HORSE, in farming, a fort of coarfe-made horfe, deftined for the fervice of a cart or plough. See EQUUS.

DRAW, in the fea-language. A fhip is faid to draw fo much water, according to the number of feet fhe finks into it; fo that if a fhip fink into the water eighteen feet perpendicularly, fhe is faid to draw eighteen feet water; and according as fhe draws more or lefs, fhe is faid to be of more or lefs draught.

DRAW-BACK, in commerce, certain duties, either of the cuftoms or of the excife, allowed upon the exportation of fome of our own manufactures; or upon certain foreign merchandife, that have paid duty on importation.

The

The oaths of the merchants importing and exporting are required to obtain the drawback of foreign goods, affirming the truth of the officer's certificate of the entry, and the due payment of the duties: and theſe may be made by the agent or huſband of any corporation or company; or by the known ſervant of any merchant uſually employed in making his entries and paying his cuſtoms. In regard to foreign goods entered outward, if leſs quantity or value be fraudulently ſhipped out than is expreſſed in the exporter's certificate, the goods therein mentioned, or their value, are forfeited, and no drawback to be allowed for the ſame. Foreign goods exported by certificate, in order to obtain the drawback, not ſhipped or exported, or re-landed in Great Britain, unleſs in caſe of diſtreſs, to ſave them from periſhing, are to loſe the benefit of the drawback, and are forfeited, or their value, with the veſſels, horſes, carriages, *&c.* employed in the re-landing thereof; and the perſons employed in the re-landing them, or by whoſe privity they are re-landed, or into whoſe hands they ſhall knowingly come, are to forfeit double the amount of the drawback. Officers of the cuſtoms conniving at, or aſſiſting in any fraud relating to certificate-goods, beſides other penalties, are to forfeit their office, and to ſuffer ſix months impriſonment, without bail or mainprize; as are alſo maſters, or perſons belonging to the ſhips employed therein. Bonds given for the exportation of certificate-goods to Ireland, muſt not be delivered up, nor drawback allowed for any goods, till a certificate under the hands and ſeals of the collector or comptroller, *&c.* of the cuſtoms be produced, teſtifying the landing.

The computation of what is to be drawn back upon the exportation of foreign goods, may be ſeen under their reſpective heads.

Draw-bridge, a bridge made after the manner of a floor, to draw up, or let down, as occaſion ſerves, before the gate of a town or caſtle.

DRAWING, in general, denotes the action of pulling out, or haling along: thus, we read of tooth-drawing, wire-drawing, *&c.*

Drawing, the art of repreſenting the appearances of objects by imitation, or copying without the aſſiſtance of mathematical rules.

The general precepts for drawing are as follow: 1. Begin with plain geometrical figures, as lines, angles, triangles, polygons, arches, circles, ovals, cones, cylinders, and the like, being the foundation of all other proportions. The circle is of uſe in the ſeveral orbicular forms, as the ſun, moon, globes, *&c.* the oval, in giving a juſt proportion to the face and mouth; and the ſquare confines a picture you are to copy, *&c.* the triangle is of uſe in drawing a ſide or half face; angles and arches, in perſpective; and the polygon, in ground-plots, fortifications, *&c.* the cone, in ſpires, ſteeples, tops of towers, *&c.* the cylinder, in columns, pillars, pilaſters, *&c.* See Perspective.

2. Having brought your hand to be fit and ready in general proportions, accuſtom yourſelf to give every object its due ſhade, according to its concavity or convexity, and to elevate or depreſs the ſame, as the object appears either nearer or farther off the light.

3. The ſecond practice of drawing, conſiſts in forming fruits, as apples, pears, cherries, *&c.* with their leaves; the imitation of flowers, as roſes, tulips, carnations, *&c.* herbs, trees, *&c.* of different kinds.

4. The third, in the imitation of beaſts, fowls, fiſhes, *&c.*

5. The fourth practice of drawing conſiſts in the imitation of the body of man, with all its lineaments, as head, noſe, eyes, ears, cheeks, arms, and ſhadows, all exactly proportioned both to the whole and to one another.

6. The fifth is in the drapery, in the imitation of cloathing, and artificially ſetting off the outward coverings, habit, and ornaments of the body, either of cloth, ſtuff, ſilk, or linen, in their natural and proper folds.

7. In drawing of all the forms before-mentioned, it is requiſite to be firſt perfect in the laying down the exact proportions; ſecondly, in the general or outward lines, before you proceed to ſhadowing, or trimming the work within.

8. In mixed and uncertain forms, where the circle, ſquare, *&c.* will be of no uſe, but only in the idea thereof in your own fancy, as horſes, oxen, and the like, you muſt do it by judgment, and ſo gain the true proportions by aſſiduous practice: thus having the ſhape of the thing in your mind, firſt draw it rudely with a coal; then, with more exactneſs, with a lead or pencil; then peruſe it well, and mend it in thoſe parts you have erred in, according to the idea you carry in your mind. When it is mended by your own judgment, compare it with ſome good pattern of the ſame kind, and amend it by that.

9. Having good copies to draw after, learn to reduce them to other proportions, either larger or ſmaller; and this by frequent practice.

10. Let a perfection in drawing be attained by diligent exerciſe, and the inſtruction of a good maſter, before there be any attempts as to colouring and painting; for the former being attained, the reſt will be eaſily underſtood, and gained by frequent practice.

Particular obſervations with regard to Drawing, *are as follows.* 1. If you draw after a print or picture, place it in ſuch a light, that the gloſs of the colours may not interrupt your light, and that the light and your eye may equally and obliquely fall upon the piece, which ſhould be placed at ſuch a diſtance, that, upon opening your eye, you may view it at once: the larger the picture is, the greater diſtance off it ſhould be placed: it ſhould alſo be right before you, and a little reclining.

2. Draw your out-lines at firſt very faint, and with a coal; and let them be drawn agreeable to the pattern, before you begin to ſhadow any part of it. When you have drawn one feature, it ſhould, in ſome meaſure, be a direction for you to draw the other, by obſerving the diſtance from that to the next feature; making a ſmall mark at the place with your coal, then draw it, and ſo to the next, till you have drawn the whole figure.

3. Then obſerve the middle of the picture you would copy, and touch upon the paper with the point of your coal: afterwards, obſerve the more conſpicuous and uppermoſt figures, if there are more than one, which you are to touch lightly in their proper places: thus, running over the whole draught, you will ſee, as it were, the ſkeleton of the piece to draw.

4. Having made out theſe ſketches, view them diligently, if they anſwer your pattern or not; for the geſtures of the life ought to ſhew themſelves eminently in the firſt and rudeſt draughts thereof: correct and mend whatever you perceive amiſs, adding and diminiſhing as it varies from the pattern; by which method it will be brought nearer and nearer to the life.

5. Obſerve the diſtance of one limb, joint, or muſcle, from another, and the ſame in all other accidents of the figure, their length, breadth, turnings, *&c.* ſhadow next to the light very faintly; and where you ſee bold and free touches, be not timorous in expreſſing the ſame. In drawing a head by the life, or otherwiſe, take care to place the features exactly right upon the croſs-lines, whether it be a full face, or three-quarter face. In fore-ſhortening you muſt make the croſs-lines to fly upwards, where they look upwards; but where the aſpect is downwards, they muſt be made downwards, in a circular manner. Having drawn the out-lines true, with a coal, you are to proceed to trace the ſame lines again with a pen, Indian ink, *&c.* drawing them with more exactneſs, and by imitating all the hatches with their exact diſtances one from another, their croſſings, turnings and windings, with more boldneſs and freedom perfect your deſign.

6. In drawing after a naked body, all the muſcles are not to be ſo plainly expreſſed as in anatomical figures: but that ſide whoſe parts are moſt apparent, and of ſignification in the performance of any action, muſt be made to appear more or leſs, according to the force of that action.

7. In drawing young perſons, the muſcles muſt not appear manifeſtly ſo hard as in older and full-grown perſons: the ſame is to be obſerved as to fat and fleſhy perſons, and ſuch as are very delicate and beautiful; and in women, ſcarce any muſcles at all are to be expreſſed, or but very little, unleſs it be in ſome very terrible action, and then too they are to be repreſented very faintly; the like is alſo to be obſerved as to little children.

8. The motion of the whole body muſt be conſidered in drawing of the muſcles; as in the riſing and falling of the arms, the muſcles of the breaſt do appear more or leſs; the hips do the like according as they are bent outward or inward; and it is the ſame chiefly in the ſhoulders, ſides, and neck, according to the ſeveral actions of the body.

9. The proportion of the figure ought to be multiplied by degrees, in proportion of one to two, three, four, *&c.* for herein the chief ſkill conſiſts: the diameter of the biggeſt place, between the knee and the foot, is double to the leaſt; and the largeſt part of the thigh, triple.

DRAY, a kind of cart uſed by brewers, for carrying barrels of beer, or ale; alſo a ſledge drawn without wheels.

Dray, among ſportſmen, denotes ſquirrel-neſts, built in the tops of trees.

DRYATON, a market-town of Shropſhire, fourteen miles north-eaſt of Shrewſbury.

DREDGE, or Dreg, among farmers, denotes oats and barley mingled together.

DREDGERS, the term uſed in the admiralty-court for the oiſter-fiſhers.

DREIN, in the military art, a trench made to draw the water out of a moat, which is afterwards filled with hurdles and earth, or with faſcines or bundles of ruſhes and planks, to facilitate the paſſage over the mud. See Trench.

DRENCH, among farriers, a phyſical potion for horſes. The ingredients for this purpoſe are to be beat coarſely, and either mingled with a decoction, or with wine. Then let all infuſe about a quarter of an hour, and give it to the horſe with a horn, after he has been tied up two hours to the rack.

DRESDEN, the capital of Upper Saxony, in Germany, ſituated on the river Elbe, ſixty-five miles north-weſt of Prague, and eighty-five ſouth of Berlin: E. long. 13° 36′, N. lat. 51°.

It is one of the largeſt and ſtrongeſt towns in Germany, and is the uſual reſidence of the elector of Saxony.

DREUX, a town of Orleanois, in France, ſeventeen miles north of Chartres, and thirty-five weſt of Paris.

DRIFT, a term uſed at ſea. Thus, any thing that floats upon the water, is ſaid to run a-drift.

Drift-sail, a ſail uſed under water, veered out right a-head by ſheets, as other ſails are. It ſerves to keep the ſhip's head right upon the ſea in a ſtorm, and to hinder her driving too faſt in a current.

DRILL, in mechanics, a ſmall inſtrument for making ſuch holes as punches will not conveniently ſerve for. Drills are of various ſizes, and are chiefly uſed by ſmiths and turners.

Drill, or Drill-box, a name given to an inſtrument for ſowing land in the new method of horſe-hoeing huſbandry. See Ariculture.

DRINK, a part of our ordinary food in a liquid form, ſerving to dilute and moiſten the dry meat.

The drinks in different countries are different. The common drink in England is either water, malt liquor, wine, or mixtures of theſe.

The firſt drinks of mankind were certainly water and milk, but the love of luxury and debauchery ſoon introduced the art of preparing intoxicating and inebriating drinks out of vegetables. The vine gave the firſt of theſe liquors; after this, wheat, barley, millet, oats, rice, apples, pears, and pomegranates; and after thoſe the juices drained from the pine, ſycamore, and mapple, were brought to this uſe: in latter times, roots, berries, and the pith of the ſugar-cane, have been employed for the ſame purpoſes.

DRIVERS, among ſportſmen, a machine for driving pheaſant-powts, conſiſting of good ſtrong ozier-wands, ſuch

ſuch as the baſket-makers uſe; theſe are to be ſet in a handle, and twiſted or bound with ſmall oziers in two or three places.

With this inſtrument, the ſportſman drives whole eyes of young powts into his nets. See the next article.

DRIVING, among ſportſmen, a method of taking pheaſant-powts. It is thus: the ſportſman finds out the haunts of theſe birds; and having fixed his nets there, he calls them together by a pheaſant-call, imitating the voice of the dam: after this he makes a noiſe with his driver, which will make them run a little way forward in a cluſter; and this he is to repeat till he has made ſure of them, which an expert ſportſman never fails to do, by driving them into his nets.

DRIVING, in metallurgy, is ſaid of ſilver, when in the operation of refining, the lead being burnt away, the remaining copper riſes upon its ſurface in red fiery bubbles.

DRIVING, in the ſea-language, is ſaid of a ſhip when an anchor being let fall will not hold her faſt, nor prevent her ſailing away with the tide or wind. The beſt help in this caſe is to let fall more anchors, or to veer out more cable; for the more cable ſhe has out, the ſafer ſhe rides. When a ſhip is a-hull, or a-try, they ſay ſhe drives to leeward.

DROGHEDA, a port-town of Ireland, twenty-three miles north of Dublin.

DROGMAN. See DRAGOMAN.

DROITWICH, a borough ſix miles north of Worceſter, which ſends two members to parliament.

DROMEDARY. See CAMELUS.

DRONE, in the hiſtory of inſects. See APIS.

DRONE-FLY, a two-winged inſect, extremely like the common drone-bee, whence alſo the name.

DROPS, in meteorology, ſmall ſpherical bodies which the particles of fluids ſpontaneouſly form themſelves into when let fall from any height.

DROPS, in medicine, a liquid remedy, the doſe of which is eſtimated by a certain number of drops.

DROPSY, in medicine, an unnatural collection of watry humours in any part of the body. See MEDICINE.

DROP-WORT, in botany. See FILIPENDULA.

Water DROP-WORT, in botany. See OENANTHE.

DROSERA, SUN-DEW, in botany, a genus of the pentandria pentagynia claſs of plants, with a funnel-faſhioned flower, conſiſting of five obtuſely-ovated petals: the fruit is an unilocular ſuboval capſule, containing a great many very ſmall ſeeds.

DROWNING, the act of ſuffocating, or being ſuffocated, by water.

Naturaliſts and phyſicians furniſh us with divers well atteſted inſtances of ſurpriſing recoveries of perſons drowned. It is certain from repeated diſſections made on perſons drowned, that they generally have leſs water in their ſtomachs than if they had voluntarily drunk a conſiderable quantity: whence it does not ſeem expedient to hang the drowned perſon by the heels, a poſition that muſt prove uneaſy as ſoon as the humours of the body ſhould reſume their ordinary motion. In order to know whether the perſon has ſwallowed too much water or not, and to make him vomit it up if he has, it is proper to put him in a tun, open at both ends, which is to be rolled in different directions: or the bearded end of a feather ſhould be introduced into the œſophagus. After taking off the cloaths of the drowned perſon, we ought, with the utmoſt expedition, to ſhelter him from the impreſſions of the cold air, and begin to warm him, by wrapping him up with cloaths and coverings: to do this more effectually, he is afterwards to be put into a pretty warm bed, applying alſo to his body hot napkins and cloths. A hot ſcorching ſun, to which drowned perſons have been expoſed, and hot baths, have produced the ſame happy effects.

The great intention to be purſued is, to put the ſolid parts of the machine in action, that thus they may reſtore the motion of the fluids: in order to this, the drowned perſon ſhould be agitated in various directions, in a bed, in the arms of perſons of ſufficient ſtrength.

Spirituous liquors ſhould be poured into his mouth, or warm urine; and ſome perſons preſcribe a decoction of pepper and vinegar, as a gargariſm: we muſt alſo attempt to irritate the internal fibres of the noſe, either by volatile ſpirits, and by the liquors uſed in apoplectic caſes; or by tickling the nerves of the noſtrils with a bearded feather; or by blowing, through a quill, ſnuff, or ſome other more powerful ſternutatory. One of the means frequently uſed with ſucceſs, is to blow warm air, by means of a pipe, into their mouths; or to introduce it by a pair of bellows; or, by injecting warm clyſters, to irritate the inteſtines: the ſmoke of tobacco conveyed into the inteſtines, by means of a tobacco pipe, is much recommended. Venæſection is by no means to be neglected; and perhaps moſt ſucceſsfully in the jugular vein.

DRUG, a general term for goods of the druggiſt and grocery kinds, eſpecially for thoſe uſed in medicine and dying.

DRUGGET, in commerce, a ſtuff ſometimes all wool, and ſometimes half wool half thread, ſometimes corded, but uſually plain.

Thoſe that have the woof of wool, and the warp of thread, are called threaded-druggets; and thoſe wrought with the ſhuttle on a loom of four marches, as the ſerges of Moui, Beauvois, and other like ſtuffs corded, are called corded druggets. As to the plain, they are wrought on a loom of two marches, with the ſhuttle, in the ſame manner as cloth, camlets, and other like ſtuffs not corded.

DRUIDS, the prieſts or miniſters of religion of the ancient Britons and Gauls. The druids were choſen out of the beſt families; and were held, both by the honours of their birth, and their office, in the greateſt veneration. They are ſaid to have underſtood aſtrology, geometry, natural hiſtory, politics, and geography: they had the adminiſtration of all ſacred things, were the interpreters of religion, and the judges of all affairs indifferently.

Whoever refuſed obedience to them, was declared impious and accurſed: they held the immortality of the

the ſoul, and the tranſmigration of ſouls. They are divided by ſome into ſeveral claſſes, as the vaceni, bardi, bubagis, ſemothii. They had a chief, or arch-druid, in every nation: he was a ſort of high-prieſt, having an abſolute authority over the reſt, and was ſucceeded by the moſt conſiderable among his ſurvivors. The youth uſed to be inſtructed by them, retiring with them to caves and deſolate foreſts, where they were ſometimes kept twenty years. They preſerved the memory and actions of great men by their verſes; but are ſaid to have ſacrificed men to Mercury. Cæſar imagined that the druids came from Britain into Gaul, but ſeveral among the modern writers are of a different opinion.

DRUM, is a martial muſical inſtrument in form of a cylinder, hollow within, and covered at the two ends with vellum, which is ſtretched or ſlackened at pleaſure by the means of ſmall cords or ſliding knots: It is beat upon with ſticks. Some drums are made of braſs, but they are commonly of wood.

Kettle DRUMS, are two ſorts of large baſons of copper or braſs, rounded in the bottom, and covered with vellum, or goat-ſkin, which is kept faſt by a circle of iron, and ſeveral holes faſtened to the body of the drum, and a like number ſcrews to ſcrew up and down. They are much uſed among the horſe, as alſo in operas, oratorios, concerts, *&c.*

DRUM, or DRUMMER, he that beats the drum; of whom each company of foot has one, and ſometimes two. Every regiment has a drum-major, who has the command over the other drums. They are diſtinguiſhed from the ſoldiers, by cloaths of a different faſhion: their poſt, when a battalion is drawn up, is on the flanks, and on a márch it is betwixt the diviſions.

DRUM *of the ear*, in anatomy. See Vol. I. p. 299.

DRUMLANERK, a town of Scotland, fifteen miles north of Dumfries.

DRUNKENNESS, a well known diſorder in the brain, occaſioned by drinking too freely of ſpirituous liquors. Drunkenneſs appears in different ſhapes, in different conſtitutions: ſome it makes gay, ſome ſullen, and ſome furious.

DRUPE, among botaniſts. See Vol. I. p. 637.

DRUSENHEIM, a town of Alſace, in Germany, four miles ſouth-eaſt of Hagenau.

DRYADÆA, in botany. See DRYAS.

DRYADS, in the heathen theology, a ſort of deities, or nymphs, which the ancients thought inhabited groves and woods. They differed from the Hamadryades, theſe latter being attached to ſome particular tree, with which they were born, and with which they died; whereas the Dryades were goddeſſes of trees and woods in general.

DRYAS, in botany, a genus of the icoſandria polygynia claſs. The calix conſiſts of eight ſegments, and the corolla of eight petals; and the ſeeds are tailed and hairy. There are two ſpecies, both natives of Britain, *viz.* the pentapetula, or cinquefoil avens; and the octopetala, or mountain avens.

DUBLIN, the capital of the province of Leinſter, and of all Ireland, ſituated at the mouth of the river Liffee, ſixty miles weſt of Holyhead in Wales: W. lon. 6° 25′, N. lat. 53° 16′.

It is a large and beautiful city, pleaſantly ſituated; having a view of the ſea on one ſide, and of a fine country on the other. It is the ſeat of the courts of juſtice, and an archbiſhop's ſee; and has a noble college, which is an univerſity of itſelf.

DUCAL, in general, ſomething belonging to a duke. See DUKE.

DUCAT, a coin current in Germany and other countries abroad, of different values.

DUCATOON, a ſilver coin, likewiſe frequent in ſeveral parts of Europe.

DUCENARIUS, in Roman antiquity, a military officer who had the command of two hundred men.

DUCK, in ornithology. See ANAS.

DUCKER. See COLYMBUS.

DUCKING, plunging in water, a diverſion anciently practiſed among the Goths, by way of exerciſe; but among the Celtæ, Franks, and ancient Germans, it was a ſort of puniſhment for perſons of ſcandalous lives.

They were ſhut up, naked to the ſhift, in an iron cage, faſtened to the yard of a ſhaloop, and ducked ſeveral times.

DUCKING *at the main-yard*, among ſeamen, is a way of puniſhing offenders on board a ſhip; and is performed by binding the malefactor, by a rope, to the end of the yard, from whence he is violently let down into the ſea, once, twice, or three times, according to his offence: and if the offence be very great, he is drawn underneath the keel of the ſhip, which they call keel-haling.

DUCKUP, at ſea, is a term uſed by the ſteer's-man, when the main-ſail, fore-ſail, or ſprit-ſail, hinders his ſeeing to ſteer by a land-mark: upon which he calls out, *Duckup the clew-lines of theſe ſails*, that is, hale the ſails out of the way. Alſo when a ſhot is made by a chace-piece, if the clew of the ſprit-ſail hinders the ſight, they call out, *Duckup*, &c.

DUCT, in general, denotes any tube or canal. It is a term much uſed by anatomiſts.

Air-DUCT, among ichthyologiſts, a canal reaching from the air-bladder in fiſhes to their ſtomach.

DUCTILITY, in phyſics, a property of certain bodies, whereby they are capable of being expanded, or ſtretched forth, by means of a hammer, preſs, *&c.* See CHEMISTRY, and MECHANICS.

DUDERSTAT, a town of Upper Saxony, thirty-five miles north-eaſt of Caſſel.

DUEL, a ſingle combat, at a time and place appointed, in conſequence of a challenge. This cuſtom came originally from the northern nations, among whom it was uſual to decide all their controverſies by arms. Both the accuſer and the accuſed gave pledges to the judges on their reſpective behalf; and the cuſtom prevailed ſo far amongſt the Germans, Danes, and Franks, that none were excuſed from it but women, ſick people, cripples, and ſuch as were under twenty-one years of age, or above ſixty. Even eccleſiaſtics, prieſts, and monks, were obliged to find champions

to

to fight in their ftead. The punifhment of the vanquifhed was either death, by hanging or beheading; or, mutilation of members, according to the circumftances of the cafe. Duels were at firft admitted not only on criminal occafions, but on fome civil ones for the maintenance of rights to eftates, and the like: in latter times, however, before they were intirely abolifhed, they were reftrained to thefe four cafes. 1. That the crime fhould be capital. 2. That it fhould be certain the crime was perpetrated. 3. The accufed muft, by common fame, be fuppofed guilty. And, 4. The matter not capable of proof by witneffes. At prefent it is ufed for a fingle combat on fome private quarrel, and muft be premeditated, otherwife it is called a rencounter. If a perfon be killed in a duel, both the principals and feconds are guilty of murder, whether the feconds engage or not. It is alfo a very high offence to challenge a perfon, either by word or letter, or to be the meffenger of a challenge. The fevere edicts made by Lewis XIV. againft duels have, in a great meafure, put a ftop to the cuftom in France.

DUELLING, in Scots law. See title 33.

DUERO, or DURO, a large river, which, rifing in Old Caftile in Spain, runs from eaft to weft, croffes the province of Leon, and, after dividing Portugal from Spain by a foutherly courfe, turns weftward, croffes Portugal, and falls into the Atlantic Ocean at Porto-Port.

DUKE is either the title of a fovereign prince, as the duke of Savoy, Parma, *&c.* the grand duke of Tufcany, Mufcovy, *&c.* or it is the title of honour and nobility next below princes. The commanders of armies in time of war, the governors of provinces and wardens of marches in times of peace, were called *duces* under the later emperors. The Goths and Vandals divided all Gaul into dutchies and counties, the governors of which they fometimes call *duces*, and fometimes *comites*. In France, under the fecond race of kings, though they retained the name and form of ducal government, there were fcarce any dukes except thofe of Burgundy, Aquitain, and France. In England, among the Saxons, the commanders of armies, *&c.* were called dukes, *duces*, without any addition, till Edward III. made his fon, the Black Prince, duke of Cornwal; after whom there were more made in the fame manner, the title defcending to their pofterity. Duke then, at prefent, is a mere title of dignity, without giving any domain, territory, or jurifdiction over the place from whence the title is taken. A duke is created by patent, cincture of fword, mantle of ftate, impofition of a cap and coronet of gold on his head, and a verge of gold put into his hand. His title is Grace; and, in the ftyle of the heralds, Moft high, potent, high-born, and noble prince.

DULCIFYING, in chemiftry, is the fweetening any matter impregnated with falts, by frequently wafhing it in pure water.

DULL, in the menage. The marks of a dull horfe, called by the French marquis de ladre, are white fpots round the eye and on the tip of the nofe, upon any general colour whatfoever. Though the vulgar take thefe fpots for figns of ftupidity, it is certain they are great marks of the goodnefs of a horfe; and the horfes that have them are very fenfible and quick upon the fpur.

DULWICH, a village near London, remarkable for its mineral waters, which are faid to contain a bitter cathartic falt, but no iron.

DUMBLAIN, a town of Scotland, about five miles north of Stirling.

DUMBNESS, the privation of the faculty of fpeech. The moft general, or rather the fole caufe of dumbnefs, is the want of the fenfe of hearing. The ufe of language is originally acquired by imitating articulate founds. From this fource of intelligence, deaf people are intirely excluded: they cannot acquire articulate founds by the ear: unlefs, therefore, articulation be communicated to them by fome other medium, thefe unhappy people muft for ever be deprived of the ufe of language; and as language is the principal fource of knowledge, whoever has the misfortune to want the fenfe of hearing, muft remain in a ftate little fuperior to that of the brute creation. Deafnefs has in all ages been confidered as fuch a total obftruction to fpeech, or written language, that an attempt to teach the deaf to fpeak or read has been uniformly regarded as impracticable, till Dr Wallis and fome others have of late fhewn, that although deaf people cannot learn to fpeak or read by the direction of the ear, there are other fources of imitation, by which the fame effect may be produced. The organs of hearing and of fpeech have little or no connection. Perfons deprived of the former generally poffefs the latter in fuch perfection, that nothing further is neceffary, in order to make them articulate, than to teach them how to ufe thefe organs. This indeed is no eafy tafk; but experience fhews that it is practicable. Mr THOMAS BRAIDWOOD, of Edinburgh, is perhaps the firft who ever brought this furprifing art to any degree of perfection. For thefe fome years paft, he has taught many people born beaf, to fpeak diftinctly, to read, to write, to underftand figures, the principles of religion and morality, *&c.* This, at firft fight, may appear to be altogether incredible; but the fact is certain. Mr Braidwood has, at prefent, ten or a dozen of deaf pupils, fome of them above twenty years of age, all making a rapid and amazing progrefs in thofe ufeful branches of education.

Mr Braidwood's principal difficulty, after he had difcovered this art, was to make people believe in the practicability of it. He advertifed in the public papers; he exhibited his pupils to many noblemen and gentlemen; ftill he found the generality of mankind unwilling to believe him. A remarkable inftance of this incredulity occurred fome years ago. A gentleman in England fent a deaf girl of his to Mr Braidwood's care. A year or two afterwards, Mr Braidwood wrote to the father, that his daughter could fpeak, read, and write diftinctly. The father returned an anfwer, begging Mr Braidwood's excufe, as he could not believe it; however, he defired a friend of his, who was oc-

cafionally going to Edinburgh, to call at Mr Braidwood, and inquire into the truth of what he had wrote him: he did fo; converfed with Mr Braidwood, faw the young lady, heard her read, fpeak, and anfwer any queftions he put to her. On his return, he told the father the furprifing progrefs his child had made; but ftill the father thought the whole an impofition: the girl herfelf wrote to her father, but he looked upon the letter as a forgery. About this time the father died, and the mother fent an uncle and coufin of the deaf lady's from Shrewfbury, in order to be fatisfied of the truth. When they arrived, Mr Braidwood told the girl her uncle and coufin were in the parlour, and defired her to go and afk them how they did, and how her mother and other friends did. The friends were aftonifhed, and could hardly credit their own ears and eyes.

We have converfed with Mr Braidwood, concerning the nature and method of teaching this wonderful art: he feems to be very defirous of communicating and tranfmitting his difcovery to pofterity: but fays, and, from the nature of the thing, we believe it to be true, that he cannot communicate it fo fully in writing as to enable any other perfon to teach it. The firft thing in the method is, to teach the pupil to pronounce the fimple founds of the vowels and confonants. We have even feen him performing this operation; but are unable to give a clear idea of it. He pronounces the found of *a* flowly, pointing out the figure of the letter at the fame time; makes his pupil obferve the motion of his mouth and throat; he then puts his finger into the pupil's mouth, depreffes or elevates the tongue, and makes him keep the parts in that pofition; then he lays hold of the outfide of the windpipe, and gives it fome kind of fqueeze, which it is impoffible to defcribe: all the while he is pronouncing *a*, the pupil is anxioufly imitating him, but at firft feems not to underftand what he would have him to do. In this manner he proceeds, till the pupil has learned to pronounce the founds of the letters. He goes on in the fame manner to join a vowel and a confonant, till at length the pupil is enabled both to fpeak and read.

It is altogether in vain for us to attempt to fay any more concerning the mode of operation. Mr Braidwood undertakes every deaf perfon, who is not at the fame time foolifh or idiotical. The greateft misfortune is, that this art is confined to a fingle man, and that his pupils muft live in the houfe with him for fome years. The expence neceffarily attending education of this kind, excludes all but people in opulent circumftances from deriving any advantage from it. Mr Braidwood fays, that the only way for preferving the art, and communicating it to a number, is to take people in the way of apprentices: this he is unable to do at his own expence. What a pity, that fuch a curious and ufeful art fhould live and die with a fingle man! There are many fums mortified in this kingdom, both by government and private perfons, for lefs important purpofes, than the prefervation and extenfion of the art of raifing a great number of our fellow-creatures from the rank of brutes, to that of reafonable beings, and ufeful members of fociety.

DUMFERMLINE, a parliament-town of Scotland, fituated in the county of Fife, fifteen miles north-weft of Edinburgh: W. long. 30° 20′, and N. lat. 56° 15′. Here was formerly a magnificent abbey and palace of the kings of Scotland, in which the princefs Elizabeth, daughter of king James VI. and mother of the princefs Sophia, from whom the prefent royal family are defcended, was born.

DUMFRIES, the capital of a county of the fame name, in Scotland, lying northwards of the Solway frith: W. long. 3° 20′, and N. lat. 54° 45′.

DUNBAR, a parliament and port-town of Scotland, about twenty-five miles eaft of Edinburgh.

DUNBARTON, the capital of a county of the fame name in Scotland, called by fome Lenox: it is a parliament town, fituated at the confluence of the rivers Clyde and Leven; fixteen miles north-weft of Glafgow.

DUNCANNON, a town of the county of Wexford, in Ireland, fix miles eaft of Waterford.

DUNDALK, a port-town of Ireland, eighteen miles north of Drogheda.

DUNDEE, a large parliament-town of Angus, in Scotland, fituated on the north fide of the frith of Tay, fourteen miles north-weft of St Andrews: W. lon. 2° 42′, and N. lat. 56° 32′.

DUNG, in hufbandry, is of feveral forts, as that of horfes, cows, fheep, hogs, pigeons, geefe, hens, &c. See AGRICULTURE.

DUNGANNON, a town of Ireland, eleven miles north of Armaugh.

DUNGING of lands. See AGRICULTURE.

DUNKELD, a town of Perthfhire in Scotland, formerly a bifhop's fee, fituated about twelve miles north of Perth.

DUNG-MEERS, in hufbandry, places where foils and dungs are mixed and digefted together. For this purpofe it is ufual to dig a pit fufficient to hold the ftock of foil the hufbandman is capable of making; and to prepare it at the bottom with ftone and clay, that it may hold water, or the moifture of the dung; and befides, it fhould be fo fituated that the finks and drips of the houfes and barns may run into it. Into this pit they caft refufe fodder, litter, dung, weeds, &c. where they lie and rot together, till the farmer have occafion for it.

DUNKIRK, a port-town of the French Netherlands: E. lon. 2° 28′, and N. lat. 51°.

DUNNEGAL, the capital of a county of the fame name in Ireland, fituated on a bay, to which it likewife gives name: W. lon. 8° 22′, and N. lat. 54° 35′.

DUNNINGTON, a market-town of Lincolnfhire, about twenty-three miles fouth-eaft of Lincoln.

DUNS, a market-town of Scotland, twelve miles weft of Berwick upon Tweed.

DUNSTABLE, a market-town, fifteen miles fouth of Bedford, and thirty north-weft of London.

DUNWICH, a borough of Suffolk, forty miles eaſt of Bury. It ſends two members to parliament.

DUO, in muſic, a ſong or compoſition to be performed in two parts only, one ſung, the other played on an inſtrument, or by two voices.

Duo is alſo when two voices ſing different parts, as accompanied with a third, which is a thorough baſe. It is ſeldom that uniſons and octaves are uſed in duos, except at the beginning and end.

DUODECIMA, in muſic, is the twelfth or the fifth doubled. See Fifth.

DUODENUM, in anatomy. See Vol. I. p. 259.

DUPLE, among mathematicians, denotes the ratio of 2 to 1. Thus the ratio of 8 to 4 is duple, or as 2 to 1.

Sub-Duple ratio is juſt the reverſe of the former, or as 1 to 2. Such is 4 to 8, or 6 to 12.

DUPLICATE, among lawyers, denotes a copy of any deed, writing, or account. It is alſo uſed for the ſecond letters patent, granted by the lord chancellor in a caſe wherein he had before done the ſame. Alſo a ſecond letter written and ſent to the ſame party and purpoſe as a former, for fear of the firſt's miſcarrying, is called a duplicate.

Duplicate proportion, or ratio. See Algebra and Arithmetic.

DUPLICATION, in general, ſignifies the doubling of any thing, or multiplying of it by 2: alſo the folding of any thing back again on itſelf.

DUPLICATURE, among anatomiſts, a term uſed to denote the folds of any membrane, or veſſel: thus we ſay, the duplicatures of the inteſtines, peritonæum, *&c.*

DUPONDUS, in antiquity, the weight of two pounds: alſo a piece of money equal to two aſes in value.

DURA mater, in anatomy. See Vol. I. p. 284.

DURANCE, a river of France, which falls into the Rhone, a little below Avignon.

DURANTA, in botany, a genus of the didynamia angioſpermia claſs. The calix is above the fruit, and divided into five ſegments; and the berry contains four ſeeds. There are two ſpecies, both natives of America.

DURATION, an idea which we get by attending to the fleeting and perpetually periſhing part of ſucceſſion; the idea of ſucceſſion being acquired by reflecting on that train of ideas which conſtantly follow one another in our minds, as long as we are awake. The ſimple modes of duration are any different lengths of it whereof we have diſtinct ideas, as hours, days, years, time, eternity, *&c.*

Duration, as marked by certain periods amd meaſures, is what we moſt properly call time. See Time.

Duration *of action*, according to Ariſtotle, is confined to a natural day in tragedy; but the epopea, according to the ſame critic, has no fixed time.

DURESSE, in law, is where a perſon is wrongfully impriſoned, or reſtrained of his liberty, contrary to law; or is threatened to be killed, wounded, or beaten, till he executes a bond, or other writing.

DURHAM, a city and county, in the north of England, ſituated on the river Were, fourteen miles ſouth of Newcaſtle: W. lon. 1° 12′, and N. lat. 54° 50′. It is the ſee of a biſhop, and ſends two members to parliament.

DUSSELDORP, a city of Germany, ſituated on the eaſtern ſhore of the Rhine, twenty miles north of Cologn: E. lon. 6° 20′, and N. lat. 51° 15′.

DUTCHY, in geography, an appellation given to the dominions of a duke.

Dutchy-court, a court of the dutchy-chamber of Lancaſter, held at Weſtminſter, before the chancellor of the ſame, for matters concerning the lands and franchiſes of that dutchy.

DUTY, in general, denotes any thing that one is obliged to perform.

Duty, in polity and commerce, ſignifies the impoſt laid on merchandizes, at importation or exportation, commonly called the duties of cuſtoms; alſo the taxes of exciſe, ſtamp-duties, *&c.* See Customs, Excise, *&c.*

The principles on which all duties and cuſtoms ſhould be laid on foreign merchandizes, which are imported into theſe kingdoms, are ſuch as tend to cement a mutual friendſhip and traffic between one nation and another; and therefore due care ſhould be taken in the laying of them, that they may anſwer ſo good an end, and be reciprocal in both countries: they ſhould be ſo laid as to make the exports of this nation at leaſt equal to our imports from thoſe nations wherewith we trade, ſo that a balance in money ſhould not be iſſued out of Great Britain, to pay for the goods and merchandizes of other countries: to the end that no greater number of our landholders and manufacturers ſhould be deprived of their revenues ariſing from the product of the lands, and the labour of the people, by foreign importations, than are maintained by exportations to ſuch countries. Theſe are the national principles on which all our treaties of commerce with other countries are to be grounded.

DUTY, in the military art, is the exerciſe of thoſe functions that belong to a ſoldier; with this diſtinction, that mounting guards and the like, where there is no enemy directly to be engaged, is called duty; but their marching to meet and fight an enemy is called going on ſervice.

DUUMVIRATE, the office or dignity of the duumviri. See the next article.

The duumvirate laſted till the year of Rome 388, when it was changed into a decemvirate.

DUUMVIRI, in Roman antiquity, a general appellation given to magiſtrates, commiſſioners, and officers, where two were joined together in the ſame functions.

Duumviri capitales were the judges in criminal cauſes: from their ſentence it was lawful to appeal to the people, who only had the power of condemning a citizen to death. Theſe judges were taken from the body of

of the decuriones; they had great power and authority, were members of the public council, and had two lictors to walk before them.

Duumviri municipales, were two magiftrates in fome cities of the empire, anfwering to what the confuls were at Rome: they were chofen out of the body of the decuriones; their office lafted commonly five years, upon which account they were frequently termed *quinquinales magiftratus*. Their jurifdiction was of great extent: they had officers walking before them, carrying a fmall fwitch in their hands; and fome of them affumed the privilege of having lictors, carrying axes and the fafces, or bundles of rods, before them.

Duumviri navales were the commiffaries of the fleet, firft created at the requeft of M. Decius, tribune of the people, in the time of the war with the Samnites. The duty of their office confifted in giving orders for the fitting of fhips, and giving their commiffions to the marine officers, *&c.*

Duumviri sacrorum were magiftrates created by Tarquinius Superbus, for the performance of the facrifice, and keeping of the fybils books. They were chofen from among the patricians, and held their office for life: they were exempted from ferving in the wars, and from the offices impofed on the other citizens, and without them the oracles of the fybils could not be confulted.

DUYVELAND, or Diveland, one of the iflands of Zealand, in the United Provinces, lying eaftward of Schonen, from which it is only feparated by a narrow channel.

DWAL, in heraldry, the herb nightfhade ufed by fuch as blazon with flowers and herbs, inftead of metals and colours, for fable or black.

DWARF, in general, an appellation given to things greatly inferior in fize to that which is ufual in their feveral kinds: thus there are dwarfs of the human fpecies, dwarf-dogs, dwarf-trees, *&c.*

The Romans were fo paffionately fond of dwarfs, that they often ufed artificial methods to prevent the growth of boys defigned for dwarfs, by inclofing them in boxes, or by the ufe of tight bandages. In Italy, even at prefent, they wafh young puppies every day with aftringent liquors, in order to prevent their growth by hardening the parts.

DWINA, the name of two large rivers, one of which rifes in Lithuania, and, dividing Livonia from Courland, falls into the Baltic fea a little below Riga: the other gives name to the province of Dwina, in Ruffia, difcharging itfelf into the White fea, a little below Archangel.

DYE, in architecture, any fquare body, as the trunk or notched part of a pedeftal: or it is the middle of the pedeftal, or that part included between the bafe and the corniche, fo called becaufe it is often made in the form of a cube or dye. See Architecture.

DYER, a perfon who profeffes the art of dyeing all manner of colours. See Dyeing.

Dyer's weed, in botany. See Reseda.

DYEING, the art of giving a lafting colour to filks, cloths, and other fubftances, whereby their beauty is much improved, and value enhanced.

This art depends chiefly on three things, *viz.* 1. Difpofing the furface of the ftuffs to receive and retain the colours; which is performed by wafhing them in different lyes, digefting, beating them, *&c.* in which human urine putrified, a fharp falt of afhes, divers foaps, and galls of animals, are of principal ufe; by means whereof the vifcous gluten of the filk worms naturally adhering to their threads, is wafhed and cleanfed from them, and thus they become fitted gradually to imbibe the colours. By thefe alfo the greafy foulnefs adhering to wool and flax is fcoured off.

2. To grind the colours, as that they may enter the body duly prepared, and preferve their brightnefs undiminifhed.

3. The third confifts in having beautiful colours.

According to Sir W. Petty's account of what is done in particular trades by the art of dyeing, 1. There is a whitening of wax, and feveral forts of linen and cotton cloths, by the fun, air, and reciprocal effufions of water. 2. Colouring of wood and leather, by lime, falt and liquors, as in ftoves, canes, and marble leathers. 3. Colouring of paper, *viz.* the marbled paper, by diftempering the colours with ox-gall, and applying them upon a ftiff gummed liquor. 4. Colouring, or rather difcolouring, the colours of filks, tiffanies, *&c.* by brimftone. 5. Colouring of feveral iron and copper-works into black with oil. 6. Colouring of leather into gold colour, or rather filver-leaves into gold by varnifhes, and in other cafes by urine and fulphur. 7. Dyeing of marble and alabafter, with heat and coloured oils. 8. Colouring filver into the brafs-colour, with brimftone or urine. 9. Colouring the barrels and locks of guns into blue and purple, with the temper of fmall-coal heat. 10. Colouring of glafs (made of fands, flints, *&c.*) as alfo of cryftals and earthen ware, with the rufts and folutions of metals. 11. The colouring of live hair, as in Poland, horfe and man's hair: as alfo the colouring of furs. 12. Enameling and annealing. 13. Applying colours, as in the printing of books and pictures, and as in making of playing cards, being each of them performed in a different way. 14. Gilding and tinning with mercury, block-tin, fal armoniac. 15. Colouring of metals, as copper with calamy, into brafs, and with zinc or fpelter into a golden colour, or into a filver one with arfenic; and of iron into a refemblance of copper with Hungarian vitriol. 16. Making painters colours by preparing of earth, chalk, and flates; as in umber, ochre, cullen-earth, *&c.* as alfo out of calces of lead, as cerufe and minium; by fublimates of mercury and brimftone, as in vermilion; by tinging whole earths varioufly, as in verdeter, and fome of the lakes; by concrete juices, or fæculæ, as in gambogium, indigo, pinks, fap-green, and lakes; as alfo by rufts, as in verdigreafe, *&c.* 17. The applying thefe colours by the adhefion of ox-gall, as in the marbled paper aforefaid; or by gum-water, as by limning; or by clammy drying oils, fuch as the oils of lintfeed, nuts, *&c.* 18. The watering of tabbies. 19. The colouring of wool, linen, cotton, filk, hair, feathers, horn, leather, and the threads

threads and webs of them with woods, roots, herbs, ſeeds, leaves, ſalts, limes, lixiviums, waters, heats, fermentations, macerations, and other great variety of management: an account of all which is a ſhort hiſtory of dyeing.

The materials uſed in the art of Dyeing, are iron and ſteel, or what is produced from them in all true blacks, called Spaniſh blacks, though not in Flanders blacks, *viz.* they uſe copperas, ſteel-filings, and ſlippe; they alſo uſe pewter for Bow-dye ſcarlet, *viz.* they diſſolve bars of pewter in aquafortis; litharge is alſo uſed by ſome, though acknowledged by few to add weight to dyed ſilk. Antimony is much uſed to the ſame purpoſe. Arſenic is uſed in crimſon upon pretence of giving luſtre, although thoſe who pretend not to be wanting in giving luſtre to their ſilks diſown its uſe. Verdigreaſe is alſo uſed by linen dyers in their yellow and greeniſh colours; though, of itſelf, it ſtrikes no deeper colour than that of a pale ſtraw. Of mineral ſalts uſed in dyeing, the chief is alum; the true uſe whereof ſeems to be in regard to the fixation of colours. The next mineral ſalt is ſaltpetre, not uſed by ancient dyers, and but by few of the modern: nor is it yet uſed but to brighten colours, by back-boiling of them, for which argol is more commonly uſed: lime is much uſed in working blue vats.

Of the animal tribes are uſed cochineal, urine of labouring men kept till it be ſtale and ſtinking, honey, yolks of eggs, and ox gall; the uſe of the urine is to ſcour, and help the fermenting and heating of woad; and is uſed alſo in blue-vats inſtead of lime: it diſchargeth the yellow, and therefore is uſed to ſpend weld withal.

Dyers uſe two ſorts of water, *viz.* river and well-water; the laſt, which is harſh, they uſe in reds and other colours wanting reſtringency, and in dyeing materials of the ſlacker contextures, as in callicoe, fuſtian, and the ſeveral ſpecies of cotton-works; but is not good for blues, and makes yellows and greens look ruſty. River-w ter is more fat and oily, and is therefore uſed in moſt caſes, and muſt be had in great quantities for waſhing and rinſing their cloths after dyeing. Water is called by dyers white liquor; but a mixture of one part bran, and five of river-water, boiled an hour and put into leaden ciſterns to ſettle, is what they call liquor abſolutely.

Gums have been uſed by dyers about ſilk, *viz.* gum arabic, tragacanth, maſtic, dragon's blood. Theſe tend little to the tincture, any more than gum in writing-ink, which only gives it a conſiſtence; ſo gum may give the ſilk a gloſſineſs; and, laſtly, to increaſe the weight.

The three peculiar ingredients for black are copperas, ſilings of ſteel, and ſlippe: the reſtringent binding materials are alder-bark, pomegranate-peels, walnut-rinds and roots, oakenſapling bark, and ſaw-duſt of the ſame, crab-tree bark, galls, and ſumac.

The ſalts are alum, ſalt-petre, ſal armoniac, pot-aſhes, and ſtone-lime; among which urine may be enumerated as a liquid ſalt.

The liquors are well and river water, urine, aquavitæ, vinegar, lemon juice, aquafortis, honey, and molaſſes.

Ingredients of another claſs are bran, wheaten-flour, yokes of eggs, leaven, cummin ſeed, fenugreek ſeed, agaric, and ſenna.

The ſmectics, or abſterſives, are fuller's earth, ſoap, linſeed-oil, and ox gall.

The metals and minerals are pewter, verdigreaſe, antimony, litharge, and arſenic.

The colourings are of three ſorts, *viz.* blue, yellow, and red; of which logwood, old fuſtic, indigo, and madder, are the chief.

General obſervations upon Dyeing.

1. All materials which of themſelves do give colour are either red, yellow, or blue; ſo that out of them, and the primitive fundamental colour white, all that great variety which we ſee in dyed ſtuffs doth ariſe.

2. That few of the colouring materials, as cochineal, ſoot, wood-wax, woad, *&c.* are in their outward and firſt appearance of the ſame colour, which by the ſlighteſt diſtempers and ſolutions in the weakeſt menſtrua, they dye upon cloth, ſilk, *&c.*

3. That many of them will not yield their colours without much grinding, ſteeping, boiling and fermenting, or corroſion by powerful menſtrua, as redwood, weld, woad, arnotto, *&c.*

4. That many of them will of themſelves give no colouring at all, as copperas or galls, or with much diſadvantage, unleſs the cloth or other ſtuff to be dyed be as it were firſt covered, or incruſtated with ſome other matter, though colourleſs aforehand, as madder, weld, brazil, with alum.

5. That ſome of them, by the help of other colourleſs ingredients, do ſtrike different colours from what they would of themſelves, as cochineal, brazil, *&c.*

6. That ſome colours, as madder, indigo, and woad, by reiterated tinctures, will at laſt become black.

7. That although green be the moſt frequent and the moſt common of natural colours, yet there is no ſimple ingredient now uſed alone to dye green with upon any material; ſap-green being the neareſt, which is uſed by country people.

8. There is no black thing in uſe which dyes black, though both the coal and ſoot of moſt things burnt or ſcorched be of that colour, and the blacker, by how much the matter before being burnt was whiter, as in ivory black.

9. The tincture of ſome dyeing ſtuffs will fade even with lying, or with the air, or will ſtain with water only, but very much with urine, vinegar, *&c.*

10. Some of the dyeing materials are uſed to bind and ſtrengthen a colour; ſome to brighten it; ſome to give luſtre to the ſtuff; ſome to diſcharge and take off the colour, either in whole or in part; and ſome out of fraud, to made the material dyed, if coſtly, heavier.

11. That ſome dyeing ingredients, or drugs, by the coarſeneſs of their bodies, make the thread of the dyed ſtuff ſeem coarſer; and ſome, by ſhrinking them, ſmaller; and ſome, by ſmoothing them, finer.

12. Many of the ſame colours are dyed upon ſeveral ſtuffs with ſeveral materials, as red-wood is uſed in cloth, not in ſilks; arnotto in ſilks, not in cloth, and may be dyed at ſeveral prices.

13. That ſcouring and waſhing of ſtuffs to be dyed, is done with ſpecial materials, as ſometimes with ox-galls, ſometimes with fullers-earth, and ſometimes ſoap; this latter being, in ſome caſes, pernicious, where pot-aſhes will ſtain, or alter the colour.

14. Where great quantities of ſtuffs are to be dyed together, or where they are to be done with any ſpeed, and where the pieces are very long, broad, thick, or otherwiſe, they are to be differently handled, both in reſpect to the veſſels and ingredients.

15. In ſome colours and ſtuffs the tingent liquor muſt be boiling, in other caſes blood-warm, and in ſome it may be cold.

16 Some tingent liquors are fitted for uſe by long keeping, and in ſome the virtues wear away by the keeping.

17. Some colours or ſtuffs are beſt dyed by reiterated dippings in the ſame liquor, ſome by continuing longer, and others a leſſer time therein.

18. In ſome caſes, the matter of the veſſel wherein the liquors are heated, and the tincture prepared, muſt be regarded, as the kettles muſt be pewter for Bow-dye.

19. There is little reckoning made how much liquor is uſed in proportion to the dyeing drugs, it being rather adjuſted to the bulk of the ſtuffs, as the veſſels are to their breadth; the quantity of dyeing drugs being proportioned both to the colour, higher or lower, and to the ſtuffs; as likewiſe the ſalts are to the dyeing drugs. Concerning the weight that colours give to ſilk, (in which it is moſt taken notice of, being ſold by weight, and a commodity of great price) it is obſerved, that one pound of raw ſilk loſeth four ounces by waſhing out the gums and the natural ſordes; that the ſame ſcoured ſilk may be raiſed to above thirty ounces from the remaining twelve, if it be dyed black with ſome materials.

Of a thing very uſeful in dyeing, eſpecially of black, nothing increaſes weight ſo much as galls, by which black ſilks are reſtored to as much weight as they loſt by waſhing out their gum: nor is it counted extraordinary that blacks ſhould gain about four or ſix ounces in the dyeing upon each pound. Next to the galls, old fuſtic increaſes the weight about $1\frac{1}{2}$ in 12; madder, about one ounce; weld, half an ounce. The blue vats in deep blues of the fifth ſtall, give no conſiderable weight; neither doth logwood, cochineal, nor even copperas, where galls are not: ſlippe adds much to the weight, and giveth a deeper black than copperas itſelf, which is a good excuſe for the dyers that uſe it.

DYEING *of wooll and woollen manufactures.*

For black in woollen manufactures, it is begun with a ſtrong decoction of woad and indigo, that communicate a deep blue; after which the ſtuffs being boiled with alum and tartar, or pot-aſh, are to be maddered with common madder, then dyed black with Aleppo galls, copperas, and ſumac, and finiſhed by back-boiling in weld. Woolls for tapeſtry are only to be woaded, and then put in black. For ſcarlet, wooll and woollen manufactures are dyed with kermes and cochineal, with which may alſo be uſed agaric and arſenic. Crimſon ſcarlet is dyed with cochineal, maſtic, aquafortis, ſal armoniac, ſublimate, and ſpirit of wine. Violet ſcarlet, purple, amaranth, and panſy-ſcarlets, are given wth woad, cochineal, indigo, braziletto, brazil, and orchal. Common reds are given with pure madder, without any other ingredient. Crimſon reds, carnations, flame and peach-colours, are given, according to their ſeveral hues, with cochineal, maſtic, without madder, or the like. Crimſon-red is prepared with Roman alum, with cochineal. Orange aurora, brick-colour, and onion-peel colour, are dyed with woad and madder, mixed according to their ſeveral ſhades. For blues, the dark are dyed with a ſtrong tincture of woad; the brighter with the ſame liquor, as it weakens in working. Dark browns, minims, and tan colours, are given with woad, weaker in decoction than for black, with alum and pot-aſhes, after which they are maddered higher than black: for tan-colours, a little cochineal is added. Pearl-colours are given with galls and copperas; ſome are begun with walnut-tree roots, and finiſhed with the former; though to make them more uſeful, they generally dip them in a weak tincture of cochineal. Greens are begun with woad, and finiſhed with weld. Pale-yellows, lemon-colour, and ſulphur colour, are given with weld alone. Olive colours of all degrees are firſt put in green, and taken down with ſoot, more or leſs, according to the ſhade that is required. Feulemort, hair-colour, muſk, and cinnamon colour, are dyed with weld and madder. Nacaret, or bright orange, is given with weld and goats-hair boiled with pot-aſhes.

DYEING *of ſilks*, is begun by boiling them in ſoap, *&c.* then ſcouring and waſhing them in water, and ſteeping them in cold alum-water. For crimſon, they are ſcoured a ſecond time, before they are put into the cochineal vat. Red crimſon is given with pure cochineal, maſtic, adding galls, turmeric, arſenic, and tartar, all mixed in a copper of fair water, almoſt boiling: with theſe the ſilk is to be boiled an hour and a half, after which it is allowed to ſtand in the liquor till next day. Violet crimſon is given with pure cochineal, arſenic, tartar, and galls; but the galls in leſs proportion than in the former: when taken out, it is waſhed and put in a vat of indigo. Cinnamon crimſon is begun like the violet, but finiſhed by back-boiling; if too bright, with copperas; and if dark, with a dip of indigo. Light blues are given in a back of indigo. Sky-blues are begun with orchal, and finiſhed with indigo. For citron colours, the ſilk is firſt alumed, then welded with indigo. Pale yellows, after aluming, are dyed in weld alone. Pale and brown aurora's, after aluming, are welded ſtrongly, then taken down with rocou and diſſolved with pot-aſhes. Flame-colour is begun with rocou, then alumed, and afterwards dipped

ped in a vat or two of brazil. Carnation and rose colours are first alumed, then dipt in brazil. Cinnamon colour, after aluming, is dipt in brazil and braziletto. Lead colour is given with fustic, or with weld, braziletto, galls and copperas. Black silks of the coarser sort, are begun by scouring them with soap, as for other colours; after which they are washed out, wrung, and boiled an hour in old galls, where they are suffered to stand a day or two: then they are washed again with fair water, wrung, and put into another vat of new galls: afterwards washed again, and wrung, and finished in a vat of black. Fine black silks are only put once into galls of the new and fine sort, that has only boiled an hour: then the silks are washed, wrung out, and dipped thrice in black, and afterwards taken down by back-boiling with soap.

The dyeing of thread is begun by scouring it in a lye of good ashes: afterwards it is wrung, rinsed out in river water, and wrung again. A bright blue is given with braziletto and indigo: bright green is first dyed blue, then back-boiled with braziletto and verdeter, and lastly woaded. A dark green is given like the former, only darkening more before woading. Lemon and pale yellow is given with weld mixed with rocou. Orange isabella, with fustic, weld, and rocou. Red, both bright and dark, with flame-colour, *&c.* are given with brazil, either alone, or with a mixture of rocou. Violet, dry-rose, and amaranth, are given with brazil, taken down with indigo. Feulemort and olive colour are given with galls and copperas, taken down with weld, rocou, or fustic. Black is given with galls and copperas, taken down and finished with braziletto wood.

DYNASTY, among ancient historians, signifies a race or succession of kings of the same line or family: such were the dynasties of Egypt.

The Egyptians reckon thirty dynasties within the space of 36525 years; but the generality of chronologers look upon them as fabulous. And it is very certain, that these dynasties are not continually successive, but collateral.

DYSCRACY, among physicians denotes an ill habit or state of the humours, as in the scurvy, jaundice, *&c.*

DYSENTERY, in medicine, a diarrhœa or flux, wherein the stools are mixed with blood, and the bowels miserably tormented with gripes. See MEDICINE.

DYSERT, a parliament-town of Scotland, in the county of Fife, situated on the northern shore of the frith of Forth, about eleven miles north of Edinburgh.

DYSOREXY, among physicians, denotes a want of appetite, proceeding from a weakly stomach.

DYSPEPSY, a difficulty of digestion.

DYSPNOEA, a difficulty of breathing, usually called asthma.

DYSURY, in medicine, a difficulty of making urine, attended with a sensation of heat and pain. See MEDICINE.

DYTISCUS, WATER-BEETLE, in zoology, a genus of insects of the order of the coleoptera; the antennæ of which are slender and setaceous, and the hind feet are hairy, and formed for swimming. There are twenty-three species, distinguished by their antennæ, the colour of the elytra, *&c.*

DYVOUR'S HABIT, in Scots law, a party-coloured habit which fradulent bankrupts, or bankrupts who have been dealers in illicite trades, are directed to wear, as a mark of ignominy, upon their being liberate from prison on a cessio bonorum. See SCOTS LAW, title 32.

E

EAGLE, in ornithology. See FALCO.

EAGLE, in heraldry, is accounted one of the most noble bearings in armoury, and, according to the learned in this science, ought to be given to none but such as greatly excel in the virtues of generosity and courage, or for having done singular services to their sovereigns; in which cases they may be allowed a whole eagle, or an eagle naissant, or only the head or other parts thereof, as may be most agreeable to their exploits.

EAGLE, in astronomy. Vol. I. p. 487.

EAGLE OWL. See BUBO.

EAGLE-STONE. See ÆTITES.

Black EAGLE, an order of knighthood, instituted by the elector of Brandenburgh, in 1701, on his being crowned king of Prussia.

The knights of this order wear an orange-coloured ribband suspending a black eagle.

White EAGLE, a like order in Poland, instituted in 1325, by Uladislaus V. on occasion of the marriage of his son Casimir to the daughter of the great duke of Lithuania.

The knights of this order wear a chain of gold, suspending a silver eagle crowned.

EAGLET, a diminutive of eagle, properly signifying a young eagle. In heraldry, when there are several eagles on the same escutcheon, they are termed eaglets.

EAR,

EAR, in anatomy. See Vol. I. p. 295.

Ear-wig, in zoology. See Forficula.

EARING, in the ſea language, is that part of the bolt-rope which at the four corners of the ſail is left open, in the ſhape of a ring. The two uppermoſt parts are put over the ends of the yard-arms, and ſo the ſail is made faſt to the yard; and into the lowermoſt earings, the ſheets and tacks are ſeized or bent at the clew.

EARL, a Britiſh title of nobility, next below a marquis, and above a viſcount. Earls were anciently called comites, becauſe they were wont *comitari regem*, to wait upon the king for council and advice. The Germans call them graves, as landgrave, margrave, palſgrave, rheingrave: the Saxons ealdormen, unleſs that title might be more properly applied to our dukes; the Danes, eolras; and the Engliſh, earls. The title, originally, died with the man. William the conqueror firſt made it hereditary, giving it in fee to his nobles, and allotting them for the ſupport of their ſtate the third penny out of the ſheriff's court, iſſuing out of all pleas of the ſhire whence they had their title. But now the matter is quite otherwiſe; for whereas heretofore *comes* and *comitatus* were correlatives, and there was no comes or earl but had a county or ſhire for his earldom, of later years the number of earls increaſing, and no more counties being left, divers have made choice of ſome eminent part of a county, as Lindſey, Holland, Cleveland, *&c.* ſome of a leſſer part, as Stafford, *&c.* others have choſen for their title ſome eminent town, as Marlborough, Exeter, Briſtol, *&c.* and ſome have taken for their title the name of a ſmall village; their own ſeat or park, as Godolphin, Clarendon, *&c.* An earl is created by cincture of ſword, mantle of ſtate put upon him by the king himſelf, a cap and a coronet put upon his head, and a charter in his hand. All the earls of England are denominated from ſome ſhire, town or place, except three; two of whom, *viz.* earl Rivers, and earl Paulet, take their denomination from illuſtrious families: the third is not only honorary, as all the reſt, but alſo officiary, as the earl-marſhal of England.

Earl-*marſhal of England*, is a great officer who had anciently ſeveral courts under his juriſdiction, as the court of chivalry, and the court of honour. Under him is alſo the herald's office or college of arms. He hath ſome pre-eminence in the court of Marſhalſea, where he may ſit in judgment againſt thoſe who offend within the verge of the king's court. This office is of great antiquity in England, and anciently of greater power than now; and has been for ſeveral ages hereditary in the moſt noble family of Howard.

EARNEST, in Scots law, a piece of money ſometimes given by a buyer, in evidence that the ſale or contract is compleated. See tit. 22.

EARTH, a foſſile, or terreſtrial matter, whereof our globe partly conſiſts. See Vol. I. p 67.

Earth, in aſtronomy and geography, one of the primary planets, being this terraqueous globe whereon we inhabit. See Astronomy and Geography.

EARTHQUAKE, in natural hiſtory, a violent agitation or trembling of ſome conſiderable part of the earth generally attended with a terrible noiſe like thunder, and ſometimes with an eruption of fire, water, wind, *&c.* See Pneumatics.

EASEL-pieces, a denomination given by painters to ſuch pieces as are contained in frames, in contradiſtinction from thoſe painted on cielings, *&c.*

EASEMENT, in law, a privilege or convenience which one neighbour has of another, whether by charter or preſcription, without profit: ſuch are a way through his lands, a ſink, or the like. Theſe, in many caſes, may be claimed.

EASING, in the ſea-language, ſignifies the ſlackening a rope, or the like: thus, to eaſe the bow-line or ſheet, is to let them go ſlacker; to eaſe the helm, is to let the ſhip go more large, more before the wind, or more larboard.

EASLOW, a borough of Cornwal, twenty-two miles ſouth of Launceſton, which ſends two members to parliament.

EAST, one of the four cardinal points of the world; being that point of the horizon, where the ſun is ſeen to riſe when in the equinoctial.

EASTER, a feſtival of the chriſtian church, obſerved in memory of our Saviour's reſurrection.

The Greeks call it *paſga*, the Latins *paſcha*, an Hebrew word ſignifying *paſſage*, applied to the Jewiſh feaſt of the paſſover. It is called eaſter in the Engliſh, from the goddeſs Eoſtre, worſhipped by the Saxons with peculiar ceremonies in the month of April.

The Aſiatic churches kept their eaſter upon the very ſame day the Jews obſerved their paſſover; and others, on the firſt Sunday after the firſt full moon in the new year. This controverſy was determined in the council of Nice, when it was ordained that eaſter ſhould be kept upon one and the ſame day, which ſhould always be a Sunday, in all chriſtian Churches in the world. For the method of finding eaſter by calculation, ſee Vol. I p. 492.

EASTERN, an appellation given to whatever relates to the eaſt: thus we ſay, eaſtern amplitude, eaſtern church, *&c.*

EATON, a town of Buckinghamſhire, ſituated on the north ſide of the Thames, oppoſite to Windſor, and famous for its collegial ſchool, founded by king Henry VI being a ſeminary for king's college Cambridge, the fellows of which are all from this ſchool.

EAVES, in architecture, the margin or edge of the roof of an houſe; being the loweſt tiles, ſlates, or the like, that hang over the walls, to throw off water to a diſtance from the wall.

EBBING *of the tides*. See Vol. I. p. 473.

EBDOMARIUS, in eccleſiaſtical writers, an officer formerly appointed weekly to ſuperintend the performance of divine ſervice in cathedrals, and preſcribe the duties of each perſon attending in the choir, as to reading, ſinging, praying, *&c.*

EBENUS, the Ebony-tree, in botany, a genus of the diadelphia decandria claſs. The calix has a number of ſmall hairy teeth, as long as the corolla; the

corolla

corolla has hardly any wings; and the pod is hairy, and contains but one feed. There is but one fpecies, a native of Crete.

EBIONITES, in church-hiftory, heretics of the firft century, fo called from their leader Ebion.

They held the fame errors with the Nazarenes, united the ceremony of the Mofaic inftitution with the precepts of the gofpel, obferved both the Jewifh fabbath and Chriftian Sunday, and in celebrating the eucharift made ufe of unleavened bread. They abftained from the flefh of animals, and even from milk. In relation to Jefus Chrift, fome of them held, that he was born like other men, of Jofeph and Mary, and acquired fanctification only by his good works. Others of them allowed, that he was born of a virgin, but denied that he was the Word of God, or had any exiftence before his human generation. They faid, he was indeed the only true Prophet; but yet a mere man, who, by his virtue, had arrived at being called Chrift, and the Son of God. They alfo fuppofed, that Chrift and the devil were two principles, which God had oppofed to each other. Of the New Teftament they only received the gofpel of St Matthew, which they called the gofpel according to the Hebrews.

EBRO, anciently Iberus, a large river of Spain, which taking its rife in Old Caftile, runs through Bifcay and Arragon, paffes by Saragofa, and, continuing its courfe through Catalonia, difcharges itfelf with great rapidity into the Mediterranean, about twenty miles below the city of Tortofa.

EBULLITION. See Boiling.

EBULUS, in botany. See Symbucus.

ECBOLIUM, in botany. See Adhatoda.

ECCHYMOSIS, in furgery, an extravafation of the blood from a vein in the arm betwixt the flefh and fkin.

ECCLESIASTES, a canonical book of the Old Teftament, the defign of which is to fhew the vanity of all fublunary things.

It was compofed by Solomon, who enumerates the feveral objects on which men place their happinefs, and then fhews the infufficiency of all worldly enjoyments.

The Talmudifts make king Hezekiah to be the author of it; Grotius afcribes it to Zorobabel, and others to Ifaiah; but the generality of commentators believe this book to be the produce of Solomon's repentance, after having experienced all the follies and pleafures of life.

ECCLESIASTICAL, an appellation given to whatever belongs to the church: thus we fay, ecclefiaftical polity, jurifdiction, hiftory, *&c.*

ECCLESIASTICUS, an apocryphal book, generally bound up with the fcriptures, fo called, from its being read in the church, *ecclefia*, as a book of piety and inftruction, but not of infallible authority.

The author of this book was a Jew, called Jefus the fon of Sirach. The Greeks call it the wifdom of the fon of Sirach.

ECCOPE, in furgery. See Amputation.

ECCOPROTICS, in pharmacy. See Cathartics, and Evacuants.

ECHAPE, in the menage, a horfe begot between a ftallion and a mare of different breeds and countries.

ECHAPER, in the menage, a gallicifm ufed in the academies, implying to give a horfe head, or to put on at full fpeed.

ECHENEIS, in ichthyology, a genus belonging to the order of thoracici. The head is fat, naked, depreffed, and marked with a number of tranfverfe ridges: it has ten rays in the branchioftege membrane; and the body is naked. There are two fpecies, *viz.* 1. the remora, with a forked tail, and eighteen ftriæ on the head. It is found in the Indian ocean. 2. The peucrates, with an undivided tail, and twenty-four ftriæ on the head. It is likewife a native of the Indian ocean.

ECHEVIN, in the French and Dutch polity, a magiftrate elected by the inhabitants of a city or town, to take care of their common concerns, and the decoration and cleanlinefs of the city.

At Paris, there is a prevôt, and four echevins; in other towns, a mayor and echevins. At Amfterdam, there are nine echevins; and, at Rotterdam, feven.

In France, the echevins take cognizance of rents, taxes, and the navigation of rivers, *&c.* In Holland, they judge of civil and criminal caufes; and if the criminal confeffes himfelf guilty, they can fee their fentence executed without appeal.

ECHINATE, or Echinated, an appellation given to whatever is prickly, thereby refembling the hedgehog.

ECHINITES, in natural hiftory, the name by which authors call the foffile centronia, frequently found in our chalk-pits. See Centronia.

ECHINOPHORA, in botany, a genus of the pentandria digynia clafs. The fruit has funk peduncles. There are two fpecies, one of which, *viz.* the fpinofa, or prickly famphire, is a native of Britain.

ECHINOPS, Glove-thistle, in botany, a genus of the fyngenefia polygamia fegregata clafs. The proper calix is erect, imbricated, and contains but a fingle flower. There are three fpecies, none of them natives of Britain.

ECHINUS, in zoology, a genus of infects belonging to the order of vermes mollufca. The body is roundifh, covered with a bony cruft, and often befet with moveable prickles; and the mouth is below, and confifts of five valves. There are feventeen fpecies, all natives of the fea.

Echinus, in architecture, a member or ornament near the bottom of the Ionic, Corinthian, and compofite capitals.

ECHIUM, Viper's bugloss, in botany, a genus of the pentandria monogynia clafs. The corolla is irregular, with a naked faux. There are feven fpecies, three of which are natives of Britain, *viz.* the vulgare, or viper's buglofs; the anglicum, or Englifh viper's buglofs; and the italicum, or wall-viper's buglofs.

ECHO, a found reverberated or reflected to the ear from fome folid body. See Pneumatics.

Echo, in architecture, a term applied to certain kinds of

of vaults and arches, moſt commonly of elliptical and parabolical figures, uſed to redouble ſounds, and produce artificial echos.

ECHOMETER, among muſicians, a kind of ſcale or rule, with ſeveral lines thereon, ſerving to meaſure the duration and length of ſounds, and to find their intervals and ratios.

ECLECTICS, ancient philoſophers, who, without attaching themſelves to any particular ſect, ſelected whatever appeared to them the beſt and moſt rational, from each.

Potamon of Alexandria was the firſt of the eclectics: he lived in the reigns of Auguſtus and Tiberius; and being tired with the ſcepticiſm of the Pyrrhonians, he reſolved upon a ſcheme that would allow him to believe ſomething, but without being ſo implicit as to ſwallow any entire hypotheſis.

ECLECTOS. See LINCTUS.

ECLIPSE, in aſtronomy, the deprivation of the light of the ſun, or of ſome heavenly body, by the interpoſition of another heavenly body between our ſight and it. See Vol. I. p. 476

ECLIPTIC, in aſtronomy, a great circle of the ſphere, ſuppoſed to be drawn through the middle of the zodiac, making an angle with the equinoctial of about 23° 30′, which is the ſun's greateſt declination; or, more ſtrictly ſpeaking, it is that path or way among the fixed ſtars, that the earth appears to deſcribe to an eye placed in the ſun. See ASTRONOMY, and GEOGRAPHY.

ECLOGUE, in poetry, a kind of paſtoral compoſition, or a ſmall elegant poem, in a natural ſimple ſtyle.

The models in this ſort of poetry are Theocritus and Virgil.

ECOUTE′, in the menage, a pace or motion of a horſe, when he rides well upon the hands and the heels, is compactly put upon his haunches, and hears or liſtens to the heels or ſpurs, and continues duly balanced between the heels, without throwing to either ſide. This happens when a horſe has a fine ſenſe of the aids of the hand and heel.

ECPHRACTICS, in medicine, remedies which attenuate and remove obſtructions. See ATTENUANTS, and DEOBSRUENTS.

ECPIESMA, in ſurgery, a ſort of fracture of the cranium, when the bones are much ſhattered, and, preſſing inwardly, affect the membranes of the brain.

ECPIESMA, in pharmacy, ſignifies the maſs remaining after the juices of vegetables have been preſſed out: and, in this ſenſe, is the ſame as magma. It ſometimes further imports the juice preſſed out.

ECPIESMUS, in the ancient writers of medicine, a word uſed to expreſs a diſtemperature of the eye, conſiſting in a very great prominence of the entire globe of the eye, which is, as it were, thruſt out of its ſocket or orbit, by a great flux of humours, or an inflammation.

ECPUCTICA, in pharmacy. See INCRASSANTS.

ECTHESIS, in church-hiſtory, a confeſſion of faith, in the form of an edict, publiſhed in the year 639, by the emperor Heraclius, with a view to pacify the troubles occaſioned by the Eutychian hereſy in the eaſtern church. However, the ſame prince revoked it, on being informed that pope Severinus had condemned it, as favouring the Monothelites; declaring at the ſame time, that Sergius, patriarch of Conſtantinople, was the author of it.

ECTHLIPSIS, among Latin grammarians, a figure of proſody whereby the *m* at the end of a word, when the following word begins with a vowel, is elided, or cut off, together with the vowel preceding it, for the ſake of the meaſure of the verſe: thus they read *mult' ille*, for *multum ille*.

ECTROPIUM, in ſurgery, is when the eye-lids are inverted, or retracted ſo as to ſhew their internal or red ſurface, and cannot ſufficiently cover the eye.

ECTYLOTICS, in pharmacy, remedies proper for conſuming calloſities.

ECU, or ESCU, a French crown, for the value of which, ſee MONEY.

EDDISH, or EADISH, the latter paſture, or graſs that comes after mowing or reaping; otherwiſe called eagraſs, or earſh, and etch.

EDDY TIDE, or EDDY-WATER, among ſeamen, is where the water runs back contrary to the tide; or that which hinders the free paſſage of the ſtream, and ſo cauſes it to return again.

EDDY-WIND is that which returns, or is beat back from a ſail, mountain, or any thing that may hinder its paſſage.

EDESSA. See ORFA.

EDICT, in matters of polity, an order or inſtrument, ſigned and ſealed by a prince, to ſerve as a law to his ſubjects. We find frequent mention of the edicts of the prætor, the ordinances of that officer in the Roman law. In the French law, the edicts are of ſeveral kinds; ſome importing a new law or regulation; others, the erection of new offices; eſtabliſhments of duties, rents, *&c.* and ſometimes articles of pacification. In France, edicts are much the ſame as a proclamation is with us; but with this difference, that the former have the authority of a law in themſelves, from the power which iſſues them forth; whereas the latter are only declarations of a law, to which they refer, and have no power in themſelves

EDINBURGH, the capital city of the kingdom of Scotland, ſituated W. long. 3°, and N. lat. 56°.

We ſhall not ſpend time in fruitleſs inquiries into the antiquity of this city, or the etymology of its name; both of which ſeem to be fabulous and uncertain. It is conjectured by ſome to have owed its origin and name to Edwin king of Northumberland, about the year 600; is taken notice of by authors in the 854 as a ſmall and inconſiderable village, and only about the middle of the 14th century as the capital of Scotland.

Edinburgh is ſituated upon a ſteep hill, riſing from eaſt to weſt, and terminating in a high and inacceſſible rock, upon which the caſtle ſtands. At the eaſt end, or lower extremity of this hill, ſtands the abbey of Holyrood-houſe, or king's palace, diſtant from the caſtle upwards of a mile; and betwixt which, along the top of the ridge, and almoſt in a ſtrait line, runs the high-ſtreet of Edinburgh. On each ſide, and parallel

rallel to this ridge or hill, is another ridge of ground lower than that in the middle, and which does not extend ſo far to the eaſt; that on the ſouth being intercepted by Saliſbury-rocks, and Arthur's-ſeat, a hill of about 650 feet of perpendicular height; and that on the north by the Calton-hill, conſiderably lower than Arthur's-ſeat: ſo that the ſituation of this city is moſt ſingular and romantic; the eaſt or lower part of the town lying between two high hills; and the weſt or higher part riſing up towards a third hill, little inferior in height to the higheſt of the other two, upon which, as has been obſerved, the caſtle is built, and overlooks the town.

The buildings of the town terminate at the diſtance of about 200 yards from the caſtle-gate; which ſpace affords a moſt delightful as well as convenient and healthful walk to the inhabitants. The proſpect from this ſpot is perhaps the fineſt any where to be met with, for extent, beauty, and variety.

In the valley or hollow betwixt the mid and ſouth ridge, and nearly parallel to the high-ſtreet, is another ſtreet called the Cowgate; and the town has now extended itſelf over moſt part of that ſouth ridge alſo. Betwixt the mid and north ridge was a loch, which, till of very late, terminated the town on that ſide. From the high-ſtreet towards the loch on the north, and Cowgate on the ſouth, run narrow croſs ſtreets or lanes, called wynds and cloſſes, which grow ſteeper and ſteeper the farther weſt or nearer the caſtle; ſo that, were it not for the cloſeneſs and great height of the buildings, this city, from its ſituation and plan, might naturally be expected to be the beſt aired, as well as the cleanlieſt in Europe. The firſt, notwithſtanding theſe diſadvantages, it enjoys in an eminent degree; but we cannot compliment it upon the latter, notwithſtanding every poſſible means has been uſed by the magiſtrates for that purpoſe.

The ſteepneſs of the aſcent makes the acceſs to the high-ſtreet from the north and ſouth very difficult; and has no doubt greatly retarded the enlargement of this city. To remedy this inconvenience on the north, and with a view to extend the town on that quarter, a moſt elegant bridge is preſently throwing over the north-loch, which will join the north ridge to the middle of the high-ſtreet, by ſo eaſy an aſcent as one in ſixteen; and in purſuance of this deſign a plan of a new town to the north is fixed upon, and is actually carrying into execution with ſurpriſing rapidity, and with an elegance and taſte that does honour to this country.

The principal public buildings in Edinburgh may be reduced to four, *viz.* St Giles's church, the palace of Holyrood houſe, Herriot's hoſpital, and the Royal Infirmary.——St Giles's church is the moſt ancient church in Edinburgh, in ſo much that it is not known when or by whom it was founded. It ſtands on the ſouth-ſide of the high-ſtreet, about a quarter of a mile below the caſtle. It is a very large, irregular, and heavy building, except the ſteeple, which runs with a ſquare ſtalk from the middle of the ſtructure, and terminates in the form of an imperial crown, and is reckoned the fineſt in Britain for elegance and ſymmetry.

The abbey of Holyrood-houſe was erected by David I. *anno* 1128, in memory, as is ſaid, of his deliverance from the horns of an enraged hart, by the interpoſition of heaven in the form of a croſs. It was firſt made a royal palace by James V. about the year 1528, who built the north wing of the preſent front, which evidently appears older than the reſt. It was completed in the preſent form by Charles II. in the year 1674; and is juſtly reckoned a moſt magnificent and elegant building.

Herriot's hoſpital was founded, July 1. 1628, by the magiſtrates of Edinburgh, in virtue of a donation of *L.* 43,608 : 11 : 3, bequeathed to them by George Herriot, goldſmith and jeweller to James VI. "for the "maintenance, relief, bringing up, and education of "ſo many poor fatherleſs boys, freemens ſons of the "town of Edinburgh," as the above ſum ſhould be ſufficient for. This hoſpital contains at preſent about a hundred and forty boys, who are well educated and taken care of. It has, notwithſtanding the large ſum laid out in building the houſe, a great annual revenue; which, as it conſiſts moſtly of lands, muſt always keep pace with the nominal value of money. This hoſpital is finely ſituated on the weſt end of the ſouth ridge, almoſt oppoſite to the caſtle; and is perhaps the moſt magnificent building of that kind in Britain.

The Royal Infirmary was founded in Auguſt 1738, by the magiſtrates of Edinburgh, in virtue of a charter from the crown, for the reception of poor diſeaſed perſons; and by conduct in the management of its funds, which aroſe moſtly from the public contributions, and were but very ſcanty, has proved an ineſtimable bleſſing to this country. This hoſpital ſtands near the eaſt end of the ſouth ridge; and is thought by ſome to be rather too magnificent, conſidering the purpoſe for which it is deſigned, and the narrowneſs of the original funds.

Edinburgh, as not being properly a ſea-port town, has never been remarkable for trade. The chief advantages it enjoys ariſe from the ſupreme courts of juſtice, which are there held; and from its college, which has become famous over Europe, particularly for phyſic.

EDITOR, a perſon of learning, who has the care of an impreſſion of any work, particularly that of an ancient author: thus Eraſmus was a great editor; the louvain doctors, Scaliger, Petavius, F. Sirmond, biſhop Walton, Mr Hearne, Mr Ruddiman, *&c.* are likewiſe famous editors.

EDUCATION, the inſtructing children, and youth in general, in ſuch branches of knowledge and polite exerciſes, as are ſuitable to their genius and ſtation.

Education is a very extenſive ſubject, that has employed the thoughts and pens of the greateſt men: Locke, the archbiſhop of Cambray, Tanaquil Faber, M. Crouſaz, Rollin, and Rouſſeau, may be conſulted on this head.

The principal aim of parents ſhould be, to know what ſphere of life their children are deſigned to act

in;

in; what education is really suitable to them; what will be the consequence of neglecting that; and what chance a superior education will give them, for their advancement in the world. Their chief study should be to give their children such a degree of knowledge, as will qualify them to fill some certain post or station in life: in short, to fit them for an employment suited to their condition and capacity, such as will make them happy in themselves and useful to society.

EDULCORATION, in chemistry, the separating, by a washing or solution in water, the salt that any body may be impregnated with, or those that may be left adhering to a body after any operation. See CHEMISTRY.

EEL, in ichthyology, a species of muræna. See MURÆNA.

EEL SPEAR, a forked instrument with three or four jagged teeth, used for catching of eels: that with the four teeth is best, which they strike into the mud at the bottom of the river, and if it strike against any eels it never fails to bring them up.

EFFARE', or EFFRAYE', in heraldry, a term applied to a beast rearing on its hind-legs, as if it were frighted or provoked.

EFFECT, in a general sense, is that which results from, or is produced by, any cause. See CAUSE.

EFFECTS, in commerce, law, &c. the goods possessed by any person, whether moveable or immoveable.

EFFERDING, a town of Upper Austria, about ten miles west of Lintz.

EFFERVESCENCE, in a general sense, signifies a slight degree of ebullition in liquors exposed to a due degree of heat: but the chemists apply it to that intestine motion excited in various fluids, either by the mixture of fluids with others of a different nature; or by dropping salts or powders of various kinds into fluids. See POWDERS.

EFFIGY, the portrait, figure, or exact representation of a person.

EFFLORESCENCE, among physicians, the same with exanthema. See EXANTHEMA.

EFFLUVIUM, in physiology, a term much used by philosophers and physicians, to express the minute particles which exhale from most, if not all, terrestrial bodies in form of insensible vapours.

EFFUSION, in a general sense, the pouring out of any thing liquid, and that with some violence.

EFT, in zoology, the English name of the common lizard. See LACERTUS.

EGERMOND, a market-town of Cumberland, ten miles south of Cockermouth.

EGG, in physiology, a body formed in certain females, in which is contained an embryo, or fœtus of the same species, under a cortical surface or shell. The exterior part of an egg is the shell, which in a hen, for instance, is a white, thin, and friable cortex, including all the other parts. The shell becomes more brittle by being exposed to a dry heat. It is lined every where with a very thin but a pretty tough membrane, which dividing at, or very near, the obtuse end of the egg, forms a small bag, where only air is contained. In new laid eggs this folliculus appears very little, but becomes larger when the egg is kept.

Within this are contained the albumen or white, and the vitellus or yelk; each of which have their different virtues.

The albumen is a cold, viscuous, white liquor in the egg, different in consistence in its different parts. It is observed, that there are two distinct albumens, each of which are inclosed in its proper membrane; of these, one is very thin and liquid, and the other more dense and viscuous, and of a somewhat whiter colour; but, in old and stale eggs, after some days incubation, inclining to a yellow. As this second albumen covers the yelk on all sides, so it is itself surrounded by the other external liquid. The albumen of a fecundated egg, is as sweet and free from corruption, during all the time of incubation, as it is in new-laid eggs; as is also the vitellus. As the eggs of hens consist of two liquors separated one from another, and distinguished by two branches of umbilical veins, one of which goes to the vitellus, and the other to the albumen; so it is very probable that they are of different natures, and consequently appointed for different purposes.

When the vitellus grows warm with incubation, it becomes more humid, and like melting wax, or fat; whence it takes up more space; for as the fœtus increases, the albumen insensibly wastes away, and condenses: the vitellus, on the contrary, seems to lose little or nothing of its bulk when the fœtus is perfected, and only appears more liquid and humid when the abdomen of the fœtus begins to be formed.

The chick in the egg is first nourished by the albumen; and when this is consumed, by the vitellus, as with milk. If we compare the chalazæ to the extremities of an axis passing through the vitellus, which is of a spherical form, this sphere will be composed of two unequal portions, its axis not passing through its centre; consequently, since it is heavier than the white, its smaller portion must always be uppermost in all positions of the egg.

The yellowish white round spot, called cicatricula, is placed on the middle of the smaller portion of the yelk; and therefore, from what has been said in the last paragraph, must always appear on the superior part of the vitellus.

Not long before the exclusion of the chick, the whole yelk is taken into its abdomen; and the shell, at the obtuse end of the egg, frequently appears cracked some time before the exclusion of the chick. The chick is sometimes observed to perforate the shell with its beak. After exclusion, the yolk is gradually wasted, being conveyed into the small guts by a small duct.

Eggs differ very much according to the birds that lay them, according to their colour, form, bigness, age, and the different way of dressing them: those most used in food are hens eggs: of these, such as are new-laid are best.

As to the preservation of eggs, it is observed that the

the egg is always quite full when it is firſt laid by the hen, but from that time it gradually becomes leſs and leſs ſo, to its decay; and however compact and cloſe its ſhell may appear, it is nevertheleſs perforated with a multitude of ſmall holes, though too minute for the diſcernment of our eyes, the effect of which is a daily decreaſe of matter within the egg, from the time of its being laid; and the perſpiration is much quicker in hot weather than in cold.

To preſerve the egg freſh, there needs no more than to preſerve it full, and ſtop its tranſpiration; the method of doing which is, by ſtopping up thoſe pores with matter which is not ſoluble in watery fluids; and on this principle it is, that all kinds of varniſh, prepared with ſpirit of wine, will preſerve eggs freſh for a long time, if they are carefully rubbed all over the ſhell: tallow, or mutton fat, is alſo good for this purpoſe, for ſuch as are rubbed over with this will keep as long as thoſe coated over with varniſh.

Artificial method of hatching EGGS. See HATCHING.

EGLANTINE, in botany. See ROSA.

EGRA, a city of Bohemia, ſituated on a river of the ſame name, about ſeventy-five miles weſt of Prague: E. long. 12° 22′, N. lat. 50° 10′.

EGYPT, an extenſive country of Africa, lying between 30° and 36° of eaſt longitude, and between 21° and 31° of north latitude; and bounded by the Mediterranean on the north; by the Red-ſea and Iſthmus of Suez, which divide it from Arabia, on the eaſt; by Abyſſinia or Ethiopia, on the ſouth; and by the deſarts of Barca and Nubia, on the weſt; being ſix hundred miles in length from north to ſouth, and from one hundred to two hundred in breadth from eaſt to weſt. Egypt is ſubject to the grand ſignior, and governed by a baſhaw, or viceroy. It owes its fertility to the annual overflowing of the Nile, which it begins to do in the months of May and June, and is uſually at its height in September, from which time the waters decreaſe till May or June again. By this ſupply of water, Egypt is rendered ſo fruitful, as to ſerve Conſtantinople and other places with corn, as it did Rome and Italy of old. They only harrow their grain into the mud, on the retiring of the water, and in March following uſually have a plentiful harveſt; and the lands, not ſown, yield good crops of graſs for the uſe of the cattle. According to Mr. Sandys, no country in the world is better furniſhed with grain, fleſh, fiſh, ſugar, fruits, melons, roots, and other garden ſtuff, than the lower Egypt.

EGYPTEN, a town of Courland, ſeventy miles ſouth-eaſt of Mittau.

EGYPTIANS, or GYPSIES, in Scots law, a band of robbers originally from Egypt, which infeſted Scotland about the end of the 16th century.

EJACULATOR, a muſcle of the penis. See Vol. I. p. 170.

EICHTERNAC, a town of Luxemburg, ſeven miles north weſt of Treves.

EJECTA, a term uſed, by lawyers, for a woman deflowered, or caſt from the virtuous.

EJECTION, in the animal oeconomy, evacuation, or the diſcharging any thing through ſome of the emunctories, as by ſtool, vomit, &c.

EJECTION, in Scots law, is the turning out the poſſeſſor of any heritable ſubject by force; and is either *legal* or *illegal*.—Legal ejection is where a perſon having no title to poſſeſs, is turned out by the authority of law: See REMOVING. Illegal ejection, is one perſon's violently turning another out of poſſeſſion without lawful authority. See LAW, title 29.

EIENHOVFN, a town of Dutch Brabant, fifteen miles ſouth of Boiſleduc.

EIFIELD, or ELFIELD, a town of lower Saxony, ſix miles north-weſt of Mentz.

EIGHT, or PIECE OF EIGHT. See MONEY.

EIMBECK, a town of lower Saxony, belonging to the elector of Hanover, twenty-five miles ſouth of Hildeſheim.

EISLEBEA, a town of Upper Saxony, five miles eaſt of Mansfield, remarkable for being the birth-place of Luther.

ELÆAGNUS, DUTCH MYRTLE, in botany, a genus of the tetrandria-monogynia claſs. It has no corolla; the calix is bell-ſhaped above the fruit, and has four ſegments; and the drupa is bell-ſhaped, and below the calix. There are three ſpecies, none of them natives of Britain.

ELÆOTHESIUM, in antiquity, the anointing room, or place where thoſe who were to wreſtle, or had bathed, anointed themſelves. See GYMNASIUM.

ELAPHEBOLIUM, in Grecian antiquity, the ninth month of the Athenian year, anſwering to the latter part of February and beginning of March. It conſiſted of thirty days, and took its name from the feſtival elaphebolia, kept in this month, in honour of Diana the huntreſs; on which occaſion, a cake made in the form of a deer, was offered to her.

ELASMIS, in natural hiſtory, a genus of talcs, compoſed of ſmall plates in form of ſpangles; and either ſingle, and not farther fiſſile; or, if complex, only fiſſile to a certain degree, and that in ſomewhat thick laminæ.

Of theſe talcs there are ſeveral varieties, ſome with large and others with ſmall ſpangles, which differ alſo in colour and other peculiarities.

ELASTIC, in natural philoſophy, an appellation given to all bodies endowed with the property of elaſticity. See the next article.

ELASTICITY, or ELASTIC FORCE, that property of bodies wherewith they reſtore themſelves to their former figure, after any external preſſure. See MECHANICS.

ELATER, in zoology, a genus of inſects belonging to the order of coleoptera. The feelers are ſetaceous. There are 38 ſpecies, diſtinguiſhed by their colour, &c.

ELATERIUM, in pharmacy, imports, in general, any purging medicine; but is particularly applied to thoſe which operate with violence.

ELATINE, in botany, a genus of the octandria-tetragynia claſs. The calix conſiſts of four leaves, and the corolla of four petals; the capſule has four cells and four

four depreſſed valves. There are two ſpecies, one of which, *viz.* the alſinaſtrum or water-wort, is a native of Britain.

ELBE, a large river in Germany, which, riſing on the confines of Sileſia, runs through Bohemia, Saxony, and Brandenburg; and afterwards dividing the dutchy of Lunenburg from that of Mecklenburg, as alſo the dutchy of Bremen from Holſtein, it falls into the German ocean, about ſeventy miles below Hamburgh.

It is navigable for great ſhips higher than any river in Europe.

ELBOW, in anatomy, the juncture of the cubitus and radius; or the outer angle made by the flexure or bend of the arm. See ANATOMY.

ELCESAITES, in church-hiſtory, ancient heretics, who made their appearance in the reign of the emperor Trajan, and took their name from their leader Elceſai. The elceſaites kept a mean between the Jews, Chriſtians, and Pagans; they worſhipped but one God, obſerved the Jewiſh ſabbath, circumciſion, and the other ceremonies of the law. They rejected the pentateuch, and the prophets; nor had they more reſpect for the writings of the apoſtles, particularly thoſe of St. Paul.

ELDERS, or SENIORS, in Jewiſh hiſtory, were perſons the moſt conſiderable for age, experience, and wiſdom. Of this ſort were the ſeventy men whom Moſes aſſociated to himſelf in the government of his people; ſuch, likewiſe, afterwards were thoſe who held the firſt rank in the ſynagogue, as preſidents.

In the firſt aſſemblies of the primitive Chriſtians, thoſe who held the firſt place were called elders. The word preſbyter, often uſed in the New Teſtament, is of the ſame ſignification: hence the firſt councils of Chriſtians were called preſbyteria, or councils of elders.

ELDER is alſo a denomination ſtill preſerved in the preſbyterian diſcipline. See PRESBYTERIAN.

ELDER, or ALDER, in botany. See ALNUS.

ELECAMPANE, in botany. See INULA.

ELECT, among eccleſiaſtical writers, thoſe whom God has choſen, or predeſtinated to be ſaved.

ELECTION, the choice that is made of a perſon, or thing, in preference of any other; as in the election of an emperor, of a pope, of a biſhop, of members of parliament, *&c.*

ELECTION, in theology, ſignifies the choice which God makes of angels and men for the objects of his grace and mercy. See GRACE, and PREDESTINATION.

ELECTOR, a perſon who has a right to elect or chuſe another to an office, honour, *&c.*

Elector is particularly, and by way of eminence, applied to thoſe princes of Germany in whom lies the right of electing the emperor: being all ſovereign princes, and the principal members of the empire.

The electoral college, conſiſting of all the electors of the empire, is the moſt illuſtrious and auguſt body in Europe. Bellarmine and Baronius atribute the inſtitution of it to pope Gregory V. and the emperor Otho III. in the tenth century; of which opinion are the generality of hiſtorians, and particularly the canoniſts: however, the number of electors was unſettled, at leaſt, till the thirteenth century. In 1356 Charles IV. by the golden bull, fixed the number of electors to ſeven; three eccleſiaſtics, *viz.* the archbiſhops of Mentz, Treves, and Cologne; and four ſeculars, *viz.* the king of Bohemia, count Palatine of the Rhine, duke of Saxony, and marquis of Brandenburg. In 1648 this order was changed, the duke of Bavaria being put in the place of the count Palatine, who having accepted the crown of Bohemia was outlawed by the emperor; but being at length reſtored, an eighth electorate was erected for the duke of Bavaria. In 1692, a ninth electorate was created, by the emperor Leopold, in favour of the duke of Hanover, of the houſe of Brunſwic Lunenburg.

There is this difference between the ſecular and eccleſiaſtic electors, that the firſt have an active and paſſive voice, that is, may chuſe and be choſen; the laſt, an active only. The three archbiſhops are to be thirty years old, before they can be advanced to the dignity; the ſeculars, eighteen, before they can perform the office themſelves. Theſe laſt have each their vicars, who officiate in their abſence.

Beſides the power of chuſing an emperor, the electors have alſo that of capitulating with, and depoſing him; ſo that, if there be one ſuffrage wanting, a proteſt may be entered againſt the proceedings. By the right of capitulation, they attribute to themſelves great privileges, as making of war, coining, and taking care of the public intereſt and ſecurity of the ſtates; and the emperor promiſes, upon oath, to receive the empire upon theſe conditions.

The electors have precedence of all other princes of the empire, even of cardinals and kings; and are addreſſed under the title of electoral highneſs.

Their ſeveral functions are as follow: the elector of Mentz is chancellor of Germany, convokes the ſtates, and gives his vote before any of the reſt. The elector of Cologne is grand chancellor of Italy, and conſecrates the emperor. The elector of Treves is chancellor of the Gauls, and confers impoſition of hands upon the emperor. The count Palatine of the Rhine is great treaſurer of the empire, and preſents the emperor with a globe at his coronation. The elector of Bavaria is great maſter of the imperial palace, and carries the golden apple. The marquis of Brandenburg is grand chamberlain, and puts the ring on the emperor's finger. The elector of Saxony is grand marſhal, and gives the ſword to the emperor. The king of Bohemia is grand butler, and puts Charlemaign's crown on the emperor's head. Laſtly, the elector of Hanover, now king of Great Britain, is arch-treaſurer, though firſt erected under the title of ſtandard-bearer of the empire.

ELECTORATE, a term uſed as well to ſignify the dignity of, as the territories belonging to, any of the electors of Germany; ſuch are Bavaria, Saxony, *&c.*

E L E C T R I C I T Y.

THE word ELECTRICITY fignifies, in general, the effects of a very fubtile fluid matter, different in its properties from every other fluid we are acquainted with. This fluid is capable of uniting with almoft every body, but unites more readily with fome particular bodies than with others: its motion is amazingly quick, is regulated by peculiar laws, and produces a vaft variety of fingular phenomena, the principal of which fhall be enumerated in this article.

As we are entirely ignorant of the nature of the electrical fluid, it is impoffible to define it but by its principal properties: that of repelling and attracting light bodies, is one of the moft remarkable. The ancients were only acquainted with this property in amber. William Gilbert, a native of Colchefter, and phyfician at London, in his treatife *De Magnete*, in the year 1600, was the firft perfon who difcovered, that fulphur, wax, refinous fubftances, glafs, and precious ftones, when dried and rubbed a little, were endowed with the fame property of attracting and repelling ftraws and other light fubftances. Sir Francis Bacon, in his phyfiological remains, gives a catalogue of electrical bodies; but it differs in nothing worth mentioning from that of Gilbert. Mr Boyle, about the year 1670, made fome addition to the catalogue of electric fubftances; but all his experiments on this fubject relate only to a few circumftances attending the fimple property of electric attraction: he had never feen the electric light, and little imagined what aftonifhing effects would be afterwards produced by this wonderful power.

Cotemporary with Mr Boyle was Otto Guericke, burgomafter of Magdeburg, and inventor of the air-pump, who was likewife one of the firft improvers of electricity. He made his experiments with a globe of fulphur, which he mounted on an axis, and whirled it in a wooden frame, rubbing it at the fame time with his hand. He firft difcovered, that a body once attracted by an excited electric was repelled by it, and not attracted again till it had been touched by fome other body: that bodies immerged in electric atmofpheres are themfelves electrified: that threads fufpended within a fmall diftance of his excited globe, were often repelled by his finger brought near them: that a feather, repelled by the globe, always turned the fame face towards it, like the moon with refpect to the earth; and that the excitation of his globe produced both light and found, though in a very inconfiderable degree. A much finer electric light was afterwards obferved by Dr Wall, and an account of it was publifhed in the Philofophical Tranfactions: Dr Wall likewife compares the light and the crackling of his excited amber to thunder and lightening.

Sir Ifaac Newton, in 1675, was the firft who difcovered that excited glafs attracted light bodies on the fide oppofite to that on which it was rubbed.

After Gilbert, Boyle, and Otto Guericke, Mr Hawkefbee, in his Phyfico-mechanical Experiments, publifhed in the year 1709, diftinguifhed himfelf by his experiments and difcoveries in electricity. He firft difcovered the electric power of glafs, the light proceeding from it, and the noife occafioned by it, together with a variety of phænomena relating to electric attraction and repulfion: Indeed little was added to his obfervations, till the difcovery of a plus and minus electricity by Dr Watfon and Dr Franklin about the year 1746, and the farther illuftration of that doctrine by Mr Canton.

From the year 1730 to the 1746, the writers on electricity are fo numerous, and their experiments fo many and various, that a volume would be infufficient for their hiftory. We fhall therefore endeavour, in the *firft* place, To give a fhort and connected view of the nature and principles of electricity, fo far as they have hitherto been unfolded, without mentioning the perfons to whom we are indebted for any particular difcovery: And, in the *fecond* place, Give a defcription of electrical machines; with a felection of a few of the moft curious and ufeful experiments, which the reader may eafily underftand after having made himfelf acquainted with the general principles.

It has been afferted, that all bodies, provided they be heated to a certain degree, and rubbed for a long time, will difcover themfelves to be poffeffed of the property of attracting and repelling light fubftances. However, metals of all kinds, although ever fo much heated, or rubbed, or polifhed, never difcover the leaft figns of electrical attraction; and confequently are excepted from the general rule, as well as water and other fluids, which cannot be fubjected to the neceffary treatment. Although moft bodies, by being heated and rubbed, difcover more or lefs of electrical attraction; yet, as fome of them poffefs this property in a more eminent degree, and with lefs labour, this circumftance has fuggefted a divifion of bodies into two claffes, according as they are more or lefs fufceptible of electricity.

The firft clafs comprehends thofe bodies which receive and collect the electrical matter moft eafily, and in greateft quantity, after being a little rubbed and heated: thefe bodies are called *electrics*, or *non conductors*; fuch as,

1. Diamonds of all kinds; the ruby, the fapphire, the emerald, the opal, the amethyft, the topaz, the beryl, the granat, rock cryftal, *&c.*

2. Glafs, and all vitrified bodies, enamels of all colours, porcelain, glafs of antimony, of lead, *&c.*

3. Balfams, refins of all kinds, wax, *&c.*

4. Bituminous bodies, fulphur, amber, afphaltum, *&c.*

5. Certain animal productions; as filk, feathers, wool, hairs, and briftles, *&c.*

The fecond clafs comprehends thofe bodies which either do not at all collect the electrical matter by friction, or

or in a very inconfiderable degree: fuch bodies are called *non-electrics*, or *conductors*, viz.

1. Water, and all aqueous and fpirituous liquors, which are incapable of being thickened, and fubjected to friction.

2 All metals, perfect and imperfect, and the greateft part of minerals; as, the load-ftone, antimony, zinc, bifmuth, the agat, the jafper, marble, free-ftone, flate, *&c.*

3. All living creatures, excepting their hair. To which may be added moft animal-fuftances; as leather, parchment, bone, ivory, horn, fhells, *&c.*

4. Trees and plants of all kinds; thread, ropes, linen-cloth, paper, *&c.*

Thefe two claffes of bodies have been called by the name of *electrics* and *non-electrics:* but as the electrical matter is not contained in the electrical bodies themfelves, but collected by them from the earth; and as non-electric allow the electrical matter to penetrate and flow through them, or to fpread equally on their furfaces, the terms *conductor* and *non-conductor* are more proper. Metals and water are the only perfect conductors; other bodies conducting only as they contain a mixture of thefe, without more or lefs of which they will not conduct at all.

Although conductors cannot be electrified by heat or friction, they may be charged with electricity, or made non-conductors, by an eafy operation; but then they retain this property no longer than they are kept from communicating with other conductors. A bar of iron will become an electric or non-conductor, by being fufpended by a filk cord, or laid upon a piece of rofin or other non-conductor, and at the fame time having one end of it in contact with a well-rubbed glafs tube, or globe. In the fame manner, water and metals of all kinds may be charged with electricity.

It is abfolutely neceffary, in exciting electricity by friction, that the glafs, or other body, be perfectly dry; the leaft moifture deftroys, or at leaft diminifhes the effect. A moift atmofphere, a burning candle, *&c.* are extremely unfavourable in making electrical experiments.

Hollow glafs globes, of about a foot diameter, and the 16th part of an inch thick, are now ufed in place of tubes, becaufe it leffens the labour of friction, and accumulates a greater quantity of electrical matter. This globe is turned rapidly by a large wheel like thofe ufed by the cutlers. When the globe is rubbed, it foon acquires a confiderable degree of electrical virtue, which is difcovered by light bodies, at the diftance of two or three feet, flying towards it. In approaching the globe with the hand or face, you will likewife feel the electric matter furrounding it like a gentle breeze of wind. Thefe fubtile emanations continue to be diffufed round the globe as long as the friction is continued; and, when the friction is ftopped, they gradually diminifh, till they are no longer perceptible. The application of non-conductors to the globe does not diminifh the electrical matter: on the contrary, the application of conductors almoft inftantly annihilates the whole quantity previoufly collected by the friction. But this effect is not produced, unlefs when the conductor at the fame time has a communication with the floor or earth where the machine ftands. For, as above obferved, if the conductor has no communication with the earth, it charges with electricity, and becomes a non-conductor. But non-conductors, as a piece of glafs, fulphur, or wax, though they do not diminifh the virtue of the globe, yet they do not acquire, like iron, *&c.* the property of attraction or repulfion. Hence it appears, that the electrical matter paffes freely along conductors, and diffipates in the earth; but, on the contrary, that non-conductors do not receive any matter from the globe, and are incapable of tranfmitting it. The following experiments will make this more plain.

1. If a piece of iron be placed on a glafs ftandard, and unconnected with any other body, as foon as the electrical matter is communicated to it, it attracts and repels pieces of gold leaf or other light bodies, and preferves this virtue even for fome minutes after its communication with the globe is cut off. But, if a piece of glafs, rofin, or any other non-conductor, be placed in the fame circumftances, they do not difcover any fuch effect.

2. If a perfon touches the piece of iron above mentioned with his hand, no friction is capable of making it attract or repel, or exhibit any marks of electricity. The fame thing happens, if a chain of any metal touch the iron, and at the fame time has a communication with the ground. In both thefe cafes, the electrical matter paffes along the iron, and diffipates in the earth.

3. In place of touching the piece of iron with the finger, if a piece of amber, wax, or any other non-conductor be applied to it, the communication with the earth being interrupted by the non-conductor, the iron, in that cafe, retains the electrical matter as before.

From thefe experiments we learn, that metals and other conductors receive the electrical matter, and tranfmit it to other conductors till it diffufes and is loft in the earth; but that, if wax, glafs, or any other non-conductor, be applied to the conductor, the motions of the matter is inftantly ftopt, and accumulates and charges the conductor, at the fame time that the non-conductor itfelf is not all affected. It is for this reafon that conductors, as filk-cords, hair-ropes, *&c.* are always employed to fufpend or fupport fuch bodies as we want to charge with electricity.

The following experiments will throw further light on this fubject.

I. If a man ftands upon a piece of rofin about five inches in diameter, and feven or eight inches thick, touching foftly the globe, while the operator is rubbing it, his whole body, in a few feconds, will be charged with electrical matter; and the following phænomena will take place.

1. His loofe hand, and indeed every part of his body, will mutually attract and repel light bodies at the diftance of three or four feet.

2. All conductors which he takes in his hand, will become electrified in the fame manner with himfelf, provided they touch nothing elfe, or be fupported upon non-conductors: and this communication to other conductors, let

let their number and extension be ever so great, instead of diminishing the electrical virtue in the body of the man, will rather augment its strength and quantity.

3. If this person gives his hand to another likewise standing on a similar piece of rosin, he too will be charged with electrical matter; and the same thing will happen to any number of persons, provided they stand upon rosin, and communicate with one another by an iron chain or other conductor. But the whole company will instantaneously lose the whole of their electrical virtue, if any non-electrified person touch a single man, or if there be any communication between one of them and a conducting substance.

4. If the first man removes his hand from the globe, and at the same time keep his former station, he and all the rest will preserve the power of attracting and repelling light substances for some time; but it gradually diminishes, till its effects totally disappear.

5. If a non-electrified person puts his hand near the first man's face, he will feel a kind of atmosphere surrounding the electrified person; if he advances his hand still nearer any part of the face, for example the nose, both the point of the finger and the nose will appear luminous in the dark: Lastly, if he touches the nose, a spark of fire instantly explodes with a crack, and strikes both parties equally with a shock more or less painful in proportion as the electrified person was charged. It is by the explosion of this spark, that the electrical matter instantly transmits itself from one body to another.

6. When we approach near an electrified person, we perceive an extraordinary smell proceeding from his body, similar to that of the phosphorus of urine.

II. An iron wire, 12,000 feet in length, was suspended about five feet from the ground by silk cords; one end of it was connected to the globe of an electrical machine, and at the other a lead ball was hung in order to perceive when the matter reached it.

1. After five or six turns of the wheel, the matter had passed along the whole wire, and communicated its virtue to the ball, which instantly attracted and repelled light bodies.

2. As this ball was equally electrified with every part of the wire, it is probable that the electric matter would instantly pervade a wire of a still greater length, provided we had a proper apparatus for the purpose.

3. Several metals and other conductors were substituted in place of the ball, and all received the electricity in the same manner.

4. The ball and other non-conductors, when touched with the finger, gave a luminous spark and as smart a shock, as when the end of the wire next the globe was touched.

5. All these effects instantly ceased whenever any person not electrified touched any part of the wire, and commenced again a few seconds after his hand was withdrawn.

6. The same effects are produced, though with more difficulty, when hair or woolen ropes were substituted in place of the silk ones: But they were entirely stopt by hemp-ropes, or when the silk ones were wetted.

7. When a hempen rope was substituted in place of the wire, the ball at the end of it was electrified with greater difficulty than when it hung at the wire, especially when the rope was dry; but when the rope was wet, the matter passed with more ease.

8. When, in place of the wire, a dry silk cord, or long glass tube, were used, they received but a very small quantity of the matter, which was not perceivable in the glass tube above 12 feet, nor in the cord above 25, beyond the globe.

9. When the wire was cut in several places, and the cut ends kept at the distance of somewhat less than a foot from each, the electrical matter darted through all these interruptions, and appeared in the ball at the furthest end. A strong blast made by a bellows across one of the interruptions, did not obstruct the passage of the matter; neither did the interposition of a piece of glass, wax, and other non-conductors: but all conductors, as the hand of a man, the point of a sword, and even a moist vapour, obstructed its course towards the ball.

10. When a man stood on a piece of rosin, and put a point of a sword in one of the interruptions, he was instantly filled with the matter, although neither he nor the sword touched the wire: neither was the course of the matter towards the ball obstructed by the interposition of the sword.

11. When a ring of brass wire, about three feet in diameter, was suspended in a vertical direction, and the iron wire was made to pass nearly through its centre, without touching any part of the circumference, the ring, in whatever part of the wire it was tried, was sensibly electrified. This shows that the electrical matter expands to a considerable distance on all sides of the electrified body.

12. The same iron wire suspended by silk cords was extended 6000 feet, (just one half of its length), in a straight line; the other half was turned back in a parallel direction towards the globe, leaving about nine or ten inches of interval between the two halves of the wire: Each extremity of the wire was supported by a dry silk cord about seven or eight feet from the globe, and the lead ball was hung at one of them. An iron chain was then fixed with another silk cord above the globe, in order to receive the matter at one of its extremities; the other end of the chain was fixed to a rod of glass about five feet long, in such a manner that the matter received from the globe might be transmitted at pleasure to the wire, by applying the end of the fixed chain to the glass rod. Matters being thus prepared, after five or six turns of the wheel, the chain was applied to one end of the wire; at the same instant the ball at the other end attracted and repelled bits of gold-leaf. The same experiment was repeated, and a finger applied to the ball, and a spark issued out, and a shock was received at the very instant that the chain was applied to the other end of the wire: A spark likewise proceeded from the chain, which afforded an easy opportunity of discovering that the two sparks were perfectly synchronous.

From these experiments it appears,

1. That the electrical matter communicates itself to all non-electrics, or conductors, whatever be their bulk or extension.

2. That the quantity of this matter diffufed is always in proportion to the magnitude and extenfion of the bodies into which it paffes; and that it is uniformly diffufed, no part of the body retaining more than any other part.

3. That, after being thus communicated to any body, it efcapes with equal facility, as foon as it finds a communication with the earth.

4. That fmall interruptions in the continuity of electrified bodies do not interrupt the motion of the electrical matter.

5. That the motion of the electrical matter is fo amazingly fwift, that it runs over a fpace of 12,000 feet in an undefinable inftant of time.

6. That it moves with equal rapidity either backward or forward, upon the application of a conductor.

7. Laftly, That an indefinitely large quantity of this matter may be accumulated by applying the globe or tube to conducting bodies of very large dimenfions. Of late other methods of condenfing a large quantity of electrical matter into a fmall fpace have been invented, as will afterwards appear when we come to treat of the Leyden phial.

The attraction and repulfion of light bodies, is the firft thing that difcovers to us the prefence of the electrical matter. This motion is always reciprocal: If the electrified body be lighter than the conductor, and both are at liberty, the motion of the former is quicker than that of the latter; if the one be fixed, and the other at liberty, the unfixed one conftantly goes to the one that is fixed, and, at the fame, takes the fhorteft road. The following experiments will illuftrate thefe motions.

1. Prefent an electrified tube to fmall pieces of gold-leaf placed on a well-polifhed plate of copper, they will inftantly fly towards the tube.

2. Sufpend an electrified tube by two filk cords; take a piece of gold-leaf, and, holding it firm betwixt your fingers, bring it near the tube; and the tube will be attracted and move toward the leaf.

3. If an electrified perfon, ftanding on a piece of rofin, holds in his hand a plate of copper, upon which pieces of gold-leaf are placed; and another perfon, who is not electrified, holds his finger above the plate; the gold-leaf will inftantly rife from the plate, and fly towards his finger.

4. Laftly, If two balls of gilt paper be fufpended fix inches afunder, the one by a filk thread three feet in length, and the other by a fmall filver wire of the fame length; when the ball fufpended by the filk thread is electrified by the tube, both balls advance with equal quicknefs towards one another, though only one of them was electrified.

The moft favourable circumftances for exhibiting the attraction of light bodies are the following:

1. They fhould be perfect conductors.

2. They ought to be of a fmall fize.

3. They fhould be fupported by a non-conductor, and raifed four or five feet from the ground.

4. No other non-conductor fhould be nearer the bodies than the tube with which the experiments are making; otherwife the attraction will be difturbed.

Repulfion generally fucceeds attraction; that is, a piece of gold leaf is no fooner attracted by the tube than it is repelled and driven off from it. This repulfion is not very perceptible when the tube is flightly electrified: but, when the electricity is brifk, the gold leaf never fails to be repelled as foon as it has touched the tube. Again, if the electricity be very ftrong, the gold-leaf, though ftrongly attracted by the tube, never touches it; the repulfive power beginning to operate two or three inches before the leaf reaches the tube: from that inftant the leaf is electrified; and, when it begins to be repelled, it has acquired as denfe an electrical atmofphere as the tube: it then flies off, and remains fufpended above the tube until it lofes the electric virtue it had acquired, either by the moift vapours in the air, or till it lofes it fuddenly by touching fome conductor. Hence it appears, that attraction precedes repulfion, only becaufe it is neceffary that the pieces of gold-leaf fhould acquire as denfe an atmofphere as that of the globe before they can be repelled by it.

When the tube has repelled a piece of gold leaf, if another tube, nearly equally electrified, be fuddenly fubftituted in place of the former tube, the leaf will continue to be repelled at an equal diftance. But if the fubftituted tube be much lefs electrified than the original one, the leaf will be attracted by that tube.

When two or more pieces of gold leaf are prefented at the fame time to a well electrified tube, they are all equally attracted and repelled; but then they mutually repel one another, fo that it is impoffible to make any two of them join; and the diftance at which they repel one another is equal to the diftance to which each of them were repelled from the tube.

If a circular piece of gold-leaf, cut into fmall fringes to near the centre of the leaf, be prefented to an electrified tube, it will firft be attracted, and then repelled: in the time of repulfion, all the fringes repel each other, and diverge more or lefs in proportion to the ftrength of electricity in the tube.

If a fmall metal veffel filled with water, and furnifhed with a capillary fiphon, having the longer leg hanging over the outfide of the veffel, be touched with an electrified iron rod; the water, which could not run out of the fiphon but drop by drop, will inftantly fly out a tone jet, and divide itfelf into very fine threads; and thefe threads continue fometimes fufpended in the air, repelled from each other to a confiderable diftance.

From thefe inftances of attraction and repulfion it appears,

1. That light bodies are attracted by electrified fubftances until they be equally electrified by communication, and until they acquire as denfe an atmofphere as the electrified fubftances themfelves.

2. That, from the moment they acquire this atmofphere, attraction ceafes and repulfion begins.

3. That no repulfion takes place but betwixt bodies electrified.

4. That repulfion continues only as long as the denfity of the two atmofpheres are equal; that it ceafes whenever the one or the other is diminifhed; that a new attraction

Plate. LXXIII

Fig. 1. ELECTRICAL APPARATUS

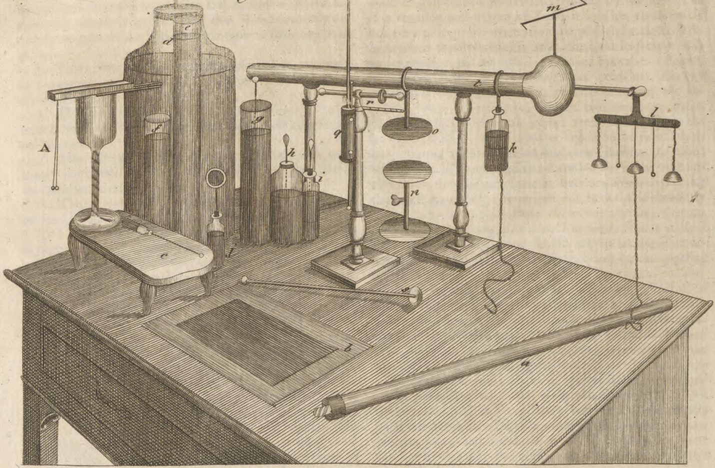


Fig. 2.

PRIESTLY'S ELECTRICAL MACHINE

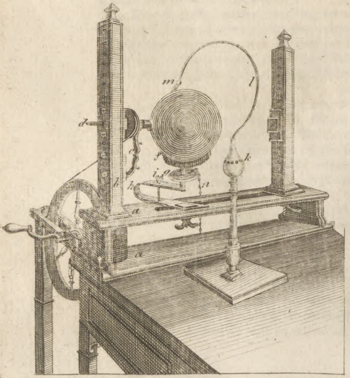
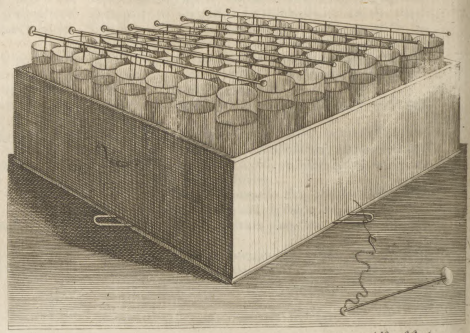


Fig. 3.

THE BATTERY



A Bell Sc.

traction commences, and continues till an equality in the atmospheres is again restored; and that, immediately upon this, a new repulsion takes place.

5. That repulsion may subsist betwixt two bodies which have never mutually been attracted, provided their atmospheres be equally dense.

6. That the distance to which bodies are repelled is always in proportion to the strength of the electricity they contain. This fact first suggested the notion of an electrometer, or a machine for measuring the different degrees of electricity.

Of Electrical Machines and Apparatus.

The improvement of electrical machines has kept pace with the improvements in the science. While nothing more than electrical attraction and repulsion was known, every phænomenon might be exhibited by means of a piece of amber, sealing wax, or glass, which the philosopher rubbed against his coat, and presented to bits of paper, feathers, and other light bodies.

To give a greater degree of friction to electric substances, Otto Guericke and Mr Hawkesbee contrived to whirl sulphur and glass in a spherical form. The first conductors were nothing more than hempen-cords supported by silken lines. In place of these, bars of metal, or gun-barrels, were soon substituted; and a rubber was employed to supply the place of a human hand. The discovery of the Leyden bottle, (to be afterwards described) occasioned more additions to the electrical apparatus; and the discoveries of Dr Franklin have made proportional additions necessary. No philosopher can now be satisfied, if he be not able to supply a conductor from the clouds, as well as from the friction of his glass globes or tubes.

Although globes or cylinders are now of the most extensive use in electrical experiments, glass-tubes are still most convenient for several purposes; they should be about three feet long, and as wide as a person can conveniently grasp, (Plate LXXIII. fig. 1 *a*.) The thickness of the glass is not material; perhaps the thinner they are the better, if they can bear sufficient friction.

The best rubber for a smooth glass is the rough side of black oiled silk, especially when a little amalgam of mercury or other metal is put upon it.

Glass-globes are in general preferable to cylinders. The globe should have its neck inclosed in a pretty deep brass cap, ending in a dilated brim, of about half an inch broad, if the globe be a large one. It has not been determined what kind of glass is the best; but flint is commonly used. Perhaps globes of twelve or thirteen inches diameter are the best size.

The best rubbers for globes are made of red basil skins, particularly the neck-part of them, where the grain is more open, and the surface somewhat rougher. That the rubber may press the globe equally, it should be put upon a plate of metal bent to the shape of the globe, and stuffed with any thing that is pretty soft: bran is good; and if the stuffing be a conductor, as flax, it will be better than if it be a non-conductor, as hair or wool. It should rest upon a spring, to favour any inequality there may be in the form of the globe. There should be no sharp edges or angles about the rubber; for that would make the insulation of it ineffectual. By the insulation of the rubber every electrical experiment may be performed with the twofold variety of *positive* and *negative*, and a conductor be made to give and take fire at pleasure. This insulation is best made by means of baked wood, in the form of a plate, five or six inches in diameter, (*g*, fig. 2.) interposed between the metallic part of the rubber and the steel spring that supports it. When positive electricity is intended to be produced, a chain (*n*, fig. 2.) must connect the rubber with the floor; but, when negative electricity is wanted, the chain must be removed, and hung upon the common conductor, while another prime conductor must be connected with the rubber; which will therefore be electrified negatively.

The best method of collecting the electric fire from the globe seems to be by three or four pointed wires, (*m*, fig. 2.) two or three inches long, hanging lightly upon the globe, and suspended on an open metallic ring.

The prime conductor should be fixed very steady: Whatever be the size of the prime conductor, the extremity of it, or that part which is most remote from the globe, should be much larger and rounder than the rest, (*k*, fig. 2); for the effort of the electric matter to fly off is always greatest at the greatest distance from the globe.

The electrician should be provided with Metallic Rods (*s*, fig. 1.) to take sparks from his conductor for various uses. These should have knobs, larger or smaller in proportion to the curvature of the conductor. If the knob be too small, it will not discharge the conductor at once, but by degrees, and with a less sensible effect; whereas the spark between broad surfaces is thick and strong.

The most formidable part of an electrical apparatus consists in the coated glass that is used for the Leyden experiment. The form of the plate is immaterial with respect to the shock; and, for different experiments, both plates of glass, and jars of various forms and sizes, must be used. For common uses, the most commodious form is that of a jar, as wide as a person can conveniently hold in his hand by grasping, and as tall as it will stand without any danger of falling; perhaps about $3\frac{1}{2}$ inches in diameter, and 8 inches in height. The mouth should be pretty open, that it may be the more conveniently coated on the inside, as well as the outside, with tinfoil. A considerable variety of these jars may be seen in the above Plate, fig. 1. *c*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*.

The method of coating is much preferable to that of putting water or brass-shavings into the jars, which both makes them heavy, and likewise incapable of being inverted, which is requisite in many experiments. Brass-dust, however, or leaden-shot, is very convenient for small phials. The tinfoil may be put on either with paste, gum water, or bees-wax. To coat the insides of vessels which have narrow mouths, moisten the inside with gum-water, and then pour some brass-dust upon it: Enough will stick to make an exceeding good coating.

In the construction of an electrical battery, a number

number of fmall jars are preferable to large ones. If one of them fhould break by an explofion or any other accident, the lofs is lefs confiderable; befides, by means of narrow jars, a greater force (that is, a greater quantity of coated furface) may be contained in lefs room. The largeft jars are about 17 inches in height, and fhould not be more than 3 in diameter, and of the fame width throughout. Thus they may be eafily coated both within and without, and a box of a moderate fize will contain a prodigious force; for the jars being coated within two inches of the top, each will contain a fquare foot of coated glafs The battery (Plate LXXIII. fig. 3.) confifts of 64 jars, each 8 inches long, and $2\frac{1}{2}$ in diameter, coated within an inch and a half of the top. The coated part of each is half a fquare foot; fo that the whole battery contains 32 fquare feet. The wire of each jar has a piece of very fmall wire twifted about the lower end of it, to touch the infide coating in feveral places; and it is put through a pretty large piece of cork within the jar, to prevent any part of it from touching the fide, which would tend to promote a fpontaneous difcharge. Each wire is turned round, fo as to make a hole or ring at the upper end; and through thefe rings a pretty thick brafs rod with knobs is put, one rod ferving for one row of the jars. The communication between thefe rods is made by laying a chain over them all: this chain is not reprefented in the plate, left the figure fhould appear confufed. When only a part of the battery is to be ufed, the chain fhould be laid over as many rods as you want rows of jars. The bottom of the box in which all the jars ftand is covered with tinfoil and brafs-duft; and a bent wire touching this tinfoil is put through the box, and appears on the outfide, as in the plate. To this wire is faftened whatever is intended to communicate with the outfide of the battery, as the piece of fmall wire in the figure; and the difcharge is made by bringing the brafs knob to any of the knobs of the battery.

To difcover the kind and degree of electricity, many forms of Electrometers have been thought of. Mr Canton's balls A, reprefented on a glafs ftanding on the ftool *c*, (Plate LXXIII. fig. 1.) ferve to difcover fmall degrees of electricity, to obferve the changes of it from pofitive to negative, and to eftimate the force of a fhock before the difcharge. Thefe balls are two pieces of cork, or pith of elder, nicely turned in a lath to about the fize of a fmall pea, and fufpended on fmall linen threads. Thefe balls repell one another to diftances exactly proportioned to the quantity of electricity contained in the veffel or other fubftance with which they are connected; and by this work the operator knows pretty exactly the force of the charge, and the fhock that will be given.

In order to repeat the experiment tending to fhew that the electric fluid is the fame with the matter of lightning, and to make obfervations on the electricity of the atmofphere, the electrician fhould be provided with A machine for drawing electricity from the clouds. The beft conftruction of which is the following: On the top of any building erect a pole *a*, (Plate LXXIV. fig. 2.) as tall as a man can well manage, having on the top of it a folid piece of glafs, or baked wood, a foot in length. Let this be covered with a tin or copper veffel (*b*) fhaped like a funnel, to prevent its ever being wetted; above this, let there rife a long flender rod *c*, terminating in a pointed wire, and having a fmall wire twifted round its whole length, the better to conduct the electricity to the funnel. From the funnel make a wire (*d*) defcend along the building, about a foot diftance from it, and conducted through an open fafh into any room that fhall be moft convenient for making the experiment. In this room, let a proper conductor be infulated, and connected with the wire coming in at the window. This wire and conductor, being completely infulated, will be electrified whenever there is a confiderable quantity of electricity in the air. And notice will be given when it is properly charged, either by Mr Canton's balls hung to it, or by a fet of bells difpofed in the following manner. Take three bells; fufpend the two outermoft from the conductor by chains, and that in the middle by a filken ftring, while a chain connects it with the floor; and hang two fmall knobs of brafs by filken ftrings, one between each two bells, to ferve inftead of clappers. In confequence of this difpofition, when the two outermoft bells, communicating with the conductor, are electrified, they will attract the clappers, and be ftruck by them. The clappers being thus loaded with electricity, will be repelled, and fly to difcharge themfelves upon the middle bell. After this, the clappers will be again attracted by the outermoft bells; and thus, by ftriking the bells alternately, a continual ringing may be kept up as long as the operator pleafes. In the dark a continual flafhing of light will be feen between the clappers and the bells. But when the electrification is very ftrong, thefe flafhes of light will be fo large, that they will be tranfmitted by the clapper from one bell to the other, without its ever coming to actual contact with either of them, and the ringing will confequently ceafe.

With regard to the conftruction of machines for electrical experiments in general, that of Dr Prieftly, reprefented on Plate LXXIII. fig. 2. is perhaps the beft. The Frame confifts of two ftrong boards of mahogany, (*a a*), of the fame length, parallel to one another, about four inches afunder, and the lower one is an inch on each fide broader than the upper: in the upper board is a groove reaching almoft its whole length. One of the pillars *b*, which are of baked wood, is immoveable, being let through the upper board, and firmly fixed in the lower; while the other pillar flides in the groove abovementioned, in order to receive globes or cylinders of different fizes; but it is only wanted when an axis is ufed; Both the pillars are perforated with holes at equal diftances from the top to the bottom; by means of which, globes may be mounted higher or lower according to their fize; and they are made tall, to admit the ufe of two or more globes at a time, one above another. Four of a moderate fize may be ufed, if two be fixed on one axis; and the wheel has feveral grooves for that purpofe.

If a globe with only one neck be ufed, as in the Plate, a brafs arm, with an open focket *c*, is neceffary to fupport the axis beyond the pulley; and this part is alfo contrived to be put higher or lower, together with the brafs focket in which the axis ftands. The axis *d* let

Fig. 1. *Dr Watson's* ELECTRICAL MACHINE

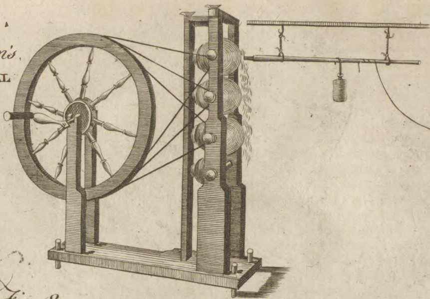


Fig. 2. CLOUD MACHINE

Fig. 3. ELEPHAS *or* ELEPHANT

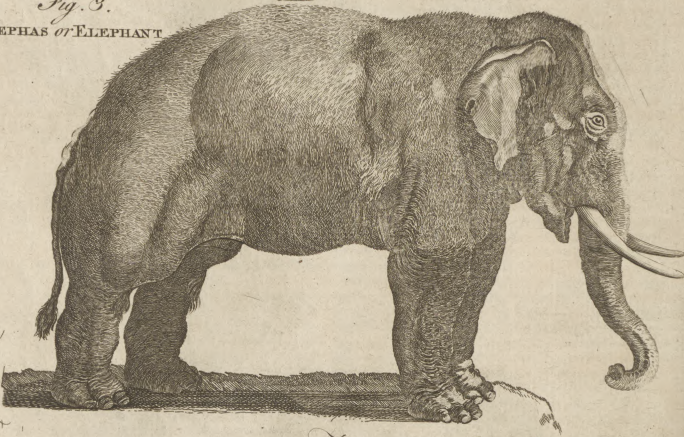


Fig. 5. ELATER

Fig. 7. ERMIN

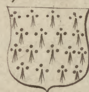


Fig. 4. ECHENEIS

Fig. 8. ERMINE

Fig. 6. ERINACEUS *or* HEDGE HOG

is made to come quite through the pillar, that it may be turned by another handle without the wheel, if the operator chuſes. The frame, being ſcrewed to the table, may be placed nearer to, or farther from, the wheel, as the length of the ſtring requires in different ſtates of the weather. The WHEEL is fixed in a frame by itſelf *e*, by which it may have any ſituation with reſpect to the pulley, and be turned to one ſide, ſo as to prevent the ſtring from cutting itſelf.

The RUBBER (*f*) conſiſts of a hollow piece of copper, filled with horſe-hair, and covered with a bazil-ſkin. It is ſupported by a ſocket, which receives the cylindrical axis, of a round and flat piece of baked wood *g*, the oppoſite part of which is inſerted into the ſocket of a bent ſteel-ſpring *h*. Theſe parts are eaſily ſeparated; ſo that the rubber, or piece of wood that ſerves to inſulate it, may be changed at pleaſure. The ſpring may be either ſlipped along the groove, or moved in the contrary direction, ſo as to give it every deſirable poſition with reſpect to the globe. It is beſides furniſhed with a ſcrew *i*, which makes it preſs harder or lighter on the globe, as the operator chuſes.

The PRIME CONDUCTOR (*k*) is a hollow veſſel of poliſhed copper in the form of a pear, ſupported by a pillar and a firm baſis of baked wood; and it receives the electrical matter by means of a long arched wire or rod of very ſoft braſs *l*, eaſily bent into any ſhape, and raiſed higher or lower as the globe requires. It is terminated by an open ring, in which are hung ſome ſharp-pointed wires *m*, playing lightly on the globe when it is in motion. The body of the conductor is furniſhed with holes and ſockets for the inſertion of metallic rods to convey the fire where-ever it is wanted.

When poſitive electricity is required, a wire or chain, as repreſented in the plate (*n*), connects the rubber with the table or the floor. When negative electricity is wanted, that wire is connected with another conductor, ſuch as that repreſented, in fig. 1. *t*; where the conductor in fig. 2. is connected with the table by another wire or chain. If the rubber be made tolerably free from points, the negative power will be as ſtrong as the poſitive.

The machine, repreſented Plate LXXV. fig. 1. was a contrivance of Dr Watſon's, to whirl four large globes at a time, and unite the power of them all. The conſtruction is ſo ſimple, that we need not give any particular deſcription of it, eſpecially after having ſo fully deſcribed that of Dr Prieſtly.

Of poſitive and negative Electricity, and the Leyden Phial.

DR WATSON and Dr Franklin firſt ſuggeſted the notion of *poſitive* and *negative*, or *plus* and *minus* electricity: ſeveral experiments led them to conclude, that every body in nature, and particularly all conducting bodies, poſſeſſed a certain quantity of electric matter, and that this natural quantity might be augmented or diminiſhed by being placed in particular circumſtances. When a body receives a larger quantity than the natural one, it is ſaid to be electrified *plus*, or *poſitively*; when the natural quantity is diminiſhed, it is ſaid to be electrified *minus*, or *negatively*. The following experiments will ſhew the different circumſtances requiſite to produce theſe two kinds of electricity.

1. A perſon ſtanding on wax, and rubbing the tube, and another perſon on wax drawing the fire, they will both appear to be electrified by a perſon ſtanding on the floor; that is, he will perceive a ſpark on approaching each of them with his knuckle.

2. But, if the perſons on wax touch one another during the exciting of the tube, neither of them will appear to be electrified.

3. If they touch one another after exciting the tube, and drawing the fire as before, there will be a ſtronger ſpark between them, than happens between either of them and the perſon on the floor.

4. After ſuch ſtrong ſpark, neither of them diſcover any electricity.

Theſe appearances are explained in the following manner: the electrical fire is ſuppoſed to be a common element, of which each of the three perſons above-mentioned has his equal ſhare, before any operation is begun with the tube. A, who ſtands on wax and rubs the tube, collects the electrical fire from himſelf into the glaſs; and his communication with all conductors being cut off by the wax, his body is not again immediately ſupplied. B, who ſtands likewiſe on wax, paſſing his knuckle along near the tube, receives the fire which was collected by the glaſs from A; and his communication with conductors, or the common ſtock of electrical matter, being likewiſe cut off, he retains the additional quantity received. To C, ſtanding on the floor, both appear to be electrified: for he having only the middle quantity of electrical fire, receives a ſpark upon approaching B who has an over quantity, but gives one to A who has an under quantity. If A and B approach to touch each other, the ſpark is ſtronger, becauſe the diſtance betwixt them is greater: after ſuch touch, there is no ſpark between either of them and C, becauſe the electrical fire in all is reduced to the original equality. If they touch while electrifying, the equality is never deſtroyed, the fire only circulating. Hence we ſay, B is electrified *poſitively*, A *negatively*; or rather B is electrified *plus*, A *minus*: and in experimenting, it is common to electrify bodies *plus* or *minus* at pleaſure. To electrify *plus* or *minus*, it is ſufficient to know, that the parts of the tube or ſphere that are rubbed, do, in the inſtant of the friction, attract the electrical fire, and therefore take it from the thing rubbing: the ſame parts immediately, as the friction upon them ceaſes, are diſpoſed to give the fire they have received to any body that has leſs. Thus you may circulate it or accumulate it upon, or ſubſtract it from any body, as you connect that body with the rubber, or the receiver, the communication in the common ſtock being cut off.

The great ſhock from what is called the LEYDEN PHIAL, was firſt diſcovered by Mr Cunæus, a native of Leyden; but was never ſo thoroughly underſtood till Dr Franklin publiſhed his experiments with regard to it. A glaſs phial or jar, filled, till within an inch of the top, with water, braſs duſt, or other non-conducting ſubſtances, was firſt uſed; but coating the veſſel with tin-foil, or

or brafs-duft, as mentioned above in the fection concerning the electrical apparatus, was found to anfwer better.

We fhall here give Dr Franklin's account of this phial nearly in his own words, together with the experiments confirming it.

1. While the wire and infide of the bottle are electrified *pofitively* or *plus*, the outfide of the bottle is electrified *negatively* or *minus*, in exact proportion; *i. e.* whatever quantity of electrical fire is thrown into the infide, an equal quantity goes out of the outfide. To underftand this, fuppofe the natural quantity of electricity in the whole bottle, before the operation begins, is equal to 20; and, at every ftroke of the tube, or turn of the globe, fuppofe a quantity equal to 1 is thrown in; then, after the firft ftroke, the quantity contained in the wire and infide of the bottle will be 21, and in the outfide 19; after the fecond ftroke, the infide will have 22, and the outfide 18; and fo on, till, after 20 ftrokes, the infide will have a quantity of electrical fire equal to 40, and the outfide none at all; and then the operation ends: for no more can be thrown into the infide, when no more can be driven out of the outfide. If more is attempted to be thrown in, it is fpued back through the wire, or flies out in loud cracks through the fides of the bottle.

2. The equilibrium of electric matter in the bottle being thus loft, it cannot be reftored by any *inward* communication or contact of the parts: but this muft be done by a communication formed *without* the bottle between the infide and the outfide, by fome conductor touching or approaching both fides at the fame time; in which cafe the equilibrium is reftored with an inexpreffible violence and quicknefs: or, it may be done by touching each fide alternately; in which cafe, the equilibrium is reftored by degrees.

3. As no more electrical fire can be thrown into the infide of the bottle, when all is driven from the outfide; fo, in a bottle not yet electrified, none can be thrown into the infide, when none can get out at the outfide; which happens, either when the glafs is too thick or when the bottle is placed in a non-conductor. Again, when the bottle is electrified, but little of the electrical fire can be drawn out from the infide by touching the wire, unlefs an equal quantity can, at the fame time, get in at the outfide. Thus place an electrified bottle on clean glafs, or dry wax, and you will not, by touching the wire, get out the fire from the infide: place it on a conductor, and touch the wire, then you will get it out in a fhort time; but fooneft when you form a direct communication as above.

4. The fhock to the nerves, or rather convulfion, is occafioned by the fudden paffage of the fire through the body, in its way from the infide to the outfide of the bottle. The fire takes the fhorteft courfe; but it does not appear, that, in order to receive a fhock, a communication with the floor is neceffary; for he that holds the bottle with one hand, and touches the wire with the other, will be fhocked as much, though his fhoes be dry, or even ftanding on wax. And on the touch of the wire (or of the prime conductor, which is the fame thing,) the fire does not proceed from the touching finger to the wire, but from the wire to the finger, and paffes through the body to the other hand, and fo into the outfide of the bottle.

The following experiments will confirm this account of the Leyden phial.

1. Place an electrified phial on wax; a fmall cork-ball held in your hand, fufpended by a dry filk thread, and brought near to the wire, will firft be attracted and then repelled: When in a repelled ftate, fink your hand, that the ball may be brought towards the outfide of the bottle; it will be inftantly attracted till it has parted with its fire.

If the outfide of the bottle had a pofitive electrical atmofphere, as well as the infide and the wire, an electrified cork would be repelled from the one as well as the other.

2. From a bent wire fticking in the table, let a fmall linen thread hang down within half an inch of the electrified phial; touch the wire of the phial repeatedly with your finger; and, at every touch, you will fee the thread inftantly attracted by the outfide of the bottle. As foon as you draw any fire from the infide by touching the wire, the outfide draws in an equal quantity by the thread.

3. Fix a wire in the outfide coating of the bottle, fo as that bending upwards its ring-end may be level with the top or ring-end of the wire in the cork of the bottle, and at three or four inches diftance. Then electrify the bottle, and place it on wax. If a cork, fufpended by a filk thread, hang between thefe two wires, it will play inceffantly from the one to the other, till the equilibrium betweed the infide and the outfide of the bottle is reftored.

4. Place a man on a cake of wax, and prefent him the wire of the electrified phial to touch, you ftanding on the floor and holding it in your hand. As often as he touches it, he will be electrified *plus*; and any one ftanding on the floor may draw a fpark from him. The fire, in this experiment, paffes out of the wire into him: and, at the fame time, out of your hand into the outfide of the bottle. Give him the electrical phial to hold, and touch the wire; as often as you touch it, he will be electrified *minus*, and may draw a fpark from any one ftanding in the floor. The fire in this cafe paffes from the wire to you, and from him into the outfide of the bottle.

5. Lay two books, or two glaffes, back to back, two two or three inches diftant, place the electrified phial; on one of them, and then touch the wire; that book will be electrified *minus*, the electrical fire being drawn out of it by the outfide of the bottle. Take off the bottle, and, holding it in your hand, touch the other with the wire; that book will be electrified *plus*, the fire paffing into it from the wire, and the outfide of the bottle is at the fame time fupplied from your hand.

The fame explofion and fhock happens, if the electrified phial is held in one hand by the hook of the wire, and the coating touched with the other, as when held by the coating and touched at the hook. To take the charged phial fafely by the hook, and not at the fame time diminifh its force; it muft firft be fet down on a con conductor. The phial will be electrified as ftrongly, if held by the hook, and the coating applied to the globe or tube,

tube, as when held by the coating and the hook applied: but the *direction* of the electrical fire, being different in the charging, will also be different in the explosion; the bottle charged through the hook will be discharged thro' the hook; the bottle charged thro' the coating will be discharged thro' the coating; because the fire must come out the same way it went in.

6. To prove this, take two bottles that were equally charged thro' the hooks, one in each hand; bring their hooks near each other, and no spark or shock will follow; because each hook is disposed to give fire, and neither to receive it. Set one of the bottles on glass, take it up by the hook, and apply its coating to the hook of the other; then there will be an explosion and shock, and both bottles will be discharged. [*N. B.* To charge a bottle commodiously thro' the coating; place it on a glass-stand; form a communication from the prime conductor to the coating, and another from the hook to the wall or floor; when it is charged, remove the latter communication before you take hold of the bottle, otherwise great part of the fire will escape by it.]

When the terms of *charging* or *discharging* the phial are used, it is in compliance with custom, and for want of better ones; since there is really no *more* electrical fire in the phial after what is called its *charging* than before, nor *less* after its *discharging*. Besides, the phial will not suffer what is called a *charging*, unless as much fire can go out of it one way as is thrown in by another. A phial cannot be charged standing on wax or glass, or hanging on the prime conductor, unless a communication be formed between its coating and the floor. But suspend two or more phials on the prime conductor, one hanging to the tail of the other, and a wire from the last to the floor, an equal number of turns of the wheel will charge them all equally, and each as strongly as a single one would have been.

When a bottle is charged in the common way, its *inside* and *outside* surfaces stand ready, the one to give fire by the hook, the other to receive it by the coating: yet as the first will not give out, unless the other can at the same instant receive in; so neither will the latter receive in, unless the first can at the same instant give out. When both can be done at once, it is done with inconceivable quickness and violence.

Glass has within its substance the same quantity of electrical fire at all times, and that quantity is very great in proportion to the mass of glass. This quantity it obstinately retains; and will have neither more nor less, though it will allow a change to be made in its parts and situation; that is, we may take away part from one of the sides, provided we throw an equal quantity into the other. Yet when the situation of the electrical fire is thus altered in the glass, it will not be at rest, or in its natural state, till it be restored to its original equality; and this restitution cannot be made through the substance of the glass, but must be done by a conducting communication formed without from surface to surface. Thus the whole force of the bottle, and power of giving a shock, resides in the GLASS itself; the coatings, or conducting substances in contact with the two surfaces, serving only to give and receive to and from the several parts of the glass; that is, to give in one side, and take away from the other. This was discovered by Dr Franklin, and proved by the following experiment: 'Purposing, '(says he,) to analize the electrified bottle, in order to 'find wherein its strength lay, we placed it on glass; and 'drew out the cork and wire, which for that purpose had 'been loosely put in. Then taking the bottle in one 'hand, and bringing a finger of the other near its mouth, 'a strong spark came from the water, and the shock was 'as violent as if the wire had remained in it, which shewed that the force did not lie in the wire. Then to find 'if it resided in the water, being crowded into and condensed in it, as confined by the glass, which had been 'our former opinion, we electrified the bottle again, and 'placing it on glass drew out the wire and cork as before; then taking up the bottle, we decanted all its 'water into an empty bottle, which likewise stood on 'glass; and taking up that other bottle, we expected, if 'the force resided in the water, to find a shock from it; 'but there was none. We judged then that it must either 'be lost in decanting, or remain in the first bottle. The 'latter we found to be true; for that bottle on trial gave 'the shock, though filled up as it stood with fresh unelectrified water from a tea-pot.——To find, then, whether glass had this property merely as glass, or whether 'the form contributed any thing to it; we took a pane 'of sash-glass, and laying it on the hand, placed a plate 'of lead on its upper surface; then electrified that plate, 'and bringing a finger to it, there was a spark and 'shock. We then took two plates of lead of equal dimensions, but less than the glass by two inches every 'way, and electrified the glass between them, by electrifying the uppermost lead; then separated the glass 'from the lead; in doing which, what little fire might be 'in the lead was taken out, and the glass being touched 'in the electrified parts with a finger, afforded only very 'small pricking sparks, but a great number of them might 'be taken from different places. Then dexterously placing it again between the leaden plates, and compleating 'a circle between the two surfaces, a violent shock ensued.——Which demonstrated the power to reside in 'glass as glass; and that the non-electrics in contact served only, like the armature of a loadstone, to unite the 'force of the several parts, and bring them at once to 'any point desired: it being the property of a non-electric, that the whole body instantly receives or gives 'what electrical fire is given to or taken from any one of 'its parts.——

'It is amazing to observe in how small a portion of 'glass a great electrical force may lie. A thin glass 'bubble about an inch diameter, weighing only six grains, 'being half filled with water, partly gilt on the outside, 'and furnished with a wire hook, gives, when electrified, 'as great a shock as a man can well bear. As the glass 'is thickest near the orifice, I suppose the lower half, 'which being gilt was electrified and gave the shock, did 'not exceed two grains; for it appeared, when broke, 'much thinner than the upper half.——If one of these 'thin bottles be electrified by the coating, and the spark

taken

'taken out through the gilding, it will break the glass 'inwards, at the same time that it breaks the gilding out-'wards. And since there is no more electrical fire in a 'bottle after charging than before, how great must be the 'quantity in this small portion of glass! It seems as if it 'were of its very substance and essence. Perhaps if that 'due quantity of electrical fire so obstinately retained by 'glass, could be separated from it, it would no longer 'be glass; it might lose its transparency, or its brittle-'ness, or its elasticity.——Experiments may possibly be 'invented hereafter to discover this.'

Of the Similarity between Lightning and Elec-*tricity.*

1. Flashes of lightning are generally seen crooked, and waving in the air. The electric spark has always the same direction when it is drawn from an irregular body at some distance, or through a space in which the best conductors are disposed in an irregular manner, which is always the case in the heterogeneous atmosphere of our globe.

2. Lightning strikes the highest and most pointed objects in its way preferable to others, as high hills, and trees, towers, spires, masts of ships, points of spears, *&c.* In like manner, all pointed conductors receive or throw off the electric fluid more readily than those which are terminated by flat surfaces.

3. Lightning is observed to take the readiest and best conductor. So does electricity in the discharge of the Leyden phial. For this reason, it would be safer, during a thunder-storm, to have one's cloaths wet than dry, as the lightning might then, in a great measure, be transmitted to the ground, by the water, on the outside of the body. It is found, that a wet rat cannot be killed by the explosion of the electrical bottle, but that a dry rat may.

4. Lightning burns. So does electricity. It will kindle hard dry rosin, spirits unwarmed, and even wood. It will fire gunpowder, by only ramming it hard in a cartridge, into each end of which pointed wires are introduced, and brought within half an inch of one another, and discharging a shock through them.

5. Lightning sometimes dissolves metals. So does electricity. The method in which Dr Franklin made electricity melt metals, was by putting thin pieces of them between two panes of glass, bound fast together, and sending an electric shock through them. Sometimes the pieces of glass, by which they were confined, would be shattered to pieces by the discharge, and be broken into a kind of coarse sand, which once happened with pieces of thick looking-glass; but if they remained whole, the pieces of metal would be missing in several places where it had lain between them, and instead of it a metallic stain would be seen on both the glasses, the stains on the under and upper glass being exactly similar in the minutest stroke.

6. Lightning rends some bodies. So does electricity. The electric spark will strike a hole through a quire of paper.—When wood, bricks, stone, *&c.* are rent by lightning, the splinters will fly off on that side where there is the least resistance. In like manner, when a hole is struck through a piece of pasteboard by an electrified jar, if the surfaces of the pasteboard are not confined and compressed, there will be a bur raised all round the hole on both sides of the pasteboard; but if one side be confined, so that the bur cannot be raised on that side, it will all be raised on the other side, which way soever the fluid was directed. For the bur round the outside of the hole is the effect of the explosion, which is made every way from the center of the electric stream, and not an effect of its direction.

7. Lightning has often been known to strike people blind. And a pigeon, after a violent shock of electricity, by which it was intended to be killed, was struck blind likewise.

8. In a thunder-storm at Stretham, described by Dr Miles, the lightning stripped off some paint which had covered a gilded moulding of a pannel of wainscot, without hurting the rest of the paint. Dr Franklin imitated this, by pasting a slip of paper over the filleting of gold on the cover of a book, and sending an electric flash through it. The paper was torn off from end to end, with such force, that it was broken in several places; and in others there was brought away part of the grain of the Turkey leather in which the book was bound. This convinced the doctor, that if it had been paint, it would have been stripped off in the same manner with that on the wainscot at Stretham.

9. Lightning destroys animal-life. Animals have likewise been killed by the shock of electricity. The largest animals which Dr Franklin and his friends had been able to kill were a hen, and a turkey which weighed about ten pounds.

10. Magnets have been observed to lose their virtue, or to have their poles reversed, by lightning. Dr Franklin did the same by electricity. By electricity he frequently gave polarity to needles, and reversed them at pleasure. A shock from four large jars, sent through a fine sewing needle, gave it polarity, so that it would traverse when laid on water. What is most remarkable in these electrical experiments upon magnets is, that if the needle, when it was struck, lay east and west, the end which was entered by the electric blast pointed north; but that if it lay north and south, the end which lay towards the north would continue to point north, whether the fire entered at that end or the contrary. He also observed, that the polarity was strongest when the needle was struck lying north and south, and weakest when it lay east and west. He takes notice, that, in these experiments, the needle, in some cases, would be finely blued, like the spring of a watch, by the electric flame; in which case the colour given by a flash from two jars only might be wiped off, but that a flash from four jars fixed it, and frequently melted the needles. The jars which the doctor used held seven or eight gallons, and were coated and lined with tinfoil.

To demonstrate, in the completest manner possible, the sameness of the electric fluid with the matter of lightning, Dr Franklin contrived to bring lightning from the heavens, by means of an electrical kite, which he raised when a storm of thunder was perceived to be coming on. This kite

kite had a pointed wire fixed upon it, by which it drew the lightning from the clouds. This lightning defcended by the hempen ftring, and was received by a key tied to the extremity of it; that part of the ftring which was held in the hand being of filk, that the electric virtue might ftop when it came to the key. He found that the ftring would conduct electricity even when nearly dry, but that when it was wet it would conduct it quite freely; fo that it would ftream out plentifully from the key at the approach of a perfon's finger.

At this key he charged phials, and from electric fire thus obtained he kindled fpirits, and performed all other electrical experiments which are ufually exhibited by an excited globe or tube.

The firft appearance of a thunder-ftorm (which generally happens when there is little or no wind) is one denfe cloud, or more, increafing very faft in fize, and rifing into the higher regions of the air. The lower furface is black, and nearly level; but the upper finely arched, and well defined. Many of thefe clouds often feem piled one upon another, all arched in the fame manner; but they keep continually uniting, fwelling, and extending their arches.

At the time of the rifing of this cloud, the atmofphere is generally full of a great number of feparate clouds, motionlefs, and of odd and whimfical fhapes. All thefe, upon the appearance of the thunder-cloud, draw towards it, and become more uniform in their fhapes as they approach; till, coming very near the thunder-cloud, their limbs mutually ftretch towards one another; they immediately coalefce, and together make one uniform mafs. Thefe are called *adfcititious* clouds, from their coming in, to enlarge the fize of the thunder-cloud. But, fometimes the thunder-cloud will fwell, and increafe very faft without the conjunction of any adfcititious clouds, the vapours in the atmofphere forming themfelves into clouds where-ever it paffes. Some of the adfcititious clouds appear like white fringes, at the fkirts of the thunder-cloud, or under the body of it; but they keep continually growing darker and darker, as they approach to unite with it.

When the thunder-cloud is grown to a great fize, its lower furface is often ragged, particular parts being detached towards the earth, but ftill connected with the reft. Sometimes the lower furface fwells into various large protuberances, bending uniformly towards the earth. And fometimes one whole fide of the cloud will have an inclination to the earth, and the extremity of it will nearly touch the earth. When the eye is under the thunder-cloud, after it is grown large, and well formed, it is feen to fink lower, and to darken prodigioufly; at the fame time that a number of fmall adfcititious clouds (the origin of which can never be perceived) are feen in a rapid motion, driving about in very uncertain directions under it. While thefe clouds are agitated with the moft rapid motions, the rain generally falls in the greateft plenty; and if the agitation be exceeding great, it commonly hails.

When the thunder-cloud is fwelling, and extending its branches over a large tract of country, the lightning is feen to dart from one part of it to another, and often to illuminate its whole mafs. When the cloud has acquired a fufficient extent, the lightning ftrikes between the cloud and the earth, in two oppofite places, the path of the lightning lying through the whole body of the cloud and its branches. The longer this lightning continues, the rarer does the cloud grow, and the lefs dark is its appearance; till, at length, it breaks in different places, and fhows a clear fky. When the thunder-cloud is thus difperfed, thofe parts which occupy the upper regions of the atmofphere are equally fpread, and very thin; and thofe that are underneath are black, but thin too; and they vanifh gradually, without being driven away with any wind.

That thunder-clouds were fometimes in a pofitive as well as negative ftate of electricity, Signior Beccaria had difcovered, before he heard of its having been obferved by Dr Franklin or any other perfon. The fame cloud, in paffing over his obfervatory, electrified his apparatus fometimes pofitively, and fometimes negatively. The electricity continued longer of the fame kind, in proportion as the thunder-cloud was fimple, and uniform in its direction; but when the lightning changed its place, there commonly happened a change in the electricity of his apparatus. It would change fuddenly after a very violent flafh of lightning, but the change would be gradual when the lightning was moderate, and the progrefs of the thunder-cloud flow.

It was an immediate inference from his obfervations of the lightning abroad, and his apparatus within, that the quantity of electric matter, in an ufual ftorm of thunder, is almoft inconceivably great; confidering how many pointed bodies, as trees, fpires, &c. are perpetually drawing it off, and what a prodigious quantity is repeatedly difcharged to or from the earth.

Confidering the vaft quantity of electric fire that appears in the moft fimple thunder-ftorms, he thinks it impoffible that any cloud, or number of clouds, fhould ever contain it all, fo as either to difcharge or receive it. Befides, during the progrefs and increafe of the ftorm, though the lightning frequently ftruck to the earth, the fame clouds were the next moment ready to make a ftill greater difcharge, and his apparatus continued to be as much affected as ever. The clouds muft, confequently, have received at one place, the moment that a difcharge was made from them in another. In many cafes, the electricity of his apparatus, and confequently of the clouds, would inftantly change from one kind to another feveral times; an effect which cannot be accounted for by any fimple difcharge or recruit. Both muft have taken place in a very quick fucceffion.

The extent of the clouds doth not leffen this difficulty: for, be it ever fo great, ftill the quantity ought to be leffened by every difcharge: and befides, the points by which the filent difcharges are made are in propotion to the extent of the clouds. Nor is the difficulty leffened by fuppofing that frefh clouds bring recruits; for befides that the clouds are not ripe for the principal ftorm, till all the clouds, to a great diftance, have actually coalefced, and formed one uniform mafs, thofe recruits bear no fort of proportion to the difcharge, and whatever it was, it would foon be exhaufted.

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The fact, therefore, muft be, that the electric matter is continually darting from the clouds in one place, at the fame time that it is difcharged from the earth in another. And it is a neceffary confequence from the whole, that the clouds ferve as conductors to convey the electric fluid from thofe places of the earth which are overloaded with it, to thofe which are exhaufted of it.

That great quantities of electric matter do fometimes rufh out of particular parts of the earth, and rife through the air into the higher regions of the atmofphere, he thinks is evident from the great quantities of fand, afhes, and other light fubftances, which have often been carried up into the air, and fcattered uniformly over a large tract of country. No other known efficient caufe of this phenomenon can be affigned, except the wind; and it has been obferved when there was no wind ftirring; and the light bodies have even been carried againft the wind. He fuppofes, therefore, that thefe light bodies are raifed by a large quantity of electric matter, iffuing out of the earth, where it was overcharged with it, and attracting and carrying with it every fubftance that could ferve as a conductor in its paffage. All thefe bodies, being poffeffed of an equal quantity of the electric fluid, will be difperfed equally in the air, and confequently over that part of the earth where the fluid was wanting, and whither they ferve to convey it. Had thefe bodies been raifed by the wind, they would have been difperfed at random, and in heaps.

This comparatively rare phenomenon, he thinks, exhibits both a perfect image, and demonftration, of the manner in which the vapours of the atmofphere are raifed to form thunder-clouds. The fame electric matter, wherever it iffues, attracts to it, and carries up into the higher regions of the air, the watery particles that are difperfed in the atmofphere. The electric matter afcends to the higher regions of the atmofphere, being folicited by the lefs refiftance it finds there than in the common mafs of the earth; which, at thofe times, is generally very dry, and confequently highly electric. The uniformity with which thunder-clouds fpread themfelves, and fwell into arches, muft be owing to their being affected by fome caufe which, like the electric matter, diffufes itfelf uniformly where-ever it acts, and to the refiftance they meet with in afcending through the air. As a proof of this, fteam, rifing from an electrified eolipile, diffufes itfelf with the fame uniformity, and in fimilar arches, extending itfelf towards any conducting fubftance.

The fame caufe which firft raifed a cloud, from vapours difperfed in the atmofphere, draws it to thofe that are already formed, and continues to form new ones; till the whole collected mafs extends fo far, as to reach a part of the earth where there is a deficiency of the electric fluid. Thither too, will thofe clouds, replete with electricity, be ftrongly attracted, and there will the electric matter difcharge itfelf upon the earth. A channel of communication being, in this manner, found, a frefh fupply of electric matter will be raifed from the overloaded part, and will continue to be conveyed by the medium of the clouds, till the equilibrium of the fluid, between the two places of the earth be reftored. When the clouds are attracted in their paffage by thofe parts of the earth where there is a deficiency of the fluid, thofe detached fragments are formed, and alfo thofe uniform depending protuberances, which, in fome cafes, are the caufe of water-fpouts, and hurricanes.

That the electric matter, which forms and animates the thunder-clouds, iffues from places far below the furface of the earth; and that it buries itfelf there, is probable from the deep holes that have, in many places, been made by lightning. Flafhes of lightning have, alfo, been feen to arife from fubterraneous cavities, and from wells. Violent inundations have accompanied thunder-ftorms, not occafioned by rain, but by water burfting from the bowels of the earth, from which it muft have been diflodged by fome internal concuffion. Deep wells have been known to fill fafter in thunder-ftorms, and others have conftantly grown turbid at the approach of thunder.

This very rife, as well as the whole progrefs of thunder-clouds, has fometimes been in a manner vifible. Exhalations have been frequently feen to rife from particular caverns, attended with a rumbling noife, and to afcend into the higher regions of the air, with all the phenomena of thunder-ftorms defcribed above, according to the defcription of perfons who lived long before the connection between electricity and lightning was fufpected.

The greateft difficulty attending this theory of the origin of thunder-ftorms relates to the collection and infulation of electric matter within the body of the earth. With refpect to the former, he has nothing particular to fay. Some operations in nature are certainly attended with a lofs of the equilibrium in the electric fluid, but no perfon has yet affigned a more probable caufe of the redundancy of electric matter which, in fact, often abounds in the clouds, than what we may fuppofe poffible to take place in the bowels of the earth. And fuppofing the lofs of the equilibrium poffible, the fame caufe that produced the effect would prevent the reftoring of it; fo that not being able to force a way, at leaft one fufficiently ready, through the body of the earth, it would iffue at the moft convenient vent into the higher regions of the air, as the better paffage. His electrical apparatus, though communicating with the earth, has frequently, in violent thunder-ftorms, given evident fparks to his finger.

In the enumeration of the effects of thunder-ftorms, he obferves that a wind always blows from the place from which the thunder-cloud proceeds; that this is agreeable to the obfervations of all mariners, and that the wind is more or lefs violent in proportion to the fuddennefs of the appearance of the thunder-cloud, the rapidity of its expanfion, and the velocity with which the adfcititious clouds join it. The fudden condenfation of fuch a prodigious quantity of vapours muft difplace the air, and repel it on all fides.

He, in fome meafure, imitated even this effect of thunder, at leaft produced a circulation of all the air in his room, by the continued electrification of his chain.

Among other effects of lightning, he mentions the cafe of a man rendered exceeding ftiff, prefently after he was ftruck dead in a ftorm of thunder. But the moft remarkable circumftance, in this cafe, was the lightning (chu-

ſing the beſt conductor) having ſtruck one particular vein, near his neck, and followed it through its minuteſt ramifications; ſo that the figure of it appeared through the ſkin, finer than any pencil could have drawn it.

He cautions perſons not to depend upon the neighbourhood of a higher, or, in all caſes, a better conductor than their own body; ſince, according to his repeated obſervations, the lightning by no means deſcends in one undivided track, but bodies of various kinds conduct their ſhare of it, at the ſame time, in proportion to their quantity and conducting power.

A great number of obſervations, relating to the deſcent of lightning, confirm his theory of the manner of its aſcent: for, in many caſes, it throws before it the parts of conducting bodies, and diſtributes them along the reſiſting medium through which it muſt force its paſſage.

Upon this principle it is, that the longeſt flaſhes of lightning ſeem to be made by its forcing into its way part of the vapours in the air. One of the principal reaſons why thoſe flaſhes make ſo long a rumbling, is their being occaſioned by the vaſt length of a vacuum, made by the paſſage of the electric matter. For though the air collapſes the moment after it has paſſed, and the vibration (on which the ſound depends) commences at the ſame moment, through the whole length of the track; yet, if the flaſh was directed towards the perſon who hears the report, the vibrations excited at the nearer end of the track will reach his ear much ſooner than thoſe excited at the more remote end; and the ſound will, without any repercuſſion or echo, continue till all the vibrations have ſucceſſively reached him.

He thinks that the Aurora Borealis may be this electric matter performing its circulation, in ſuch a ſtate of the atmoſphere as renders it viſible, or approaching nearer to the earth than uſual.

Stones and bricks ſtruck by lightning are often vitrified. He ſuppoſes that ſome ſtones in the earth having been ſtruck in this manner firſt gave occaſion to the vulgar opinion of the thunder-bolt.

Signior Beccaria was very ſenſible that heat contributes much to the phenomena of thunder, lightning, and rain; but he could not find, by any experiment, that it tended to promote electricity. He therefore rather thought that heat operated, in this caſe, by exhaling the moiſture of the air, and thereby cutting off the communication of the electric fluid between one place and another, particularly between the earth and the higher regions of the air, whereby its effects were more viſible.

Method of ſecuring buildings and perſons from the effects of lightning.

EXPERIMENTS made in electricity firſt gave philoſophers a ſuſpicion that the matter of lightning was the ſame with the electric matter. Experiments afterwards made on lightning obtained from the clouds by pointed rods, received into bottles, and ſubjected to every trial, have ſince proved this ſuſpicion to be perfectly well founded; and that whatever properties we find in electricity, are alſo the properties of lightning.

This matter of lightning, or of electricity, is an extreme ſubtile fluid, penetrating other bodies, and ſubſiſting in them equally diffuſed.

When by any operation of art or nature, there happens to be a greater proportion of this fluid in one body than in another, the body which has moſt, will communicate to that which has leaſt, till the proportion becomes equal; provided the diſtance between them be not too great; or, if it is too great, till there be proper conductors to convey it from one to the other.

If the communication be through the air without any conductor, a bright light is ſeen between the bodies, and a ſound is heard. In our ſmall experiments we call this light and ſound the electric ſpark and ſnap; but in the great operations of nature, the light is what we call *lightning*, and the ſound (produced at the ſame time, though generally arriving later at our ears than the light does to our eyes) is, with its echoes, called *thunder*.

If the communication of this fluid is by a conductor, it may be without either light or ſound, the ſubtile fluid paſſing in the ſubſtance of the conductor.

If the conductor be good and of ſufficient bigneſs, the fluid paſſes through it without hurting it. If otherwiſe, it is damaged or deſtroyed.

All metals, and water, are good conductors.—Other bodies may become conductors by having ſome quantity of water in them, as wood, and other materials uſed in building, but not having much water in them, they are not good conductors, and therefore are often damaged in the operation by lightning.

Glaſs, wax, ſilk, wool, hair, feathers, and even wood, perfectly dry, are non-conductors: that is, they reſiſt inſtead of facilitating the paſſage of this ſubtile fluid.

When this fluid has an opportunity of paſſing through two conductors, one good and ſufficient, as of metal, the other not ſo good, it paſſes in the beſt, and will follow it in any direction.

The diſtance at which a body charged with this fluid will diſcharge itſelf ſuddenly, ſtriking through the air into another body that is not charged, or not ſo highly charged, is different according to the quantity of the fluid, the dimenſions and form of the bodies themſelves, and the ſtate of the air between them.——This diſtance, whatever it happens to be between any two bodies, is called their *ſtriking diſtance*, as till they come within that diſtance of each other, no ſtroke will be made.

The clouds have often more of this fluid in proportion than the earth; in which caſe as ſoon as they come near enough (that is, within the ſtriking diſtance) or meet with a conductor, the fluid quits them and ſtrikes into the earth. A cloud fully charged with this fluid, if ſo high as to be beyond the ſtriking diſtance from the earth, paſſes quietly without making any noiſe or giving light; unleſs it meets with other clouds that have leſs.

Tall trees, and lofty buildings, as the towers and ſpires of churches, become ſometimes conductors between the clouds and the earth; but not being good ones, that is, not conveying the fluid freely, they are often damaged.

Buildings that have their roofs covered with lead, or other metal, and ſpouts of metal continued from the roof

into

in to the ground to carry off the water, are never hurt by lightning, as whenever it falls on fuch a building, it paffes in the metals and not in the walls.

When other buildings happen to be within the ftriking diftance from fuch clouds, the fluid paffes in the walls, whether of wood, brick or ftone, quitting the walls only when it can find better conductors near them, as metal rods, bolts, and hinges of windows or doors, gilding on wainfcot, or frames of pictures; the filvering on the backs of looking-glaffes; the wires for bells; and the bodies of animals, as containing watry fluids. And in paffing thro' the houfe it follows the direction of thefe conductors, taking as many in its way as can affift it in its paffage, whether in a ftrait or crooked line, leaping from one to the other, if not far diftant from each other, only rending the wall in the fpaces where thefe partial good conductors are too diftant from each other.

An iron rod being placed on the outfide of a building, from the higheft part continued down into the moift earth, in any direction ftrait or crooked, following the form of the roof or other parts of the building, will receive the lightning at its upper end, attracting it fo as to prevent its ftriking any other part; and, affording it a good conveyance into the earth, will prevent its damaging any part of the building.

A fmall quantity of metal is found able to conduct a great quantity of this fluid. A wire no bigger than a goofe quill has been known to conduct (with fafety to the building as far as the wire was continued) a quantity of lightning that did prodigious damage both above and below it; and probably larger rods are not neceffary, tho' it is common to make them of half an inch, fome of three quarters, or an inch diameter.

The rod may be faftened to the wall, chimney, *&c.* with ftaples of iron.—The lightning will not leave the rod (a good conductor) to pafs into the wall (a bad conductor) through thofe ftaples.—It would rather, if any were in the wall, pafs out of it into the rod to get more readily by that conductor into the earth.

If the building be very large and extenfive, two or more rods may be placed at different parts, for greater fecurity.

Small ragged parts of clouds fufpended in the air between the great body of clouds and the earth (like leafgold in electrical experiments), often ferve as partial conductors for the lightning, which proceeds from one of them to another, and by their help comes within the ftriking diftance to the earth or a building. It therefore ftrikes through thofe conductors a building that would otherwife be out of the ftriking diftance.

Long fharp points communicating with the earth, and prefented to fuch parts of clouds, drawing filently from them the fluid they are charged with, they are then attracted to the cloud, and may leave the diftance fo great as to be beyond the reach of ftriking.

It is therefore that we elevate the upper end of the rod fix or eight feet above the higheft part of the building, tapering it gradually to a fine fharp point, which is gilt to prevent its rufting.

Thus the pointed rod either prevents a ftroke from the cloud, or, if a ftroke is made, conducts it to the earth with fafety to the building.

The lower end of the rod fhould enter the earth fo deep as to come at the moift part, perhaps two or three feet; and if bent when under the furface fo as to go in a horizontal line fix or eight feet from the wall, and then bent again downwards three or four feet, it will prevent damage to any of the ftones of the foundation.

A perfon apprehenfive of danger from lightning, happening during the time of thunder to be in a houfe not fo fecured, will do well to avoid fitting near the chimney, near a looking-glafs, or any gilt pictures or wainfcot; the fafeft place is in the middle of the room, (fo it be not under a metal luftre fufpended by a chain), fitting in one chair and laying the feet up in another. It is ftill fafer to bring two or three matraffes or beds into the middle of the room, and folding them up double, place the chair upon them; for they not being fo good conductors as the walls, the lightning will not chufe an interrupted courfe through the air of the room and the bedding, when it can go thro' a continued better conductor, the wall. But where it can be had, a hamock or fwinging bed, fufpended by filk cords equally diftant from the walls on every fide, and from the cieling and floor above and below, affords the fafeft fituation a perfon can have in any room whatever; and what indeed may be deemed quite free from danger of any ftroke by lightning.

In order to fecure fhips from fuftaining damage by lightning, a copper road, about the thicknefs of a goofe quill, fhould be connected with the fpindles and iron work of the mafts continued down to the deck, and from thence, in the moft convenient direction, till the end of the rod be always in contact with the fea-water.

With regard to powder-mills and magazines, the apparatus to conduct the lightning from them fhould be detached from the buildings themfelves, and conveyed to the neareft water.

Of Medical Electricity.

The firft application of electricity to the cure of difeafes was made by M. Jallabert, profeffor of philofophy at Geneva, on a lockfmith whofe right arm had been paralytic fifteen years. He was brought to M. Jallabert on the 26th of December 1747, and was compleatly cured by the 28th of February 1748. In this interval he was frequently electrified, fparks being taken from the arm, and fometimes the electrical fhock fent through it.

The report of this cure at Geneva, engaged Mr Sauvages of the academy in Montpelier to attempt the cure of paralytics, in which he had confiderable fuccefs.

In the year 1757, Mr Patrick Bryden, in a few days, performed a compleat cure of a hemiplegia, and indeed an almoft univerfal paralytic affection of two years continuance.

Dr Hart, Dr Wilfon, Mr Lovet, Mr Wefley, and many others, relate a number of cafes wherein the palfy was either cured or mitigated by electricity.

Dr Watfon cured an univerfal tetanus, in the year 1762, by electrifying the patient, at proper intervals, for three months.

Dr

Dr Franklin and others mention ſome paralytic caſes, in which electricity ſeemed rather to make the patient worſe than better.

Mr Wilſon cured a woman of a deafneſs of ſeventeen years ſtanding.—And Mr Lovet conſiders electricity as a ſpecific in all caſes of violent pains, obſtinate headachs, the ſciatica, and the cramp. The toothach, he ſays, is generally cured by it in an inſtant. He relates a caſe, from Mr Floyer ſurgeon at Dorcheſter, of a compleat cure of a gutta ſerena; and another of obſtinate obſtructions in two young women.

De Haen ſays, that he never failed to cure St Vitus's dance by electricity; and found it of uſe in ſome caſes of deafneſs.

Hitherto electricity has been generally applied to the human body either in the method of drawing ſparks, as it is called, or of giving ſhocks. But theſe operations are both violent, and though the ſtrong concuſſion may ſuit ſome caſes, it may be of diſſervice in others, where a moderate ſimple electrification might have been of uſe.

The great objection to this method is the tediouſneſs and expence of the application. But an electrical machine might be contrived to go by wind or water, and a convenient room might be annexed to it; in which a floor might be raiſed upon electrics, a perſon might ſit down, read, ſleep, or even walk about during the electrification. It were to be wiſhed, that ſome phyſician of underſtanding and ſpirit would provide himſelf with ſuch a machine and room. No harm could poſſibly be apprehended from electricity, applied in this gentle and inſenſible manner, and good effects are at leaſt poſſible, if not highly probable.

ELECTRUM, in natural hiſtory. See AMBER.

ELECTUARY, in pharmacy, a form in which both officinal and extemporaneous medicines are frequently made.

It may be conſidered as a number of boluſes united together, but is made ſomewhat ſofter by an addition of a due proportion of preſerves or ſyrups. When the conſiſtence is very ſoft, it is called ſometimes by the name of opiata.

The principal conſideration in preſcribing officinal electuaries is, that ſuch things only be put together as will not, by any oppoſite qualities, deſtroy one another, or loſe their natural properties by lying long in this manner; and likewiſe that the whole be of a conſiſtence that will hold ingredients of different gravities in equal mixture.

ELEEMOSYNÆ, and ELEEMOSYNARIUS. See ALMS, and ALMONER.

ELEGANCE, or ELEGANCY, an ornament of politeneſs and agreeableneſs ſhewn in any diſcourſe, with ſuch a choice of rich and happy expreſſions, as to riſe politely above the common manners, ſo as to ſtrike people of a delicate taſte.

It is obſerved that elegance, though irregular, is preferable to regularity without elegance: that is, by being ſo ſcrupulous of grammatical conſtruction, we loſe certain licences wherein the elegance of language conſiſts.

ELEGIAC, in ancient poetry, any thing belonging to elegy. See ELEGY.

Elegiac verſes are alternately hexameter and pentameter, as in the following verſes of Ovid. See HEXAMETER.

Flebilis indignos, elegeia, ſolve capillos:
Ah nimis ex vero nunc tibi nomen erit.

Who was the inventor of elegiac poetry is not known. Horace profeſſes himſelf quite ignorant of it. The principal writers of elegiac verſe, among the Latins, were Propertius, Ovid, and Tibullus, the latter whereof Quinctilian eſteems the beſt elegiac poet; but Pliny the younger gives the preference to the firſt: the chief writers of elegy among the Greeks were Callimachus, Parthenius, and Euphorion.

ELEGIT, in law, a writ of execution, which lies for a perſon who has recovered debt or damages; or upon a recognizance in any court, againſt a defendant that is not able to ſatisfy the ſame in his goods.

ELEGY, a mournful and plaintive kind of poem. See ELEGIAC.

As elegy, at its firſt inſtitution, was intended for tears, it expreſſed no other ſentiments, it breathed no other accents but thoſe of ſorrow: with the negligence natural to affliction, it ſought leſs to pleaſe than to move; and aimed at exciting pity, not admiration. By degrees, however, elegy degenerated from its original intention, and was employed upon all ſorts of ſubjects, gay or ſad, and eſpecially upon love. Ovid's book of Love, the poems of Tibullus and Propertius, notwithſtanding they are termed elegies, are ſometimes ſo far from being ſad, that they are ſcarce ſerious. The chief ſubjects then to which elegy owes its riſe, are death and love: that elegy therefore ought to be eſteemed the moſt perfect in its kind which has ſomewhat of both at once; ſuch, for inſtance, where the poet bewails the death of ſome youth or damſel falling a martyr to love.

ELEMENT, a term uſed by philoſophers to denote the original component parts of bodies, or thoſe into which they are ultimately reſolvable. See CHEMISTRY, Vol II. p. 66.

ELEMENT, in a figurative ſenſe, is uſed for the principles and foundations of any art or ſcience, as Euclid's Elements, &c.

ELEMI, or ELEMY, in the materia medica, a kind of reſin, very improperly called gum-elemi. There are two ſorts of it kept in the ſhops; the one genuine, and brought from Ethiopia; the other ſpurious, and the produce of America. The true kind is a yellowiſh reſin, with a caſt of green and white; its ſmell is acrid and pleaſant, and its taſte acrid and bitter. It is very inflammable, and readily diſſolves in oil and other fat ſubſtances over the fire; which two characters alone

lone sufficiently distinguish it from the gums: but this genuine elemi is very rare in Europe.

The spurious elemi is a whitish resin, produced from a tall tree, with pinnated leaves, not unlike those of the pear-tree. It is in some degree pellucid, and of a fragrant smell. It is only used externally, being greatly recommended for resolving tumours, deterging ulcers, wounds, *&c.*

ELENCHUS, in logic, a sophism, or fallacious argument, which deceives the hearer under the appearance of truth. See SOPHISM.

ELEPHANT, in zoology. See ELEPHAS.

Knights of the ELEPHANT, an order of knighthood in Denmark, conferred upon none but persons of the first quality and merit. It is also called the order of St Mary. Its institution is said to have been owing to a gentleman among the Danish croisees having killed an elephant, in an expedition against the Saracens, in 1184; in memory of which king Canutus instituted this order, the badge of which is a towered elephant, with an image of the holy virgin encircled with rays, and hung on a watered sky-coloured ribbon, like the George in England.

ELEPHANTIASIS, called also the lepra of the Arabians, in medicine, a chronical disease, one of the two species of leprosy, which affects the whole body, where even the bones as well as the skin are covered with spots and tumours, which being red, at last turn black. See MEDICINE.

ELEPHANTINE, in Roman antiquity, an appellation given to the books wherein were registered the transactions of the senate and magistrates of Rome, of the emperors or generals of armies, and even of the provincial magistrates; the births and classes of the people, and other things relating to the census.

They are supposed to have been so called as being made of ivory; though some will have them to have been written on the intestines of elephants.

ELEPHANTOPUS, in botany, a genus of the syngenesia polygamia segregata class. The receptacle is naked; the corolla is divided into five segments; the calix is imbricated; and the pappus has several aristæ. There are two species, both natives of the Indies.

ELEPHAS, or the ELEPHANT, in zoology, a genus of quadrupeds belonging to the order of bruta. The characters are these: The elephant has no foreteeth in either jaw, and the dog-teeth are very long: The probofcis, or trunk, is long, and capable of laying hold of any thing; and the body is somewhat naked.

The elephant is the largest of all land-animals. From the front to the origin of the tail he is generally about 16 feet long, from the end of the trunk 25 feet, and about 14 feet high. The circumference of the neck is 17 feet, and the circumference of the body at the grossest part 25 feet 10 inches; the tail is about 6 feet long, and $2\frac{1}{2}$ in circumference. The circumference of the legs is about 6 feet. The eyes are small in proportion to the size of the animal. The muzzle is very different from that of any other quadruped; it is nothing but the origin of a long trunk which hangs between the two large tusks; the mouth appears behind the trunk, which serves in place of an upper lip, and the under lip terminates in a point. The tail is short, and small in comparison of the trunk, which has the appearance of a long thick tail placed before. The feet are short, round, clumsy, and only distinguishable by the toes. The trunk is, properly speaking, the nose extended, and terminated by a couple of nostrils. But, besides serving as an organ of smell, the trunk performs all the functions of a strong and dextrous arm. The trunk of an elephant is about 8 feet long, $5\frac{1}{2}$ feet in circumference near the mouth, and one foot and a half near the extremity: It is a pipe of an irregular conical figure, and widened at the end: The superior side of the trunk is convex, and furrowed transversely; and the inferior side is flat, and has two longitudinal rows of small protuberances resembling the tentacula of the silk-worm and most other caterpillars. The upper part of the trunk corresponds with the extremity of the nose in other quadrupeds, and answers the same intention; the inferior part serves as an upper lip, including the nostrils at the same time; for the trunk is a continued canal, divided into two cavities by a longitudinal partition; these cavities ascend along the forepart of the upper jaw, where they make a turn inward and descend into the palate, and then terminate in two separate orifices; they have likewise each a separate orifice at the end of the trunk. At the place where these cavities make a turn, and before they enter into the bones of the head, there is a moveable cartilaginous plate situate in such a manner as enables the elephant to shut the canal, and to prevent the water with which it occasionally fills the trunk from entering into the passage of the nose where the organs serving for the sensation of smell are placed. The elephant can move the trunk in all directions; he can extend or shorten it at pleasure, without altering the diameters of the two canals within. By this means respiration is not interrupted, whatever be the situation of the trunk; and the water is allowed to remain till the animal chuses to throw it out by an expiration. Each canal is lined with a smooth strong membrane, and the surface of the trunk is covered with another strong membrane or skin. The substance contained between the exterior and interior membranes, is a composition of longitudinal and transverse muscles, which serve to extend and contract the length of the trunk. At the extremity of the trunk there is a concave protuberance, in the bottom of which are the two passages of the nostrils. The inferior part of the protuberance is thicker than the sides, and the superior part is stretched out like a finger about five inches long; which, together with the edges of the whole extremity of the trunk, takes on different figures according to the necessities of the animal. It is by this organ that the animal lays hold of food, or other substances, which he manages with as much dexterity as a man does his hand, taking up grains of corn, or the smallest piles of grass, and conveying them to his mouth. When he drinks, he thrusts his trunk into the water, and fills it by drawing in his breath, and exhausting the air:

When the trunk is thus filled with water, he can either throw it out to a great diſtance, or drink it by putting the end of the trunk in his mouth.

The two large tuſks, which ſome call the horns of the elephant, are of a yellowiſh colour, and extremely hard. The bony ſubſtance of which they are compoſed is known by the name of ivory, and much uſed in different branches of manufacture.

The ears are very large, and reſemble thoſe of an ape. The ſkin of the elephant has but few hairs on it, and placed at great diſtances from each other. It is full of wrinkles, like thoſe on the palm of a man's hand, beſides many chaped and greaſy ridges. The female has two dugs, one on each ſide of the breaſt. The parts of generation are ſmall in proportion to thoſe of other animals. The penis reſembles that of a horſe. The female organ is ſituate near the middle of the belly, more than two feet diſtant from the uſual ſituation in other quadrupeds: When they copulate, the female lies down on her back.

Elephants, even in a ſavage ſtate, are peaceable and gentle creatures. They never uſe their weapons but in defence of themſelves or companions. Their ſocial diſpoſitions are ſo ſtrong, that they are ſeldom found alone, but march always in large troops; the oldeſt and moſt experienced lead the van; the younger, or lame ones, keep in the middle; and thoſe of a ſecond rate, as to age, walk in the rear. The females carry their young on their tuſks, embracing them at the ſame time with their trunk. They ſeldom march in this regular order but when they reckon the journey dangerous, ſuch as an expedition to cultivated lands, where they expect to meet with reſiſtance. On other occaſions they are leſs cautious, ſome of them falling behind or ſeparating from the reſt, but ſeldom ſo far as to be without the reach of aſſiſtance by alarming and aſſembling their companions. It is only theſe wanderers that the hunters dare attack; for it would require a whole army to aſſail a troop of them; and even an army would be unable to conquer them without loſing a number of lives. It is dangerous to offer them the leaſt injury; for they run ſtraight upon the offender; and, although the weight of their body be great, their ſteps are ſo large, that they eaſily outrun the ſwifteſt man, whom they either pierce with their tuſks or ſeize with their trunk, dart him in the air like a ſtone, and then trample him under their feet. But they never attack any perſon, unleſs when provoked. However, as they are extremely ſenſible and delicate with regard to injuries, it is always prudent to keep out of their way. Travellers who frequent theſe countries kindle large fires, and beat drums during the night, in order to prevent their approach. After being once attacked by men, or falling into any ambuſh, they are ſaid never to forget the injury, but ſearch for every opportunity of getting revenge. As they are endowed perhaps with a more exquiſite ſenſation of ſmell than any other animal, owing to the great extent of their noſe, they can ſcent a man at a very great diſtance, and trace him by his footſteps.

Elephants are peculiarly fond of the banks of rivers, deep valleys, and marſhy grounds, eſpecially when well ſhaded with trees. They delight in drawing up water into their trunks, even when they do not drink it, and amuſe themſelves in daſhing the water around. They cannot endure cold, and are equally averſe to an exceſs of heat: In order to avoid the ſcorching heat of the ſun, they retire to the thickeſt and moſt ſhady parts of the foreſt. The bulk of their bodies is ſo enormous, that they do not chuſe to go into deep waters ſo frequently as ſome other quadrupeds; although the length of their trunk, which they raiſe ſtraight up, and by which they reſpire, is a great advantage in ſwimming.

The ordinary food of elephants is roots, herbs, leaves, the tender branches of trees, fruits, and grains: but they abhor fleſh or fiſh. When any of them diſcovers a fine paſture, he immediately calls and invites his companions to come and eat with him. As they devour a large quantity of food in a ſhort time, they are always ſhifting their paſture; when they meet with cultivated grounds, they make a prodigious deſolation, and deſtroy more plants by their feet than they uſe for nouriſhment, which is very conſiderable, amounting to 150 pounds of herbage every day: by this means, as they conſtantly graze in large troops, they lay waſte whole fields in an hour. The Indians and negroes employ every art to prevent them from viſiting their cultivated lands, making great noiſe, and burning large fires round their fields. However, theſe precautions are not always ſufficient to prevent the elephants from viſiting them. They chaſe away the domeſtic animals, put the men to flight, and ſometimes even throw down their limber huts. Elephants are hardly ſuſceptible of fear; the only things which can ſurpriſe them, or ſtop their courſe, are artificial fires, ſuch as ſquibs, crackers, *&c.* the effects of which are ſo ſudden and ſo quickly repeated, that the elephants frequently turn back; and when one runs, all the reſt inſtantly follow his example.

Although the ſocial diſpoſition in the elephant be exceeding ſtrong; yet whenever the females come in ſeaſon, it immediately gives place to the ſtronger and more intereſting paſſion of love. They obſerve the greateſt delicacy in their amours, abhorring nothing ſo much as to be ſeen by their companions. The troop divide themſelves into couples, ſteal off into the moſt ſecret places of the foreſt, and then give way to all the impulſes of nature, which are lively and laſting in proportion to the long period of abſtinence; for the female goes with young two years, and it is only once in three years that the ſeaſon of love returns. They bring forth but one at a time, which, as ſoon as it comes into the world, is as large as a wild boar, and is furniſhed with teeth; however, the large tuſks do not make their appearance till ſome time after, and at the age of ſix months they are ſeveral inches long. Elephants of this age are as large as an ox, when in a natural ſtate. But it is incredible how they degenerate when inſlaved and under the management of men. Their diſguſt and chagrine for the loſs of liberty ſeems never to depart from their minds. In this ſtate, though they feel, at the proper ſeaſons, the

the ſtrongeſt deſires for the ſex, no art can allure them to copulate: but the natural paſſion, reſtrained by an exceſs of modeſty, burſts out into ſuch violent fits of fury and reſentment, that the ſtrongeſt chains are hardly ſufficient to command them. This is a ſtriking difference betwixt the elephant and moſt other tamed animals. It is only the individual that we can enſlave; the ſpecies, in ſpite of all our endeavours, ſtill retain their original freedom and independence.

The manner of taking and taming the elephant, therefore, merits our attention. In foreſts and ſuch places as are frequented by elephants, the Indians chuſe a ſpot and incloſe it with ſtrong pallisſades; they uſe the largeſt trees as the principal ſtakes, to which are fixed ſmaller ones in a tranſverſe direction. Theſe croſs-trees are fixed ſo as to allow a man to paſs eaſily through. There is likewiſe a large port left for the elephant, over which is ſuſpended a ſtrong barrier, which is let down as ſoon as he enters. In order to decoy him into the incloſure, the hunters take along with them a tame female in ſeaſon, and travel about till they come ſo near as that the cry of the female can reach a male, whom they previouſly obſerve in the foreſt; then the guide of the female makes her give the cry peculiar to the ſeaſon of love: the male inſtantly replies, and ſets out in queſt of her. The guide then makes the female proceed toward the artificial incloſure, repeating her cries from time to time as ſhe goes along. She enters into the incloſure, the male follows her, and the Indians immediately ſhut the port behind him. He no ſooner diſcovers the hunters, and that he is incloſed, than his paſſion for the ſex is converted into rage and fury. The hunters entangle him with ſtrong ropes; they fetter his legs and trunk; they bring two or three tame elephants in order to pacify and reconcile him to his condition. In a word, they reduce them to obedience in a few days, by a proper application of torture, and careſſes. There are many other methods of catching elephants. Inſtead of making large incloſures with pallisſades, like the kings of Siam, and other monarchs, the poor Indians content themſelves with a very ſimple apparatus: they dig deep pits in the roads frequented by elephants, covering them over with branches of trees, turf, *&c.* When an elephant falls into one of theſe pits, he is unable to get out again.

The elephant, when tamed, is the moſt friendly and obedient of all animals: he is entirely attached to the perſon who feeds and takes care of him. In a ſhort time he underſtands ſigns, and the ſound of his maſter's voice. He diſtinguiſhes the language of paſſion, of command, of ſatisfaction, and acts accordingly. He receives his orders with attention, and executes them with prudence and alacrity, but without precipitation. He eaſily learns to bow his knees and lower his body, for the convenience of thoſe who mount him. He careſſes his friends with his trunk. He lifts burdens with his trunk, and aſſiſts thoſe who are loading him in laying them on his back. He delights in ſhining harneſs and trappings. When yoked in a cart or waggon, he pulls equally and chearfully, unleſs he be abuſed by injudicious chaſtiſements. His guide is generally mounted on his neck, with a ſmall rod of iron ſharp at the point in his hand; he directs his motion by pricking him on the ears and head; but, for the moſt part, a word is ſufficient.

A tame elephant will do more labour than ſix horſes; but then he requires a proportional quantity of food. They are the principal beaſts of burden in many parts of Africa and the Eaſt Indies. They carry ſacks and bundles of all kinds on their neck, back, and tuſks. They never loſe or damage any thing committed to their care: They will ſtand on the edge of a river, take bundles off their necks and tuſks, lay them carefully in a boat wherever they are deſired, and try with their trunk whether they are properly ſituate; if they be loaded with caſks, they go in queſt of ſtones to prop them and prevent them from rolling.

From the earlieſt accounts in hiſtory, the eaſtern nations have employed elephants in war; Alexander the Great was the firſt European who ever mounted an elephant. He carried a number of them into Greece, which Pyrrhus employed ſome years after againſt the Romans at the battle of Tarentum. Both the Greeks and Romans ſoon learnt to get the better of theſe monſtrous animals, they opened their ranks and allowed them to paſs through; neither did they attempt to hurt them, but threw darts, *&c.* at their guides. Now that fire-arms are the principal inſtruments of war, elephants, who are terrified at the noiſe and flame, inſtead of being uſeful, would only tend to embarraſs and confuſe an army. However, in Cochin and other parts of Malabar, as alſo in Tonquin, Siam, and Pegu, where fire-arms are little underſtood, they are ſtill uſed in battle. The guide ſits aſtride upon the neck, and the combatants ſit or ſtand upon the other parts of the body.

When the elephant is properly managed, he lives very long even in a ſtate of ſlavery and labour. That ſome have lived in this ſtate 130 years, is pretty well authenticated. In a natural ſtate, they often exceed 200 years, and propagate their ſpecies till they be 120: It is 30 years before they come to their full growth. [Plate LXXIV. fig. 3.]

ELEVATION, the ſame with altitude or height. See ALTITUDE.

ELEVATION *of the hoſt*, in the church of Rome, that part of the maſs where the prieſt raiſes the hoſt above his head for the people to adore. See MASS and HOST.

ELEVATOR, in anatomy, the name of ſeveral muſcles, ſo called from their ſerving to raiſe the parts of the body to which they belong. See ANATOMY, Part II.

ELEVATORY, in ſurgery, an inſtrument for raiſing depreſſed or fractured parts of the ſcull, to be applied after the integuments and perioſteum are removed. See SURGERY.

ELEUSINIA, in Grecian antiquity, a feſtival kept in honour of Ceres, every fourth year by ſome ſtates, but by others every fifth. The Athenians celebrated it at Eleuſis, a town of Attica, whence the name.

It was celebrated with a world of ceremony, and perſons of both ſexes were initiated in it; it being deemed

deemed impious to neglect doing ſo. The myſteries were of two ſorts, the leſſer, and the greater; whereof the former were ſacred to Proſerpine, Ceres's daughter, and the latter to Ceres herſelf. According to Lactantius, they conſiſted in a myſtical repreſentation of what mythologiſts teach of Ceres; though ſome of the Chriſtian fathers will have the great myſtery, or ſecret, which they were forbidden by law, upon pain of death, to divulge, to have been the repreſentation or figures of both male and female privities, which were handed about and expoſed to the company.

ELEUTHERIA, another feſtival celebrated at Platæa, by delegates from almoſt all the cities of Greece, in honour of Jupiter Eleutherius, or the aſſertor of liberty.

It was inſtituted in memory of the victory obtained by the Grecians, in the territories of Platæa, over Mardonius, the Perſian general, left by Xerxes with a mighty army to ſubdue Greece.

ELF, a term now almoſt obſolete, formerly uſed to denote a fairy, or hobgoblin. an imaginary being, the creature of ignorance, ſuperſtition, and craft. See Fairy.

Elf-arrows, in natural hiſtory, a name given to the flints, anciently faſhioned into arrow-heads, and ſtill found foſſile in Scotland, America, and ſeveral other parts of the world; they are believed by the vulgar to be ſhot by fairies, and that cattle are ſometimes killed by them.

ELGIN, the capital of the county of Murray, in Scotland, ſituated on the river Loſey, about ſix miles north of the Spey: W. long. 2° 25′, N. lat. 57° 40.

ELIQUATION, in metallurgy, a ſeparation of the different parts of mixed bodies, by the different degrees of fire required to melt them. See Chemistry.

ELISION, in grammar, the cutting off, or ſuppreſſing a vowel at the end of a word, for the ſake of ſound, or meaſure, the next word beginning with a vowel.

Eliſions are pretty frequently met with in Engliſh poetry, but more frequently in the Latin, French, *&c.* They chiefly conſiſt in ſuppreſſions of the *a*, *e*, and *i*, though an eliſion ſuppreſſes any of the other vowels.

ELIXATION, in pharmacy, the extracting the virtues of ingredients by boiling or ſtewing.

ELIXIR, in medicine, a compound tincture extracted from many efficacious ingredients. Hence the difference between a tincture and an elixir ſeems to be this, that a tincture is drawn from one ingredient, ſometimes with an addition of another to open it, and to diſpoſe it to yield to the menſtruum; whereas an elixir is a tincture extracted from ſeveral ingredients at the ſame time. See Tincture.

ELK, in zoology. See Cervus.

ELKHOLM, a port-town of Gothland, in Sweden, twenty-four miles weſt of Carelſcroon.

ELL, a meaſure of length, different in different countries; but thoſe moſtly uſed, are the Engliſh and Flemiſh ells: whereof the former is three feet nine inches, or one yard and a quarter; and the latter only twenty-ſeven inches, or three quarters of a yard. In Scotland, the ell contains $37\frac{2}{10}$ Engliſh inches.

ELLERENA, a town of Eſtremadura, in Spain, fifty miles ſouth eaſt of Merida.

ELLIPSIS, in geometry. See Conic Sections.

Ellipsis, in grammar, a figure of ſyntax, wherein one or more words are not expreſſed; and from this deficiency, it has got the name ellipſis.

The ellipſis, properly ſo called, is when the deficient word or words muſt be ſupplied from elſewhere; as *Hectoris Andromache*, where *uxor* is underſtood; that is, Andromache, Hector's wife.

ELLIPTIC, or Elliptical, ſomething belonging to an ellipſis.

ELLIPOMACHROSTYLA, in natural hiſtory, a genus of imperfect cryſtals, with ſingle pyramids; one end of their column being affixed to ſome ſolid body. They are dodecahedral, with thinner hexangular columns and hexangular pyramids.

Of theſe cryſtals, authors enumerate a great many ſpecies; among which are the whitiſh pellucid ſprig cryſtal, a bright brown kind, a dull brown kind, and a bright yellow kind, all which are farther diſtinguiſhed according to the different lengths of their pyramids.

ELLIPOPACHYSTYLA, in natural hiſtory, a genus of imperfect cryſtals, compoſed of twelve planes, in an hexangular column, terminated by an hexangular pyramid at one end, and irregularly affixed to ſome other body at the other, with ſhorter columns.

There are two ſpecies of theſe cryſtals, one ſhort, bright and colourleſs, found in great plenty in New Spain and other parts of America; the other, a ſhort, dull, and duſky brown one, found in Germany, and ſometimes in England.

ELM, in botany. See Ulmus.

ELNA, a town of Catalonia in Spain, but ſubject to France, ſituated ten miles ſouth of Perpignan.

ELOCUTION, in rhetoric, the adapting words and ſentences to the things or ſentiments to be expreſſed. It conſiſts of elegance, compoſition, and dignity. The firſt comprehending the purity and perſpicuity of a language, is the foundation of elocution; the ſecond ranges the words in proper order; and the laſt adds the ornaments of tropes and figures to give ſtrength and dignity to the whole.

ELODES, in botany. See Hypericum.

ELOGY, a praiſe or panegyric beſtowed on any perſon or thing, in conſideration of its merit. The beauty of elogy conſiſts in an expreſſive brevity. Eulogiums ſhould not have ſo much as one epithet, properly ſo called, nor two words ſynonymous; they ſhould ſtrictly adhere to truth; for extravagant and improbable elogies rather leſſen the character of the perſon or thing they would extol.

ELOINED, in law, ſignifies reſtrained or hindered from doing ſomething: thus it is ſaid, that if thoſe within age be eloined, ſo that they cannot ſue perſonally, their next friend ſhall ſue for them.

ELONGATION, in aſtronomy, the digreſſion or receſs of a planet from the ſun, with reſpect to an eye placed on our earth. See Astronomy.

Elongation, in ſurgery, is an imperfect luxation, occaſioned by the ſtretching or lengthening of the ligaments of any joint.

ELOPEMENT, in law, is where a married woman departs

parts from her hufband, and cohabits with an adulterer; in which cafe the hufband is not obliged to allow her any alimony out of his eftate, nor is he chargeable for neceffaries for her of any kind.

ELOPS, in ichthyology, a genus of the order of abdominales. The head is fmooth, and the teeth are in the margin of the jaws and the palate; there are thirty rays in the branchioftege membrane. There is but one fpecies, *viz.* the favrus, with a tail armed both above and below. It is a native of Carolina.

ELOQUENCE, the art of fpeaking well, fo as to affect and perfuade.

Cicero defines it, the art of fpeaking with copioufnefs and embellifhment.

Eloquence and rhetoric differ from each other, as the theory from the practice; rhetoric being the art which defcribes the rules of eloquence, and eloquence that art which ufes them to advantage.

ELSINORE, a port-town of Denmark, about twenty-two miles north of Copenhagen, and fituated on the Sound or the entrance into the Baltic fea

ELVAS, a city and bifhop's fee of Alentejo, in Portugal, fituated near the frontiers of Spanifh Eftremadura: W. long. 7° 35′, and N. lat. 38° 45′.

It is one of the ftrongeft fortreffes in Portugal.

ELUL, in ancient chronology, the twelfth month of the Jewifh civil year, and the fixth of the ecclefiaftical: it confifted of only twenty-nine days, and anfwered pretty nearly to our Auguft.

ELUTRIATION, the feparating the lighter matters from the mixt ores of metals, by means of great quantities of fair water. See CHEMISTRY.

ELY, a city and bifhop's fee of Cambridgefhire, fituated about twelve miles north of Cambridge: E. long. 15′, and N. lat. 52° 24′.

It is a county of itfelf, including the territory around, and has a judge who determines all caufes civil and criminal within its limits.

ELYMUS, in botany, a genus of the tetrandria digynia clafs. The involucrum confifts of two leaves; and the fpiculæ are double. There are eight fpecies, only one of which, *viz.* the arenarius, or fea lyme grafs, is a native of Britain.

ELYSIUM, or ELYSIAN FIELDS, in heathen mythology, certain plains abounding with woods, fountains, verdure, and every delightful object; fuppofed to be the habitation of heroes and good men after death.

According to fome, the fable of Elyfium is of Phœnician extraction, or rather founded upon the account of paradife delivered in the Scriptures.

ELYTROIDES, or VAGINALES, in anatomy. See Vol. I. p. 270.

EMANATION, the act of flowing or proceeding from fome fource or origin; or, the thing that proceeds from that action.

EMANCIPATION, in the Roman law, the fetting free a fon from the fubjection of his father; fo that whatever moveables he acquires belong in property to him, and not to his father as before emancipation.

Emancipation puts the fon in capacity of managing his own affairs, and of marrying without his father's confent, though a minor. Emancipation differs from manumiffion, as the latter was the act of a mafter in favour of a flave, whereas the former was that of a father in favour of his fon.

There were two kinds of emancipation; the one tacit, which was by the fons being promoted to fome dignity, by his coming of age, or by his marrying, in all which cafes he became his own mafter of courfe.

The other, exprefs; where the father declared before a judge, that he emancipated his fon. In performing this, the father was firft to fell his fon imaginarily to another, whom they called *pater fiduciarius*, father in truft, of whom being bought back again by the natural father, he manumitted him before the judge by a verbal declaration.

Emancipation ftill obtains in France with regard to minors or pupils, who are hereby fet at liberty to manage their own effects, without the advice or direction of their parents or tutors.

EMARGINATED, amongft botanifts. See Vol. I. p. 640.

EMASCULATION, the act of caftrating or depriving a male of thofe parts which characterife his fex. See CASTRATION.

EMBALMING, is the opening a dead body, taking out the inteftines, and filling the place with odoriferous and deficcative drugs and fpices, to prevent its putrifying. The Egyptians excelled all other nations in the art of preferving bodies from corruption; for fome that they have embalmed upwards of two thoufand years ago, remain whole to this day, and are often brought into other countries as great curiofities. Their manner of embalming was thus: they fcooped out the brains with an iron fcoop, out at the noftrils, and threw in medicaments to fill up the vacuum: they alfo took out the entrails, and, having filled the body with myrrh, caffia, and other fpices, except frankincenfe, proper to dry up the humours, they pickled it in nitre, where it lay foaking for feventy days. The body was then wrapped up in bandages of fine linen and gums, to make it ftick like glue, and fo was delivered to the kindred of the deceafed, entire in all its features, the very hairs of the eye-lids being preferved. They ufed to keep the bodies of their anceftors, thus embalmed, in little houfes magnificently adorned, and took great pleafure in beholding them, alive as it were, without any change in their fize, features, or complexion. The Egyptians alfo embalmed birds, *&c.* The prices for embalming were different; the higheft was a talent, the next twenty minæ, and fo decreafing to a very fmall matter: but they who had not wherewithal to anfwer this expence, contented themfelves with infufing, by means of a fyringe, thro' the fundament, a certain liquor extracted from the cedar, and leaving it there wrapped up the body in falt of nitre: the oil thus preyed upon the inteftines, fo that when they took it out, the inteftines came away with it, dried, and not in the leaft putrified: the body being inclofed in nitre, grew dry, and nothing remained befides the fkin glued upon the bones.

EMBARGO, in commerce, in arreft on fhips, or merchandife,

chandiſe, by public authority; or a prohibition of ſtate, commonly on foreign ſhips, in time of war, to prevent their going out of port, ſometimes to prevent their coming in, and ſometimes both, for a limited time.

The king may lay embargoes on ſhips, or employ thoſe of his ſubjects, in time of danger, for ſervice and defence of the nation; but they muſt not be for the private advantage of a particular trader, or company; and therefore a warrant to ſtay a ſingle ſhip is no legal embargo. No inference can be made from embargoes which are only in war time; and are a prohibition by advice of council, and not at proſecution of parties. If goods be laden on board, and after an embargo or reſtraint from the prince or ſtate comes forth, and then the maſter of the ſhip breaks ground, or endeavours to ſail, if any damage accrues, he muſt be reſponſible for the ſame; the reaſon is, becauſe his freight is due, and muſt be paid, nay though the goods be ſeized as contraband.

Embargo differs from quarantine, inſomuch as this laſt is always for the term of forty days, in which perſons from foreign parts, infected with the plague, are not permitted to come on ſhore. See QUARANTINE.

EMBASSADOR, or AMBASSADOR, a public miniſter ſent from one ſovereign prince, as a repreſentative of his perſon, to another.

Embaſſadors are either ordinary or extraordinary. Embaſſador in ordinary, is he who conſtantly reſides in the court of another prince, to maintain a good underſtanding, and look to the intereſt of his maſter. Till about two hundred years ago, embaſſadors in ordinary were not heard of; all, till then, were embaſſadors extraordinary, that is, ſuch as are ſent on ſome particular occaſion, and who retire as ſoon as the affair is diſpatched.

By the law of nations, none under the quality of a ſovereign prince can ſend or receive an embaſſador. At Athens, embaſſadors mounted the pulpit of the public orators, and there opened their commiſſion, acquainting the people with their errand. At Rome, they were introduced to the ſenate, and delivered their commiſſions to them.

Embaſſadors ſhould never attend any public ſolemnities, as marriages, funerals, &c. unleſs their maſters have ſome intereſt therein: nor muſt they go into mourning on any occaſions of their own, becauſe they repreſent the perſons of their prince. By the civil law, the moveable goods of an embaſſador, which are accounted an acceſſion to his perſon, cannot be ſeized on, neither as a pledge, nor for payment of a debt, nor by order or execution of judgment, nor by the king's or ſtate's leave where he reſides, as ſome conceive; for all actions ought to be far from an embaſſador, as well that which toucheth his neceſſaries, as his perſon: if, therefore, he hath contracted any debt, he is to be called upon kindly, and if he refuſes, then letters of requeſt are to go to his maſter Nor can any of the embaſſador's domeſtic ſervants that are regiſtered in the ſecretaries of ſtate's office be arreſted in perſon or goods: if they are, the proceſs ſhall be void, and the parties ſuing out and executing it ſhall ſuffer and be liable to ſuch penalties and corporal puniſhment as the lord chancellor or either of the chief juſtices ſhall think fit to inflict. Yet embaſſadors cannot be defended when they commit any thing againſt that ſtate, or the perſon of the prince, with whom they reſide; and if they are guilty of treaſon, felony, &c. or any other crime againſt the law of nations, they loſe the privilege of an embaſſador, and may be ſubject to puniſhment as private aliens.

EMBASSY, the office or function of an embaſſador. See the preceding article.

EMBDEN, a port-town and city of Germany, capital of a county of the ſame name, now in poſſeſſion of the king of Pruſſia; it is ſituated at the mouth of the river Ems: E. long 6° 45′, and N. lat. 53° 50′.

EMBER-WEEKS, or DAYS, in the epiſcopal church, are certain ſeaſons of the year, ſet apart for the imploring God's bleſſing, by prayer and faſting, upon the ordinations performed in the church at ſuch times.

Theſe ordination-faſts are obſerved four times in the year, *viz.* the Wedneſday, Friday, and Saturday after the firſt Sunday in lent, after Whitſunday, after the fourteenth of September and the thirteenth of December; it being enjoined, by a canon of the church, that deacons and miniſters be ordained, or made, only upon the Sundays immediately following theſe ember-faſts.

EMBERIZA, in ornithology, a genus of birds, belonging to the order of paſſeres. The bill is conical, and the mandibles recede from each other towards the baſe; the inferior mandible has the ſides narrowed inwards, but the upper one is ſtill narrower. There are twenty-four ſpecies, *viz.* The nivalis, or great pyed mountain-finch of Ray, and the ſnow-bird of Edwards, has white-wings; but the outer edge of the prime-feathers are black; the tail is black, with three white feathers on each ſide, They inhabit Lapland and Hudſon's bay, and in hard winters they come into Sweden, when they are totally white. 2. The hyemalis, or ſnow-ſparrow of Cateſby, is black above, and the belly is white. It is a native of North America. 3. The miliaris, or grey emberiza, is of a greyiſh colour, ſpotted with black in the belly, and the orbits are rediſh. It is the bunting of Engliſh authors, and a bird of Europe. 4. The hortulana, or ortolan, has black wings; the firſt three feathers on the tail are white on the edges, only the two lateral are black outwardly. The orbits of the eyes are naked and yellow; the head is greeniſh, and yellow towards the inferior mandible. It feeds principally upon the panick-graſs; grows very fat, and is reckoned a delicate morſel by certain epicures. It is a bird of Europe. 5. The citrinella, or yellow hammer, has a blackiſh tail, only the two outward ſide-feathers are marked on the inner edge with a ſharp white ſpot. It is a bird of Europe, and comes about houſes in winter: it builds its neſt on the ground in meadows. 6. The olivacea, or olive emberiza, is of an olive colour above, whiter below; the nape of the neck is orange-coloured, and it has a black belt acroſs the breaſt. It is a native of Dominica. 7. The orix, or grenadier of

of Edwards, is greyiſh, with the front and belly black, a tawny neck and rump, and a black-bill. It is a native of Africa. 8. The quelca, has a grey back, a black front, and a red bill. It is a native of Africa. 9. The capenſis, or ortolon of the cape of Good Hope, is greyiſh, with a white nape of the neck, and a black belt round the orbits and mandibles. It inhabits the Cape of Good Hope. 10. The ludovicia is greyiſh above, and pale below; the breaſt is reddiſh, and there is a black circle on the head. 11. The cia, is reddiſh, with white eye-brows, and black lines on the head. It is a bird of Europe. 12. The cirlus, is a bird of Europe; it has a greyiſh back, a ſpotted breaſt, and yellowiſh eye-brows. 13. The familiaris is greyiſh and ſpotted; the tips of the tail-feathers are white, and hind part of the back yellow. It is a native of Aſia. 14. The flaveola, is greyiſh, with a yellow face; it is about the ſize of a ſiſkin, and is a native of warm countries. 15. The amazona is of a tanny colour, with the crown of the head yellow, and the baſe of the wings white underneath. It is a native of Surinam. 16. The orizivora, or ortolan of Carolina, is browniſh, with a tawny head, and a black belly. It is properly a native of Cuba, but migrates to Carolina about the autumn after the rice is reaped. 17. The ſchoeniclas, or reed-ſparrow, has a black head, a blackiſh-grey body, and a white ſpot on the quill-feathers. It is a bird of Europe. 18. The pſittacus, is of a tawny aſh-colour, with yellow wings, and two of the tail-feathers remarkably long. 19. The paradiſæa is browniſh, with a red breaſt, and two long ſharp-pointed feathers in the tail, and a black bill. It is a native of Africa, and ſheds the long feathers of the tail every year, like the peacock. 20. The ſerena, has a red bill, a black fillet, a red vertex, and a wedge-ſhaped tail. 21. The vidua, or Indian ſparrow of Aldrovandus, is blackiſh above, and white below, with four very long feathers in the tail, and a red bill. It is a native of India. 22. The principalis, is ſpotted, with the breaſt, bill, and legs red. It is a bird of Argola. 23. The regia, has a red bill, four long equal feathers in the tail, and red legs. It is a native of Africa. 24. The ciris, has a blueiſh head, a yellow belly, and a green back. It is a native of North America.

EMBLEM, a kind of painted enigma, or certain figures painted or cut, metaphorically expreſſing ſome action, with reflections underneath, which in ſome meaſure explain the ſenſe of the device, and at the ſame time inſtruct us in ſome moral truth, or other matter of knowledge.

EMBLEMENTS, among lawyers, denote the profits of ſown lands; but are ſometimes uſed, more largely, for any products that naturally ariſe from the ground.

EMBOLISMIC, or INTERCALARY. See INTERCALARY.

EMBOLUS, the moveable part of a pump, or ſyringe, called alſo the piſton, or ſucker.

EMBOSSING, or IMBOSSING, in architecture and ſculpture, the forming or faſhioning works in relievo, whether cut with a chiſſel or otherwiſe.

EMBRASURE, in architecture, the enlargement made of the aperture of a door or window, on the inſide of the wall; its uſe being to give the greater play for the opening of the door or caſement, or to admit the more light.

EMBROCATION, in ſurgery and pharmacy, an external kind of remedy, which conſiſts in an irrigation of the part affected, with ſome proper liquor, as oils, ſpirits, &c. by means of a woollen or linen cloth, or a ſpunge, dipped in the ſame.

EMBROIDERY, a work in gold, or ſilver, or ſilk thread, wrought by the needle upon cloth, ſtuffs, or muſlin, into various figures. In embroidering ſtuffs, the work is performed in a kind of loom, becauſe the more the piece is ſtretched, the eaſier it is worked. As to muſlin, they ſpread it upon a pattern ready deſigned; and ſometimes, before it is ſtretched upon the pattern, it is ſtarched, to make it more eaſy to handle. Embroidery on the loom is leſs tedious than the other, in which, while they work flowers, all the threads of the muſlin, both lengthwiſe and breadthwiſe, muſt be continually counted; but, on the other hand, this laſt is much richer in points, and ſuſceptible of greater variety. Cloths too much milled are ſcarce ſuſceptible of this ornament, and in effect we ſeldom ſee them embroidered. The thinneſt muſlins are left for this purpoſe; and they are embroidered to the greateſt perfection in Saxony: in other parts of Europe, however, they embroider very prettily, and eſpecially in France.

There are ſeveral kinds of embroidery; as, 1. Embroidery on the ſtamp, where the figures are raiſed and rounded, having cotton or parchment put under them to ſupport them. 2. Low embroidery, where the gold and ſilver lie low upon the ſketch, and are ſtitched with ſilk of the ſame colour. 3. Guimped embroidery: this is performed either in gold or ſilver; they firſt make a ſketch upon the cloth, then put on cut vellum, and afterwards ſow on the gold and ſilver with ſilk thread: in this kind of embroidery they often put gold and ſilver cord, tinſel, and ſpangles. 4. Embroidery on both ſides, that which appears on both ſides of the ſtuff. 5. Plain embroidery, where the figures are flat and even, without cords, ſpangles, or other ornaments.

EMBRUN, or AMBRUN, a city of Dauphiny, in France, near the confines of Piedmont: E. long. 6° 6′, and N. lat. 44° 35.

EMBRIO, in phyſiology, the firſt rudiments of an animal in the womb, before the ſeveral members are diſtinctly formed; after which period it is denominated a fœtus.

EMBRYOTHLASTES, in midwifery, an inſtrument contrived for breaking the bones, for the more eaſy extraction of the fœtus in difficult labours.

EMBRYOTOMY, the cutting a fœtus to pieces whilſt in the womb, practiſed in caſes of neceſſity, when there is no other way of ſaving the mother.

EMBRYULCUS, a hook for extracting the child in difficult labours. See MIDWIFERY.

EMERALD, in natural hiſtory, a genus of precious ſtones, of a green colour, and next in hardneſs to the ruby.

Our jewelers diſtinguiſh emeralds into two kinds, the oriental

oriental and occidental: the emeralds of the East-Indies are evidently finer than those of any other part of the world; but our jewellers, seldom meeting with these, call the American emeralds the oriental, and usually sell crystal accidentally tinged with green, under the name of the occidental emerald: these being also the most common, there has grown an opinion among the lapidaries, that the emerald is no harder than the crystal; because what they take to be emeralds, are in general only crystals.

The genuine emerald, in its most perfect state, is perhaps the most beautiful of all the gems; it is found of various sizes, but usually small; a great number of them are met with of about the sixteenth part of an inch in diameter, and they are found from this to the size of a walnut.

The emerald is of different figures like the diamond and many of the other gems, being sometimes found in a roundish or pebble-like form, but much more frequently in a columnar one, resembling common crystal: the pebble-emeralds are always the hardest and brightest, but are seldom found exceeding the size of a pea: the crystalliform ones grow several together, and are often larger: the pebble kind are found loose in the earths of mountains, and sands of rivers; the columnar are found usually bedded in, or adhering to, a white, opake, and coarse crystalline mass, and sometimes to the jasper, or the prasius.

The oriental emerald is of the hardness of the sapphire and ruby, and is second only to the diamond in lustre and brightness: the American is of the hardness of the garnet, and the European somewhat softer than that yet considerably harder than crystal: It loses it colour in the fire, and becomes undistinguishable from the white sapphire.

The oriental emeralds are very scarce, and at present found only in the kingdom of Cambay; very few of them have of late been imported into Europe, insomuch that it has been supposed there were no oriental emeralds; but within these ten years, some few have been brought from Cambay into Italy, that greatly excel the American ones. The American, being what our jewelers call oriental emeralds, are found principally about Peru; and the European are principally from Silesia.

To counterfeit EMERALDS: Take of natural crystal, four ounces; of red-lead, four ounces; verdegrease, forty-eight grains; crocus martis, prepared with vinegar, eight grains; let the whole be finely pulverized and sifted; put this into a crucible, leaving one inch empty: lute it well, and put it into a potter's furnace, and let it stand there as long as they do their pots. When cold, break the crucible, and you will find a matter of a fine emerald colour, which, after it is cut and set in gold, will surpass in beauty an oriental emerald.

EMERY, in natural history, a rich iron ore found in large masses of no determinate shape or size, extremely hard, and very heavy. It is usually of a dusky brownish red on the surface; but when broken, is of a fine bright iron-grey, but not without some tinge of redness; and is spangled all over with shining specks, which are small flakes of a foliaceous talc, highly impregnated with iron. It is also sometimes very red, and then usually contains veins of gold. It makes no effervescence with any of the acid menstruums, and is found in the island of Guernsey, in Tuscany, and many parts of Germany.

EMETIC, a medicine which induces vomiting.

EMINENCE, a title of honour peculiar to cardinals. See CARDINAL.

EMIR, a title of dignity among the Turks, signifying a prince.

This title was first given to the caliphs; but when they assumed the title of sultans, that of emir remained to their children; as that of Cæsar among the Romans. At length the title became attributed to all who were judged to descend from Mahomet by his daughter Fatimah, and who wear the green turban instead of the white. The Turks make an observation, that the emirs, before their fortieth year, are men of the greatest gravity, learning and wisdom; but after this, if they are not great fools, they discover some signs of levity and stupidity. This is interpreted by the Turks as a sort of divine impulse in token of their birth and sanctity. The Turks also call the vizirs, bashaws, or governors of provinces, by this name.

EMISSARY, in a political sense, a person employed by another to sound the opinions of people, spread certain reports, or act as a spy over other peoples actions.

EMMENAGOGUES, in pharmacy, medicines which promote the menses, either by giving a greater force to the blood in its circulation, whereby its momentum against the vessels is increased; or by making it thinner, whereby it will more easily pass through any outlet.

EMMERIC, a city of Westphalia, in Germany, subject to Prussia: E. long. 5° 45′, N. lat. 51° 48′.

EMOLLIENTS, in medicine and pharmacy, are such remedies as sheath and soften the asperity of the humours, and relax and supple the solids at the same time.

EMPALEMENT, an ancient kind of punishment, which consisted in thrusting a stake up the fundament.

EMPALEMENT *of a flower*, the same with calix. See CALIX.

EMPEROR, a title of honour among the ancient Romans, conferred on a general who had been victorious, and now made to signify a sovereign prince, or supreme ruler of an empire.

The title of emperor adds nothing to the rights of sovereignty; it only gives preheminence above other sovereigns. The emperors, however, pretend, that the imperial dignity is more eminent than the regal. It is disputed whether emperors have the power of disposing of the regal title; however this may be, they have sometimes taken upon them to erect kingdoms: thus it is that Bohemia, Prussia, and Poland, are said to have been raised to that dignity. In the east, the title of emperor is more frequent than with us; thus the sovereign princes of China, Mogul, &c. are called emperors.

perors. In the weſt, the title has been a long time reſtrained to the emperors of Germany. The firſt who bore it was Charlemagne, who was crowned by Pope Leo III. in 800. And it is to be obſerved, that there was not a foot of land or territory annexed to the emperor's title.

In the year 1723, the Czar of Muſcovy aſſumed the title of emperor of all the Ruſſias. The kings of France were alſo called emperors, when they reigned with their ſons, whom they aſſociated in the crown: thus Hugh Caput was called emperor, and his ſon Robert king. The kings of England were anciently ſtyled emperors, as appears from a charter of king Edgar.

The emperor of Germany is a limited monarch in regard to the empire, though he is an abſolute ſovereign in moſt of his hereditary dominions; the late emperors of the Auſtrian family, having hereditary dominions, enumerated all of them in their title. Charles VI. was ſtyled emperor of the Romans, always auguſt, king Bohemiah and Hungary, archduke of Auſtria, *&c.*; but the preſent empreſs inheriting thoſe countries, her conſort enjoys only the title of emperor of the Romans, duke of Lorrain and Tuſcany. The emperor creates dukes, marquiſſes, and other noblemen; and he appoints moſt of the officers, civil and military, in the empire: he is elected by the nine electors; and he ſummons the general diet of the empire.

EMPETRUM, BERRY BEARING HEATH, in botany, a genus of the diœcia triandria claſs. The calix of both male and female conſiſts of three ſegments, and the corolla of three petals. The female has nine ſtyli; and the berry contains nine ſeeds. There are two ſpecies, one of which, *viz.* the nigrum, black-berried heath, crow or crake berries, is a native of Britain.

EMPHASIS, in rhetoric, a particular ſtreſs of the voice and action, laid on ſuch parts or words of the oration as the orator wants to enforce upon his audience.

EMPHYSEMA, in ſurgery, a tumour generally occaſioned in a fracture of the ribs. See SURGERY, and MEDICINE.

EMPIRE, a large extent of land, under the juriſdiction or government of an emperor. See EMPEROR.

EMPIRIC, an appellation given to thoſe phyſicians who conduct themſelves wholly by their own experience, without ſtudying phyſic in a regular way. Some even uſe the term, in a ſtill worſe ſenſe, for a quack who preſcribes at random, without being at all acquainted with the principles of the art.

EMPIS, in zoology, a genus of inſects belonging to the order of diptera. The beak is horny, inflected, conſiſts of two valves, and is longer than the thorax. There are five ſpecies, principally diſtinguiſhed by their colour.

EMPRESS, the ſpouſe of an emperor, or a woman who governs an empire. See EMPEROR.

EMPROSTHOTONOS, a ſpecies of convulſion, wherein the head bends forward. See MEDICINE.

EMPYREMA, in medicine, a diſorder wherein purulent matter is contained in the thorax or breaſt, after an inflammation and ſuppuration of the lungs and pleura. See MEDICINE, and SURGERY.

EMPYREUM, a term uſed by divines for the higheſt heaven, where the bleſſed enjoy the beatific viſion.

EMPYREUMA, among chemiſts and phyſicians, the fiery taſte or offenſive ſmell which brandies, and other bodies prepared by fire, are impregnated with. See CHEMISTRY.

EMRODS. See HÆMORRHOIDS.

EMULGENT, or RENAL ARTERIES. See ANATOMY, Part III.

EMULSION, a ſoft liquid remedy, of a colour and conſiſtence reſembling milk. See CHEMISTRY.

EMUNCTORY, in anatomy, a general term for all thoſe parts which ſerve to carry off the excrementitious parts of the blood and other humours of the body. Such more eſpecially are the kidneys, bladder, and moſt of the glands. See ANATOMY.

ENÆMON, in medicine, an epithet often applied by Hippocrates and Galen, to ſuch topical medicines as are appropriated to a wound newly inflicted, before the blood be ſtopped.

ENÆOREMA, in medicine, that pendulous ſubſtance which floats in the urine. It is alſo called ſublimamentum and nubeculæ, from its reſemblance to little clouds.

ENALLAGE, in grammar, is when one word is ſubſtituted for another of the ſame part of ſpeech: a ſubſtantive for an adjective, as *exercitus victor*, for *victorioſus*; *ſcelus*, for *ſceleſtus*.

ENAMEL, a kind of coloured glaſs, uſed in enamelling and painting in enamel.

Enamels have for their baſis a pure cryſtal glaſs or frit, ground up with a fine calx of lead and tin prepared for the purpoſe, with the addition uſually of white ſalt of tartar. Theſe ingredients baked together, are the matter of all enamels, which are made by adding colours of this or that kind in powder to this matter, and melting or incorporating them together in a furnace.

For white enamel, Neri (De Arte Vitriar.) directs only manganeſe to be added to the matter which conſtitutes the baſis. For azure, zaffer mixed with calx of braſs. For green, calx of braſs with ſcales of iron, or with crocus martis. For black, zaffer with manganeſe, or with crocus martis; or manganeſe with tartar. For red, manganeſe, or calx of copper and red tartar. For purple, manganeſe with calx of braſs. For yellow, tartar and manganeſe. And for violet-coloured enamel, manganeſe with thrice-calcined braſs.

In making theſe enamels, the following general cautions are neceſſary to be obſerved. 1. That the pots muſt be glazed with white glaſs, and muſt be ſuch as will bear the fire. 2. That the matter of enamels muſt be very nicely mixed with the colours. 3. When the enamel is good, and the colour well incorporated, it muſt be taken from the fire with a pair of tongs. 4. The general way of making the coloured enamel is this: powder, ſift, and grind all the colours very nicely, and firſt mix them with one another, and then with the common matter of enamels: then ſet them in pots in a furnace, and when they are well mixed and incorporated,

incorporated, caſt them into water; and when dry, ſet them in a furnace again to melt; and when melted, take a proof of it. If too deep-coloured, add more of the common matter of enamels; and if too pale, add more of the colours.

Enamels are uſed either in counterfeiting or imitating precious ſtones, in painting in enamel; or by enamellers, jewellers, and goldſmiths, in gold, ſilver, and other metals. The two firſt kinds are uſually prepared by the workmen themſelves, who are employed in theſe arts. That uſed by jewellers, *&c.* is brought to us chiefly from Venice or Holland, in little cakes of different ſizes, commonly about four inches diameter, having the mark of the maker ſtruck upon it with a puncheon. It pays the pound 1 s. 7 $\frac{41}{100}$ d. on importation, and draws back 1 s. 5 $\frac{70}{100}$ d. at the rate of 4 s. per pound.

ENAMELLING, the art of laying enamel upon metals, as gold, ſilver, copper, *&c.* and of melting it at the the fire, or of making divers curious works in it at a lamp. It ſignifies alſo to paint in enamel.

The method of painting in ENAMEL. This is performed on plates of gold or ſilver, and moſt commonly of copper, enamelled with the white enamel; whereon they paint with colours which are melted in the fire, where they take a brightneſs and luſtre like that of glaſs. This painting is the moſt prized of all for its peculiar brightneſs and vivacity, which is very permanent, the force of its colours not being effaced or ſullied with time, as in other painting, and continuing always as freſh as when it came out of the workman's hands. It is uſual in miniature, it being the more difficult the larger it is, by reaſon of certain accidents it is liable to in the operation. Enamelling ſhould only be practiſed on plates of gold, the other metals being leſs pure: copper, for inſtance, ſcales with the application, and yields fumes; and ſilver turns the yellows white. Nor muſt the plate be made flat; for in ſuch caſe, the enamel cracks; to avoid which, they uſually forge them a little round or oval, and not too thick. The plate being well and evenly forged, they uſually begin the operation by laying on a couch of white enamel (as we obſerved above) on both ſides, which prevents the metal from ſwelling and bliſtering; and this firſt lay ſerves for the ground of all the other colours. The plate being thus prepared, they begin at firſt by drawing out exactly the ſubject to be painted with red vitriol, mixed with oil of ſpike, marking all parts of the deſign very lightly with a ſmall pencil. After this, the colours (which are to be before ground with water in a mortar of agate extremely fine, and mixed with oil of ſpike ſomewhat thick) are to be laid on, obſerving the mixtures and colours that agree to the different parts of the ſubject; for which it is neceſſary to underſtand painting in miniature. But here the workman muſt be very cautious of the good or bad qualities of the oil of ſpike he employs to mix his colours with, for it is very ſubject to adulterations. See OIL.

Great care muſt likewiſe be taken, that the leaſt duſt imaginable come not to your colours while you are either painting or grinding them; for the leaſt ſpeck, when it is worked up with it, and when the work comes to be put into the reverberatory to be red-hot, will leave a hole, and ſo deface the work.

When the colours are all laid, the painting muſt be gently dried over a ſlow fire to evaporate the oil, and the colours afterwards melted to incorporate them with the enamel, making the plate red-hot in a fire like what the enamellers uſe. Afterwards that part of the painting muſt be paſſed over again which the fire hath any thing effaced, ſtrengthening the ſhades and colours, and committing it again to the fire, obſerving the ſame method as before, which is to be repeated till the work be finiſhed.

Method of ENAMELLING *by the lamp.* Moſt enamelled works are wrought at the fire of a lamp, in which, inſtead of oil, they put melted horſe-greaſe, which they call caballine oil. The lamp, which is of copper or white iron, conſiſts of two pieces, in one of which is a kind of oval plate, ſix inches long, and two high, in which they put the oil and the cotton. The other part, called the box, in which the lamp is incloſed, ſerves only to receive the oil which boils over by the force of the fire. This lamp, or, where ſeveral artiſts work together, two or three more lamps are placed on a table of proper height. Under the table, about the middle of its height, is a double pair of organ-bellows, which one of the workmen moves up and down with his foot, to quicken the ſlame of the lamps, which are by this means excited to an incredible degree of vehemence. Grooves made with a gauge in the upper part of the table, and covered with parchment, convey the wind of the bellows to a pipe of glaſs before each lamp; and that the enamellers may not be incommoded with the heat of the lamp, every pipe is covered at ſix inches diſtance with a little tin plate, fixed into the table by a wooden handle. When the works do not require a long blaſt, they only uſe a glaſs pipe, into which they blow with their mouth.

It is incredible to what a degree of fineneſs and delicacy the threads of enamel may be drawn at the lamp. Thoſe which are uſed in making falſe tufts of feathers are ſo fine, that they may be wound on the reel like ſilk or thread. The fictitious jets of all colours, uſed in embroideries, are alſo made of enamel; and that with ſo much art, that every ſmall piece hath its hole to paſs the thread through wherewith it is ſewed. Theſe holes are made by blowing them into long pieces, which they afterwards cut with a proper tool.

It is ſeldom that the Venetian or Dutch enamels are uſed alone; they commonly melt them in an iron-ladle, with an equal part glaſs or cryſtal; and when the two matters are in perfect fuſion, they draw it out into threads of different ſizes, according to the nature of the work. They take it out of the ladle while liquid, with two pieces of broken tobacco pipes, which they extend from each other at arm's length. If the thread is required ſtill longer, then another workman holds one end, and continues to draw it out, while the firſt holds the enamel to the flame. Thoſe threads, when cold,

cold, are cut into what lengths the workman thinks fit, but commonly from ten to twelve inches; and as they are all round, if they are required to be flat, they muſt be drawn through a pair of pincers while yet hot. They have alſo another iron inſtrument in form of pincers, to draw out the enamel by the lamp when it is to be worked and diſpoſed in figures. Laſtly, they have glaſs-tubes of various ſizes, ſerving to blow the enamel into various figures, and preſerve the neceſſary vacancies therein; as alſo to ſpare the ſtuff, and form the contours. When the enameller is at work, he ſits before his lamp with his foot on the ſtep that moves on the bellows; and holding in his left hand the work to be enamelled, or the braſs or iron-wires the figures are to be formed on, he directs with his right the enamel thread, which he holds to the flame with a management and patience equally ſurpriſing. There are few things they cannot make or repreſent with enamel; and ſome figures are as well finiſhed, as if done by the moſt ſkilful carvers.

ENARTHROSIS, in anatomy, a ſpecies of diarthroſis. See ANATOMY, Part I.

ENCÆNIA, the name of three ſeveral feaſts celebrated by the Jews in memory of the dedication, or rather purification, of the temple, by Judas Maccabæus, Solomon, and Zorobabel.

This term is likewiſe uſed in church-hiſtory for the dedication of Chriſtian churches.

ENCAMPMENT, the pitching of a camp. See CAMP.

ENCANTHIS, in ſurgery, a tubercle ariſing either from the caruncula lacrymalis, or from the adjacent red ſkin; ſometimes ſo large, as to obſtruct not only the puncta lacrymalia, but alſo part of the ſight, or pupil itſelf. See SURGERY.

ENCAUSTIC and ENCAUSTUM, the ſame with enamelling and enamel. See ENAMELLING, and ENAMEL.

ENCEINTE, in fortification, is the wall or rampart which ſurrounds a place, ſometimes compoſed of baſtions or curtains, either faced or lined with brick or ſtone, or only made of earth. The enceinte is ſometimes only flanked by round or ſquare towers, which is called a Roman wall.

ENCEPHALI, in medicine, worms generated in the head, where they cauſe ſo great a pain, as ſometimes to occaſion diſtraction.

ENCEPPE', in heraldry, denotes fettered, chained, or girt about the middle, as is uſual with monkeys.

ENCHANTER, a perſon ſuppoſed to practiſe enchantment or faſcination. See FASCINATION, WITCHCRAFT, *&c.*

ENCHANTER'S NIGHTSHADE, in botany. See CIRCÆA.

ENCHASING, INCHASING, or CHASING, the art of enriching and beautifying gold, ſilver, and other metalwork, by ſome deſign or figures repreſented thereon in low relievo.

Enchaſing is practiſed only on hollow thin works, as watch-caſes, cane-heads, tweezer-caſes, or the like. It is performed by punching or driving out the metal, to form a figure, from with-inſide, ſo as to ſtand out prominent from the plane or ſurface of the metal. In order to this, they provide a number of fine ſteel blocks, or puncheons, of divers ſizes; and the deſign being drawn on the ſurface of the metal, they apply the inſide upon the heads or tops of theſe blocks, directly under the lines or parts of the figures; then, with a fine hammer, ſtriking on the metal, ſuſtained by the block, the metal yields, and the block makes an indenture or cavity on the inſide, correſponding to which there is a prominence on the outſide, which is to ſtand for that part of the figure.

Thus the workmen proceeds to chaſe and finiſh all the parts by ſucceſſive application of the block and hammer to the ſeveral parts of the deſign. And it is wonderful to conſider with what beauty and juſtneſs, by this ſimple piece of mechaniſm, the artiſts in this kind will repreſent foliages, groteſques, animals, hiſtories, *&c.*

ENCHYSMA, in medicine, the ſame with enema. See ENEMA.

ENCLITICA, in grammar, particles which are ſo cloſely united with other words, as to ſeem part of them, as in *virumque*, *&c.*

There are three enclitic particles in Latin, viz. *que*, *ne*, *ve*.

ENCRATITES, in church-hiſtory, heretics who appeared towards the end of the ſecond century: they were called Encratites, or Continentes, becauſe they gloried in abſtaining from marriage and the uſe of wine and animal-food.

ENCYCLOPÆDIA. See CYCLOPÆDIA, and DICTIONARY.

ENDECERIS, in antiquity, denotes a veſſel or galley with eleven tires of oars.

ENDEMIC, or ENDEMICAL DISEASES, thoſe to which the inhabitants of particular countries are ſubject more than others, on account of the air, water, ſituation, and manner of living.

ENDIVE, in botany. See CICHORIUM.

ENDLESS, ſomething without an end: thus authors mention endleſs rolls, the endleſs ſcrew, *&c.*

ENDORSE, in heraldry, an ordinary, containing the eighth part of a pale, which Leigh ſays is only uſed when a pale is between two of them.

ENDORSED, in heraldry, is ſaid of things borne back to back, more uſually called adoſsé. See ADOSSE'.

ENDOWMENT, in law, denotes the ſettling a dower on a woman; though ſometimes it is uſed figuratively, for ſettling a proviſion upon a parſon, on the building of a church; or the ſevering a ſufficient portion of tithes for a vicar, when the benefice is appropriated.

ENEMA, in medicine. See CLYSTER.

ENEMY, in law, an alien or foreigner, who publicly invades the kingdom.

ENERGUMENS, in church-hiſtory, perſons ſuppoſed to be poſſeſſed by the devil, concerning whom there were many regulations among the primitive Chriſtians. They were denied baptiſm, and the euchariſt; at leaſt, this was the practice of ſome churches: and though they were under the care of exorciſts, yet it was thought

thought a becoming act of charity to let them have the public prayers of the church, at which they were permitted to be present. See Exorcism.

ENERGY, a term of Greek origin, signifying the power, virtue, or efficacy of a thing. It is also used, figuratively, to denote emphasis of speech.

ENFILADE, in the art of war, is used in speaking of trenches, or other places, which may be scoured by the enemy's shot along their whole length. In conducting the approaches at a siege, care must be taken that the trenches be not enfiladed from any work of the place. See Trenches.

ENFRANCHISEMENT, in law, the incorporating a person into any society or body politic.

ENGASTRIMYTHI, in Pagan theology, the Pythians, or priestesses of Apollo, who delivered oracles from within, without any action of the mouth or lips.

The ancient philosophers, *&c.* are divided upon the subject of the engastrimythi. Hippocrates mentions it as a disease. Others will have it a kind of divination. Others attribute it to the operation or possession of an evil spirit. And others to art and mechanism. M. Scottus maintains that the engastrimythi of the ancients were poets, who, when the priests could not speak, supplied the defect by explaining in verse what Apollo dictated in the cavity of the bason on the sacred tripod.

ENGENDERING, a term sometimes used for the act of producing or forming any thing: thus meteors are said to be engendered in the middle region of the atmosphere, and worms in the belly. See Generation.

ENGERS, the capital of a county of the same name, in Germany, situated on the river Rhine, about seven miles north of Coblentz

ENGHIEN, a city of Hainalt, about fourteen miles south-west of Brussels.

ENGINA, an island on the north-east of the Morea, about fifty miles east of Corinth.

ENGINE, in mechanics, is a compound machine, made of one or more mechanical powers, as levers, pullies, screws, *&c.* in order to raise, cast, or sustain any weight, or produce any effect which could not be easily effected otherwise. See Mechanics.

Engine *for extinguishing fires*. See Hydrostatics, and Hydraulics.

Pile-Engine, one contrived for driving piles. See Mechanics.

Steam-Engine, a machine to raise water by fire, or rather by the force of water turned into steam. See Hydrostatics, and Hydraulics.

ENGINEER, in the military art, an able expert man, who, by a perfect knowledge in mathematics, delineates upon paper, or marks upon the ground, all sorts of forts, and other works proper for offence and defence. He should understand the art of fortification, so as to be able, not only to discover the defects of a place, but to find a remedy proper for them; as also how to make an attack upon, as well as to defend, the place. Engineers are extremely necessary for these purposes: wherefore it is requisite that, besides being ingenious, they should be brave in proportion. When at a siege the engineers have narrowly surveyed the place, they are to make their report to the general, by acquainting him which part they judge the weakest, and where approaches may be made with most success. Their business is also to delineate the lines of circumvallation and contravallation, taking all the advantages of the ground; to mark out the trenches, places of arms, batteries, and lodgments, taking care that none of their works be flanked or discovered from the place. After making a faithful report to the general of what is a-doing, the engineers are to demand a sufficient number of workmen and utensils, and whatever else is necessary.

ENGLAND, the southern division of Great Britain, situated in the Atlantic ocean, between 2° E. and 6° W. longitude, and between 49° 55′ and 55° 55′ N. latitude.

There are in England, including Wales, fifty-two counties, two archbishoprics, twenty-four bishoprics, two universities, twenty-nine cities, upwards of eight hundred towns, and near ten thousand parishes; supposed to contain about 7,000,000 of people.

New England, comprehending the colonies of Massachusets, New Hampshire, Connecticut, Rhode-island, and Providence-Plantation, is situated between 67° and 73° W. longitude, and between 41° and 45° N. latitude

ENGLISH, or the English tongue, the language spoken by the people of England, and, with some variation, by those of Scotland, as well as part of Ireland, and the rest of the British dominions.

The ancient language of Britain is generally allowed to have been the same with the Gaulic, or French; this island, in all probability, having been first peopled from Gallia, as both Cæsar and Tacitus affirm, and prove by many strong and conclusive arguments, as by their religion, manners, customs, and the nearness of their situation. But now we have very small remains of the ancient British tongue, except in Wales, Cornwall, the islands and highlands of Scotland, part of Ireland, and some provinces of France; which will not appear strange, when what follows is considered.

Julius Cæsar, some time before the birth of our Saviour, made a descent upon Britain, though he may be said rather to have discovered than conquered it; but, about the year of Christ 45, in the time of Claudius, Aulus Plautius was sent over with some Roman forces, by whom two kings of the Britons, Codigunus and Caractacus, were both overcome in battle: whereupon a Roman colony was planted at Malden in Essex, and the southern parts of the island were reduced to the form of a Roman province: after that, the island was conquered as far north as the friths of Dumbarton and Edinburgh, by Agricola, in the time of Domitian; whereupon, a great number of the Britons, in the conquered part of the island, retired to the west part called Wales, carrying their language with them.

The greatest part of Britain being thus become a Roman province, the Roman legions, who resided in Britain for above two hundred years, undoubtedly disseminated

ſeminated the Latin tongue; and the people being afterwards governed by laws written in Latin, muſt neceſſarily make a mixture of languages. This ſeems to have been the firſt mutation the language of Britain ſuffered.

Thus the Britiſh tongue continued, for ſome time, mixed with the provincial Latin, till, the Roman legions being called home, the Scots and Picts took the opportunity to attack and harraſs England: upon which, K. Vortigen, about the year 440, called the Saxons to his aſſiſtance, who came over with ſeveral of their neighbours, and having repulſed the Scots and Picts, were rewarded for their ſervices with the iſle of Thanet, and the whole county of Kent; but growing too powerful, and not being contented with their allotment, diſpoſſeſſed the inhabitants of all the country on this ſide of the Severn: thus the Britiſh tongue was in a great meaſure deſtroyed, and the Saxon introduced in its ſtead.

What the Saxon tongue was long before the conqueſt, about the year 700, we may obſerve in the moſt ancient manuſcripts of that language, which is a gloſs on the Evangeliſts, by biſhop Edfrid, in which the three firſt articles of the Lord's prayer runs thus.

" Uren fader thic arth in heofnas, ſic gehalgud thin " noma, ſo cymeth thin ric. Sic thin willa ſue is " heofnas, and in eortho, *&c.*"

In the beginning of the ninth century the Danes invaded England; and getting a footing in the northern and eaſtern part of the country, their power gradually increaſed, and they became ſole maſters of it in about two hundred years. By this means the ancient Britiſh obtained a tincture of the Daniſh language: but their government being of no long continuance, did not make ſo great an alteration in the Anglo-Saxon, as the next revolution, when the whole land, *A. D.* 1067, was ſubdued by William the Conqueror, duke of Normandy in France: for the Normans, as a monument of their conqueſt, endeavoured to make their language as generally received as their commands, and thereby rendered the Britiſh language an entire medley.

About the year 900, the Lord's prayer, in the ancient Anglo-Saxon, ran thus:

" Thue ur fader the eart on heofenum, ſi thin na-" ma gehalgod; cume thin rice ſi thin willa on eorthan " ſwa, ſwa on heofenum, *&c.*"

About the year 1160, under Henry II. it was rendered thus by pope Adrian, an Engliſhman, in rhyme:

" Ure fader in heaven riche,
" Thy name be halyed ever lich,
" Thou bring us thy michell bliſſe:
" Als hit in heaven y-doe,
" Evar in yearth beene it alſo, *&c.*"

Dr Hicks gives us an extraordinary ſpecimen of the Engliſh, as ſpoken in the year 1385, upon the very ſubject of the Engliſh tongue.

" As it is knowe how meny maner peple beeth in " this lond; ther beeth alſo ſo many dyvers longages " and tonges. Nothelefs Walſchemen and Scots that " beeth nought medled with other nation, holdeth wel " nyh hir firſte longage and ſpeche; but yif the Scottes, " that were ſometime confederate and woned with the " Pictes, drawe ſomewhat after hir ſpeche; but the " Flemynges, that woneth on the weſte ſide of Wales, " haveth loſt her ſtrange ſpech, and ſpeketh Sexon-" liche now. Alſo Engliſhemen, they had from the " bygynnynge thre maner ſpeche: northerne, ſou-" therne, and middel ſpeche in the middel of the " lond, as they come of thre maner of peple of Ger-" mania: nothelefs by commyxtion and mellynge firſt " with Danes, and afterwards with Normans, in meny " the contrary longage is apayred (*corrupted.*)

" This apayrynge of the burth of the tunge is bycauſe " of tweie thinges; oon is for children in ſcole agenſt " the uſuage and maner of all other nations, beeth " compelled for to leve hire own longage, and for to " conſtrue hir leſſons and here thynges in French, and " ſo they haveth ſethe Normans come firſt into Enge-" lond. Alſo gentlemen children beeth taught to " ſpeke Frenſche from the tyme that they beeth rok-" ked in here cradel, and kunneth ſpeke and play " with a childes broche; and uplondiſſche men will " lykne hymſelf to gentilmen, and fondeth with great " beſyneſſe for to ſpeak Frenſche to be told of.—Hit " ſeemeth a greet wonder how Engliſchemen and her " own longage and tonge is ſo dyverſe of ſown in this " oon ilond: and the longage of Normandie is com-" lynge of another lond, and hath oon maner ſoun " amonge alle men that ſpeketh hit arigt in Engelond. " Alſo of the foreſaid Saxon tonge that is deled (*di-" vided*) a three, and is abide ſcarceliche with fewe " uplondiſſche men is greet wonder. For men of the " eſt, with men of the weſt, is, as it were, undir " the ſame partie of hevene acordeth more in ſown-" ynge of ſpeche, than men of the north, with men " of the ſouth. Therefore it is that Mercii, that " beeth men of myddel Engelond, as it were, par-" teners of the endes, underſtondeth bettre the ſide " longages northerne and ſoutherne, than northerne or " ſoutherne underſtondeth either other.—All the lon-" gage of the Northumbers and ſpechialliche at York, " is ſo ſcharp, ſlitting and frotynge, and unſchape, that " we ſoutherne men may that longage unnethe un-" derſtonde, *&c.*" *Hicks's Theſaur. liter. ſept.*

In the year 1537, the Lord's prayer was printed as follows: " O oure Father which arte in heven, ha-" lowed be thy name: let thy kingdome come, thy " will be fulfiled as well in erth as it is in heven; " geve us this daye in dayly bred, *&c.*" Where it may be obſerved that the diction is brought almoſt to the preſent ſtandard, the chief variations being only in the orthography. By theſe inſtances, and many others that might be given, it appears, that the Engliſh Saxon language, of which the Normans deſpoiled us in a great meaſure, had its beauties, was ſignificant and emphatical, and preferable to what they impoſed on us. " Great, verily," ſays Camden, " was the glory of our " tongue before the Norman conqueſt, in this, that the " old Engliſh could expreſs, moſt aptly, all the concep-" tions of the mind in their own tongue, without bor-" rowing from any." Of this he gives ſeveral examples.

Having

Having thus ſhewn how the ancient Britiſh language was in a manner extirpated by the Romans, Danes, and Saxons, and ſucceeded by the Saxon, and after that the Saxon blended with the Norman French, we ſhall now mention two other cauſes of change in the language: the firſt of theſe is owing to the Britons having been a long time a trading nation, whereby offices, dignities, names of wares, and terms of traffic are introduced, which we take with the wares from the perſons of whom we have them, and form them anew, according to the genius of our own tongue; and beſides this change in the language, ariſing from commerce, Britain's having been a conſiderable time ſubject to the ſee of Rome, in eccleſiaſtical affairs, muſt unavoidably introduce ſome Italian words among us. Secondly, as to the particular properties of a language, our tongue has undergone no ſmall mutation, or rather has received no ſmall improvement upon that account: for, as to the Greek and Latin, the learned have, together with the arts and ſciences now rendered familiar among us, introduced abundance; nay, almoſt all the terms of art in the mathematics, philoſophy, phyſic, and anatomy; and we have entertained many more from the Latin, French, *&c.* for the ſake of neatneſs and elegancy: ſo that, at this day, our language, which about 1800 years ago, was the ancient Britiſh, or Welch, *&c.* is now a mixture of Saxon, Teutonic, Dutch, Daniſh, Norman, and modern French, embelliſhed with the Greek and Latin. Yet this, in our opinion, is ſo far from being a diſadvantage to the Engliſh tongue, as now ſpoke (for all languages have undergone changes, and do continually participate with each other) that it has ſo enriched it, as now to become the moſt copious, ſignificant, fluent, courteous, and maſculine language in Europe, if not in the world.

ENGRAFTING, or GRAFTING, in gardening. See GARDENING.

ENGRAILED, or INGRAILED, in heraldry, a term derived from the French *greſly*, hail; and ſignifying a thing the hail has fallen upon and broke off the edges, leaving them ragged, or with half-rounds, or ſemicircles, ſtruck out of their edges.

ENGRAVING, the art of cutting metals and precious ſtones, and repreſenting thereon figures, letters, or whatever device, or deſign, the artiſt fancies.

Engraving, properly a branch of ſculpture, is divided into ſeveral other branches, according to the matter whereon it is employed, and the manner of performing it.

The original way of engraving on wood is denominated at preſent, with us, by cutting in wood; that on metals with aquafortis, is named etching; that by the knife, burniſher, punch, and ſcraper, is called mezzotinto; that on ſtones for tombs, *&c.* ſtone-cutting; and that performed with the graver on metals or precious ſtones, keeps alone the primitive name of engraving, being that which we ſhall at preſent attend to.

ENGRAVING *on copper*, is employed in repreſenting portraits, hiſtories, landſkips, foliages, figures, buildings, *&c.* either after paintings, or deſigns for that purpoſe.

It is performed with the graver on a plate of copper, which, being well poliſhed, is covered over thinly with virgin-wax, and then ſmoothed, while warm, with a feather, ſo that the wax be of an equal thickneſs on the plate; and on this the draught or deſign, done in black lead, red chalk, or ungummed ink, is laid with the face of the drawing on the wax: then they rub the backſide, which will cauſe the whole deſign of the drawing to appear on the wax. The deſign, thus transferred, is traced through on the copper, with a point, or needle; then heating the plate, and taking off the wax, the ſtrokes remain to be followed, heightened, *&c.* according to the tenor of the deſign, with the graver, which muſt be very ſharp and well pointed.

In the conduct of the graver conſiſts almoſt all the art, which depends not ſo much upon rules as upon practice, the habitude, diſpoſition, and genius of the artiſt, the principles of engraving being the ſame with thoſe of painting; for if an engraver be not a perfect maſter of deſign, he can never hope to arrive at a degree of perfection in this art. In conducting the ſtrokes, or cuts, of the graver, he muſt obſerve the action of the fingers, and of all their parts, with their outlines; and remark how they advance towards, or fall back from his ſight, and then conduct his graver according to the riſings or cavities of the muſcles, or folds, widening the ſtrokes in the light, and contracting them in the ſhades; as alſo at the extremity of the outlines, to which he ought to conduct the cuts of the graver, that the figures or objects repreſented may not appear as if they gnawn; and lightening his hand, that the outlines may be perfectly ſound, without appearing cut or ſlit; and, although his ſtrokes neceſſarily break off where a muſcle begins, yet they ought always to have a certain connection with each other, ſo that the firſt ſtroke ſhould often ſerve to make the ſecond, becauſe this will ſhew the freedom of the graver.

If hair be the ſubject, let the engraver begin his work by making the outlines of the principal locks, and ſketch them out in a careleſs manner, which may be finiſhed, at leiſure, with finer and thinner ſtrokes to the very extremities.

The engraver muſt avoid making very acute angles, eſpecially in repreſenting fleſh, when he croſſes the firſt ſtrokes with the ſecond, becauſe it will form a very diſagreeable piece of tabby-like lattice-work except in the repreſentation of ſome clouds, in tempeſts, the waves of the ſea, and in repreſentations of ſkins of hairy animals, and leaves of trees. So that the medium between ſquare and acute ſeems to be the beſt and moſt agreeable to the eye. He that would repreſent ſculpture, muſt remember, that as ſtatues, *&c.* are moſt commonly made of white marble, or ſtone, whoſe colour does not produce ſuch dark ſhades as other matters do, they have no black to their eyes, nor hair of the head and beard flying in the air. If the engraver would

would preferve one quality and harmony in his works, he fhould always fketch out the principal objects of his piece before any part of them are finifhed.

The inftruments neceffary for this fort of engraving are, befides a graver, a cufhion, or fand-bag, made of leather, to lay the plate on, in order to give it the neceffary turns and motions; a burnifher made of iron, or fteel, round at one end, and ufually flattifh at the other, to rub out flips and failures, foften the ftrokes, *&c.*; a fcraper, to pare off the furface, on occafion; and a rubber, of a black hat, or cloth rolled up, to fill up the ftrokes that they may appear the more vifible.

In ENGRAVING *precious ftones*, they ufe either the diamond, or the emery. The diamond, which is the hardeft of all ftones, is only cut by itfelf, or with its own matter. The firft thing to be done in this branch of engraving, is to cement two rough diamonds to the ends of two fticks big enough to hold them fteady in the hand, and to rub or grind them againft each other till they be brought to the form defired. The duft or powder that is rubbed off ferves afterwards to polifh them, which is performed with a kind of mill that turns a wheel of foft iron. The diamond is fixed in a brafs difh, and, thus applied to the wheel, is covered with diamond-duft, mixt up with oil of olives; and when the diamond is to be cut facet-wife, they apply firft one face, then another, to the wheel. Rubies, fapphires, and topazes, are cut and formed the fame way on a copper wheel, and polifhed with tripoli diluted in water. As to agates, amethyfts, emeralds, hyacinths, granates, rubies, and others of the fofter ftones, they are cut on a leaden wheel, moiftened with emery and water, and polifhed with tripoli, on a pewter wheel Lapis-lazuli, opal, *&c.* are polifhed on a wooden wheel. To fafhion and engrave vafes of agate, cryftal, lapis-lazuli, or the like, they make ufe of a kind of lathe, like that ufed by pewterers to hold the veffels, which are to be wrought with proper tools; that of the engraver generally holds the tools, which are turned by a wheel; and the veffel is held to them to be cut and engraved, either in relievo or otherwife; the tools being moiftened, from time to time, with diamond-duft and oil, or at leaft emery and water. To engrave figures or devices on any of thefe ftones, when polifhed, fuch as medals, feals, *&c.* they ufe a little iron wheel, the ends of whofe axis are received within two pieces of iron, placed upright, as in the turner's lathe; and to be brought clofer, or fet further apart, at pleafure: at one end of the axis are fitted the proper tools, being kept tight by a fcrew. Laftly, The wheel is turned by the foot, and the ftone applied by the hand to the tool, and is fhifted and conducted as occafion requires.

The tools are generally of iron, and fometimes of brafs; their form is various, but it generally bears fome refemblance to chiffels, gouges, *&c.* Some have fmall round heads, like buttons, others like ferrels, to take the pieces out, and others flat, *&c.* when the ftone has been engraven, it is polifhed on wheels of hair-brufhes and tripoli.

ENGRAVING *on fteel* is chiefly employed in cutting feals, punches, matrices, and dyes proper for ftriking coins, medals, and counters. The method of engraving with the inftruments, *&c.* is the fame for coins as for medals and counters: All the difference confifts in their greater or lefs relievo, the relievo of coins being much lefs confiderable than that of medals, and that of counters ftill lefs than that of coins.

Engravers in fteel commonly begin with punches, which are in relievo, and ferve for making the creux, or cavities, of the matrices and dyes: though fometimes they begin with the creux, or hollownefs, but then it is only when the intended work is to be cut very fhallow. The firft thing done, is that of defigning the figures; the next is the moulding them in wax, of the fize and depth they are to lie, and from this wax the punch is engraven When the punch is finifhed, they give it a very high temper, that it may the better bear the blows of the hammer with which it is ftruck to give the impreffion to the matrix.

The fteel is made hot to foften it, that it may the more readily take the impreffion of the punch; and after ftriking the punch on it, in this ftate, they proceed to touch up or finifh the ftrokes and lines, where by reafon of their finenefs or the too great relievo they are any thing defective, with fteel gravers of different kinds, chiffels, flatters, *&c.* being the principal inftruments ufed in graving on fteel.

The figure being thus finifhed, they proceed to engrave the reft of the medal, as the mouldings of the border, the engrailed ring, letters, *&c.* with little fteel punches, well tempered, and very fharp.

ENGUICHE', in heraldry, is faid of the great mouth of a hunting horn, when its rim is of a different colour from that of the horn itfelf.

ENGYSCOPE, the fame with microfcope. See MICROSCOPE.

ENHARMONIC, in the ancient mufic, one of their genera or kinds of mufic, fo called from its fuperior excellence; though wherein it confifted, fays Mr Malcom, is hard to fay: it was allowed by all to be fo very difficult, that few could ever practife it.

ENHYDRUS, in natural hiftory, a genus of fiderochita or cruftated ferrugineous bodies, formed in large and in great part empty cafes, inclofing a fmall quantity of an aqueous fluid.

Of this genus there are only two fpecies: 1. The thick-fhelled enhydrus, with black, reddifh-brown, and yellow crufts, 2. The thinner fhelled kind, with yellowifh-brown and purple crufts; neither of which ferments with aqua fortis, or gives fire with fteel.

ENIXUM, among chemifts, a kind of neutral falt, generated of an acid and an alkali.

The fal enixum of Paracelfus, is the caput mortuum of fpirits of nitre with oil of vitriol, or what remains in the retort after the diftillation of this fpirit; being of a white colour, and pleafing acid tafte.

ENMANCHE', in heraldry, is when lines are drawn from the centre of the upper edge of the chief to the fides, to about half the breadth of the chief; fignifying

fying sleeved, or resembling a sleeve, from the French *manche*.

ENNEAGON, in geometry, a polygon with nine sides. See POLYGON.

ENNEAHEDRIA, in natural history, a genus of columnar, crystalliform, and double-pointed spars, composed of a trigonal column, terminated at each end by a trigonal pyramid.

Of this genus there are several species, distinguished by the length or shortness of the column and pyramids, none of which will give fire with steel, but all of them ferment with aqua fortis. See SPAR.

ENNEANDRIA, in botany. See BOTANY, p. 635. and Plate LIII. fig. 9.

ENS, among metaphysicians, denotes entity, being, or existence: this the schools call *ens reale*, and *ens positivum*, to distinguish it from their *ens rationis*, which is only an imaginary thing, or exists only in the imagination.

ENS, among chemists, imports the power, virtue, and efficacy which certain substances exert upon our bodies.

ENS, in geography, a city of Germany, situated at the confluence of the Danube and the river Ens, about eighty miles south of Vienna: E. long. 14° 20′, N. lat. 48° 16′.

ENSEELED, in falconry, is said of a hawk that has a thread drawn through her upper eye-lid, and made fast under her beak, to take away the sight.

ENSIGN, in the military art, a banner under which the soldiers are ranged according to the different companies or parties they belong to.

ENSIGN is also the officer that carries the colours, being the lowest commissioned officer in a company of foot, subordinate to the captain and lieutenant.

ENSISHEIM, a town of Germany, in the landgraviate of Alsace, about fifty miles south of Strasburg: E. long. 7° 30′, N. lat. 47° 50′.

ENSKIRKEN, a town of Germany, fifteen miles south-west of Cologn.

ENTABLATURE, or ENTABLEMENT, in architecture, is that part of an order of a column which is over the capital, and comprehends the architrave, frieze, and corniche. See ARCHITECTURE.

ENTABLER, in the menage, the fault of a horse whose croupe goes before his shoulders in working upon volts; which may be prevented by taking hold of the right rein, keeping your right leg near, and removing your left leg as far from the horse's shoulder as possible.

This is always accompanied with another fault called aculer. See ACULER.

ENTAIL. See TAILZIE.

ENTE′, in heraldry, a method of marshalling. more frequent abroad than with us, and signifying grafted or ingrafted.

We have, indeed, one instance of enté in the fourth grand quarter of his majesty's royal ensign, whose blazon is Brunswick and Lunenburg impaled with ancient Saxony, *enté en pointé*, grafted in point.

ENTELECHIA, a word used by Aristotle to express the soul, and which, not occurring in any other author, has given the commentators upon that philosopher great trouble to discover its true meaning.

ENTEROCELE, in surgery, a tumor formed by a prolapsion of the intestines through the rings of the abdomen, and processes of the peritonæum, into the scrotum. See SURGERY.

ENTEROLOGY, a term used by physicians, for a discourse or treatise on the contents of the head, breast, and abdomen.

ENTEROMPHALUS, the same with a hernia umbilicalis, or rupture at the navel.

ENTERSOLE, in architecture, a kind of little story, sometimes called a mezanzine, contrived occasionally at the top of the first story, for the conveniency of a wardrobe, *&c.*

ENTHUSIASM, a transport of the mind, whereby it is led to think and imagine things in a sublime, surprising, yet probable manner. This is the enthusiasm felt in poetry, oratory, music, painting, sculpture, *&c.*

ENTHUSIASM, in a religious sense, implies a transport of the mind, whereby it fancies itself inspired with some revelation, impulse, *&c.* from heaven.

ENTHUSIAST, a person possessed with enthusiasm. See the preceding article.

ENTHYMEME, among logicians, denotes a syllogism, perfect in the mind, but imperfect in the expression, by reason one of the propositions is suppressed, as being easily supplied by the understanding of those with whom we discourse.

ENTOMON, in zoology. See ONISCUS.

ENTREPAS, in the manege, a broken pace or going, that is neither walk nor trot, but has somewhat of an amble.

This is a pace or gait of such horses as have no reins or back, and go upon their shoulders; or, of such as are spoiled in their limbs.

ENTRING-LADDERS, in a ship, are of two sorts; one used by the vessel's sides, in a harbour, or in fair weather, for persons to go in and out of the ship: the other is made of ropes, with small staves for steps; and is hung out of the gallery to enter into the boat, or to come aboard the ship, when the sea runs so high that they dare not bring the boat to the ship's side for fear of staving it.

ENTROCHUS, in natural history. See ISIS.

ENTRY *of an heir*, in Scots law, that form of law by which an heir vests in himself a proper title to his predecessor's estate. See *Precept of* CLARE CONSTAT.

Bill of ENTRY, in commerce. See BILL.

In making entries inwards, it is usual for merchants to include all the goods they have on board the same ship in one bill, though sometimes they may happen to be upwards of twenty several kinds; and in case the goods are short entered, additional or post entries are now allowed; though formerly the goods, so entered, were forfeited. As to bills of entry outwards, or including goods to be exported, upon delivering them, and paying the customs, you will receive a small piece of

of parchment called a cocket, which teſtifies your payment thereof, and all duties for ſuch goods.

If ſeveral ſorts of goods are exported at once, of which ſome are free, and others pay cuſtoms; the exporter muſt have two cockets, and therefore muſt make two entries; one for the goods that pay, and the other for the goods that do not pay cuſtom.

Entries of goods, on which a drawback is allowed, muſt likewiſe contain the name of the ſhip in which the goods were imported, the importer's name, and time of entry inwards. The entry being thus made, and an oath taken that the cuſtoms for thoſe goods were paid as the law directs, you muſt carry it to the collector and comptroller, or their deputies; who, after examining their books, will grant warrant, which muſt be given to the ſurveyor, ſearcher, or land-waiter, for them to certify the quantity of goods; after which the certificate muſt be brought back to the collector and comptroller, or their deputies, and oath made that the ſaid goods are really ſhipped, and not landed again in any part of Great Britain.

ENVELOPE, in fortification, a work of earth, ſometimes in form of a ſimple parapet, and at others like a ſmall rampart with a parapet: it is raiſed ſometimes on the ditch, and ſometimes beyond it.

ENVIRONNE', in heraldry, ſignifies ſurrounded with other things: thus, they ſay, a lion environné with ſo many bezants. See BEZANT.

ENUMERATION, an account of ſeveral things, in which mention is made of every particular article.

ENVOY, a perſon deputed to negociate ſome affair with any foreign prince or ſtate. Thoſe ſent from the courts of France, Britain, Spain, *&c.* to any petty prince or ſtate, ſuch as the princes of Germany, the republics of Venice, Genoa, *&c.* go in quality of envoys, not embaſſadors; and ſuch a character only do thoſe perſons bear, who go from any of the principal courts of Europe to another, when the affair they go upon is not very ſolemn or important. There are envoys ordinary and extraordinary, as well as embaſſadors; they are equally the ſame under the protection of the law of nations, and enjoy all the privileges of embaſſadors, only differing from them in this, that the ſame ceremonies are not performed to them.

ENVY, in ethics, an uneaſineſs of the mind, cauſed by the conſideration of a good we deſire, obtained by one we think leſs worthy of it than ourſelves. See PASSION, and MORALS.

EPACT. See ASTRONOMY, *Of the Diviſion of Time.*

EPANORTHOSIS, in rhetoric, a figure by which a perſon corrects, or ingeniouſly revokes, what he juſt before alledged, as being too weakly expreſſed, in order to add ſomething ſtronger, and more conformable to the paſſion with which he is agitated.

The epanorthoſis is diſtinguiſhed into two kinds. The one is when we correct or revoke the word, as in the following example of the apoſtle, *But I laboured more abundantly than they all: yet not I, but the grace of God, which was with me,* 1 Cor. xv. 10. where, what he firſt attributed to his own merit, he chuſes afterwards to call the work of grace, as being the principal cauſe. The ſecond kind of epanorthoſis, is when we correct or revoke the ſentiment, as in the following of Cicero: *Italiam ornare, quam domum ſuam, maluit: quamquam, Italia ornata, domus ipſa mihi videtur ornatior.*

EPARER, in the menage, ſignifies the flinging of a horſe, or his yerking and ſtriking with his hind-legs.

EPAULEMENT, in fortification, a work raiſed to cover ſidewiſe, is either of earth, gabions, or faſcines loaded with earth. The epaulements of the places of arms for the cavalry, at the entrance of the trenches, are generally of faſcines mixed with earth.

EPENTHESIS, in grammar, the interpoſition or inſertion of a letter or ſyllable in the middle of a word; as *alituum,* for *alitum*; *relligio,* for *religio*; *indupe-rator,* for *imperator,* &c.

EPERLANUS, in ichthyology. See SALMO.

EPHA, or EPHAH, in Jewiſh antiquity, a meaſure for things dry, containg 1.0961 of a buſhel.

EPHÆTUM, in botany See RANUNCULUS.

EPHEDRA, the SEA-GRAPE, or SHRUB HORSE-TAIL, in botany, a genus of the dioecia monadelphia claſs. The calix of the amentum of the male and female is divided into ſegments; the corolla is wanting in both; the ſtamina are ſeven; there are two piſtils, and two ſeeds covered with a kind of cup-berry. There are two ſpecies, none of them natives of Britain.

EPHEMERY, in medicine, the name of a ſpecies of fever continuing the ſpace of one day, or ſometimes more; for the medical writers expreſs themſelves by *ephemera ſimplex, vel plurium dierum.* See MEDICINE.

EPHEMERA, the DAY-FLY, in zoology, a genus belonging to the order of neuroptera. It has no teeth or palpæ; there are two large protuberances above the eyes; the wings are erect, the two hind ones being largeſt; and the tail is briſtly. There are eleven ſpecies, diſtinguiſhed by their colour and the number of briſtles in their tail. This fly derives its name from the circumſtance of its living but one day.

EPHEMERIDES, in literary hiſtory, an appellation given to thoſe books or journals, which ſhew the motions and places of the planets for every day of the year.

It is from the tables contained in theſe ephemerides that eclipſes, and all the variety of aſpects of the planets, are found.

EPHEMERUM, in botany. See TRADESCANTIA.

EPHIALTES, in medicine, the ſame with the incubus, or night-mare. See INCUBUS.

EPHIPPUIM, in anatomy. See ANATOMY, Part I.

EPHOD, in Jewiſh antiquity, one part of the prieſtly habit; being a kind of girdle, which, brought from behind the neck over the two ſhoulders, and hanging down before, was put croſs the ſtomach, then carried round the waiſt, and made uſe of as a girdle to the tunic.

There were two ſorts of ephods, one of plain linen for the prieſts, and the other embroidered for the high prieſt.

EPHORI, in Grecian antiquity, magiſtrates eſtabliſhed in

in ancient Sparta to balance the regal power. The authority of the ephori was very great. They ſometimes expelled and even put to death the kings, and aboliſhed or ſuſpended the power of the other magiſtrates, calling them to account at pleaſure. There were five of them, others ſay nine. They preſided in the public ſhews and feſtivals. They were entruſted with the public treaſure, made war and peace, and were ſo abſolute, that Ariſtotle makes their government equal to the prerogative of a monarchy. They were eſtabliſhed by Lycurgus.

EPHYDRUM, in botany. See EQUISETUM.

EPIC, or HEROIC POEM. See COMPOSITION.

EPICEDIUM, in ancient poetry, a poem rehearſed during the funeral ſolemnity of perſons of diſtinction.

EPICOENE, in grammar, a term applied to nouns, which, under the ſame gender and termination, mark indifferently the male and female ſpecies.

EPICUREAN PHILOSOPHY, the doctrine or ſyſtem of philoſophy maintained by Epicurus and his followers.

His philoſophy conſiſted of three parts, canonical, phyſical, and etherial. The firſt was about the canons, or rules of judging. The cenſure which Tully paſſes upon him for his deſpiſing logic, will hold true only with regard to the logic of the ſtoics, which he could not approve of, as being too full of nicety and quirk. Epicurus was not acquainted with the analytical method of diviſion and argumentation, nor was he ſo curious in modes and formation as the ſtoics. Soundneſs and ſimplicity of ſenſe, aſſiſted with ſome natural reflections, was all his art. His ſearch after truth proceeded only by the ſenſes, to the evidence of which he gave ſo great a certainty, that he conſidered them as an infallible rule of truth, and termed them the firſt natural light of mankind.

In the ſecond part of this philoſophy he laid down atoms, ſpace, and gravity, as the firſt principles of all things: he did not deny the exiſtence of God, but thought it beneath his majeſty to concern himſelf with human affairs: he held him a bleſſed immortal being, having no affairs of his own to take care of, and above meddling with thoſe of others.

As to his ethics, he made the ſupreme good of man to conſiſt in pleaſure, and conſequently ſupreme evil in pain. Nature itſelf, ſays he, teaches us this truth, and prompts us from our birth to procure whatever gives us pleaſure, and avoid what gives us pain. To this end he propoſes a remedy againſt the ſharpneſs of pain: this was to divert the mind from it, by turning our whole attention upon the pleaſures we have formerly enjoyed: he held that the wiſe man muſt be happy, as long as he is wiſe; that pain, not depriving him of his wiſdom, cannot deprive him of his happineſs.

There is nothing that has a fairer ſhew of honeſty than the moral doctrine of Epicurus. Gaſſendus pretends, that the pleaſure in which this philoſopher has fixed the ſovereign good, was nothing elſe but the higheſt tranquillity of mind in conjunction with the moſt perfect health of body: but Tully, Horace, and Plutarch, as well as almoſt all the fathers of the church, give us a very different repreſentation: indeed the nature of this pleaſure, in which the chief happineſs is ſuppoſed to be ſeated, is a grand problem in the morals of Epicurus. Hence there were two kinds of Epicureans, the rigid and the remiſs: the firſt were thoſe who underſtood Epicurus's notion of pleaſure in the beſt ſenſe, and placed all their happineſs in the pure pleaſures of the mind, reſulting from the practice of virtue: the looſe or remiſs Epicureans, taking the words of that philoſopher in a groſs ſenſe, placed all their happineſs in bodily pleaſures or debauchery.

EPICYCLE, in the ancient aſtronomy, a little circle whoſe centre is in the circumference of a greater circle; or it is a ſmall orb, or ſphere, which being fixed in the deferent of a planet, is carried along with it; and yet, by its own peculiar motion, carries the planet faſtened to it round its proper centre.

It was by means of epicycles, that Ptolemy and his followers ſolved the various phænomena of the planets, but more eſpecially their ſtations and retrogradations.

EPICYCLOID, in geometry, a curve generated by the revolution of the periphery of a circle, along the convex or concave ſide of the periphery of another circle.

EPICYEMA, among phyſicians, denotes a ſuperfœtation; being a falſe conception or mole happening after the birth of a regular fœtus.

EPIDEMIA, in Grecian antiquity, feſtivals kept in honour of Apollo and Diana, at the ſtated ſeaſons when theſe deities, who could not be preſent every where, were ſuppoſed to viſit different places, in order to receive the vows of their adorers.

EPIDEMIC, among phyſicians, an epithet of diſeaſes which at certain times are popular; attacking great numbers at or near the ſame time. See MEDICINE.

EPIDENDRUM, in botany, a genus of the gynandria diandria claſs. The nectarium is oblique, reflected, and ſhaped like a turban. There are thirty ſpecies, none of them natives of Britain.

EPIDERMIS, in anatomy. See ANATOMY, p. 255.

EPIDIDYMIS, in anatomy. See ANATOMY, p. 171.

EPIGASTRIC REGION, a part or ſubdiviſion of the abdomen. See ANATOMY, p. 256.

EPIGLOTTIS, in anatomy, one of the cartilages of the larynx, or wind-pipe. See ANATOMY, p. 281.

EPIGRAM, in poetry, a ſhort poem in verſe, treating only of one thing, and ending with ſome lively, ingenious, and natural thought or point.

EPIGRAPHE, among antiquarians, denotes the inſcription of a building, pointing out the time when, the perſons by whom, the uſes, and the like, for which it was erected.

EPILEPSY, in medicine, the ſame with what is otherwiſe called the falling-ſickneſs, from the patient's falling ſuddenly to the ground. See MEDICINE.

EPILOBIUM, in botany, the WILLOW-HERB, a genus of the octandria monogynia claſs. The calix is divided into four ſegments, and the corolla conſiſts of four petals; the capſule is oblong and below the flower; and the ſeeds are pappous. There are ſeven ſpecies, all of them natives of Britain, *viz.* the anguſtifolium, or

roſebay

rosebay willow-herb; the hirsutum, or small-flowered hairy willow herb; the ramosum, great flowered willow herb, or codlings and cream; the montanum, or smooth-leaved willow herb; the tetragonum, or narrow-leaved willow-herb; the palustre, or marsh willow herb; and the alpinum, or mountain willow-herb.

EPILOGUE, in oratory, the end or conclusion of a discourse, ordinarily containing a recapitulation of the principal matters delivered.

EPILOGUE, in dramatic poetry, a speech addressed to the audience after the play is over, by one of the principal actors therein, usually containing some reflections on certain incidents in the play, especially those in the part of the person that speaks it.

EPIMEDIUM, BARREN-WORT, in botany, a genus of the tetrandia monogynia class. It has four cap-shaped nectaria lying upon the petals; the corolla consists of four petals; and the calix is caducous. There is but one species, a native of Germany.

EPIPHANY, a Christian festival, otherwise called the Manifestation of Christ to the Gentiles, observed on the sixth of January, in honour of the appearance of our Saviour to the three magi, or wise-men, who came to adore him and bring him presents. The feast of epiphany was not originally a distinct festival, but made a part of that of the nativity of Christ, which being celebrated twelve days, the first and last of which were high or chief days of solemnity, either of these might properly be called epiphany, as that word signifies the appearance of Christ in the world.

EPIPHONEMA, in rhetoric, a sententious exclamation containing a lively remark placed at the end of a discourse or narration.

EPIPHORA, in medicine, a preternatural defluxion of the eyes, when they continually discharge a sharp serous humour, which excoriates the cheeks. See MEDICINE.

EPIPHYSIS, in anatomy. See ANATOMY, Part I.

EPIPLOCELE, in medicine, is a kind of hernia, or rupture, in which the omentum subsides into the scrotum.

EPIPLOOMPHALON, in medicine, an hernia umbilicalis, proceeding from the omentum falling into the region of the umbilicus or navel.

EPIPLOON. See OMENTUM.

EPISCOPACY, the quality of episcopal government, or that form of church-discipline, wherein diocesian bishops are established distinct from and superior to priests or presbyters. See BISHOP.

EPISCOPAL, something belonging to bishops.

EPISCOPALIANS, in church-history, an appellation given to those who prefer the episcopal government and discipline to all others.

By the test act, none but episcopalians, or members of the church of England, are qualified to enjoy any office civil or military.

EPISCOPUS. See BISHOP.

EPISODE, in poetry, a separate incident, story, or action, which a poet invents, and connects with his principal action, that his work may abound with a greater diversity of events; though, in a more limited sense, all the particular incidents whereof the action or narration is compounded, are called episodes. See COMPOSITION.

EPISPASTIC, in medicine, a topical remedy, which being applied to the external parts of the body, attracts the humours to that part.

EPISTATES, in the Athenian government, was the president of the proedri. See PROEDRI.

EPISTEMONARCH, in the ancient Greek church, an officer of great dignity, who had the care of every thing relating to faith, in the quality of censor. His office answered pretty nearly to that of master of the sacred palace at Rome.

EPISTLE, denotes the same with a missive letter; but is now chiefly used in speaking of ancient writings, as the epistles of St Paul, epistles of Cicero, epistles of Pliny, *&c.*

EPISTOLARY, something belonging to an epistle. See EPISTLE.

EPISTROPHE, in rhetoric, a figure, wherein that which is supposed of one thing, is strongly affirmed of another: thus, *Are they Hebrews? so am I. Are they Israelites? so am I. Are they of the seed of Abraham? so am I*, &c.

EPISTYLE, in the ancient architecture, a term used by the Greeks for what we call architrave, *viz.* a massive piece of stone or wood, laid immediately over the capital of a column.

EPITAPH, a monumental inscription in honour or memory of a person defunct, or an inscription engraven or cut on a tomb, to mark the time of a person's decease, his name, family; and, usually, some eulogium of his virtues, or good qualities.

EPITASIS, in ancient poetry, the second part or division of a dramatic poem, wherein the plot, entered upon in the first part, or protasis, was carried on, heightened, and worked up, till it arrived at its state, or height, called catastasis.

EPITASIS, in medicine, the increase of a disease, or beginning of a paroxysm, particularly in a fever.

EPITHALAMIUM, in poetry, a nuptial song, or composition, in praise of the bride and bridegroom, praying for their prosperity, for a happy offspring, *&c.*

Among the Greeks, the married couple were no sooner bedded, than the young men and maids gathered round the door, dancing and singing the epithalamium, shouting and stamping with their feet, with intention to drown the maid's cries.

EPITHEM, in pharmacy, a kind of fomentation, or remedy of a spirituous or aromatic kind, applied externally to the regions of the heart, liver, *&c.* to strengthen and comfort the same, or to correct some intemperature thereof. See FOMENTATION.

EPITHET, in poetry and rhetoric, an adjective expressing some quality of a substantive to which it is joined; or such an adjective as is annexed to substantives by way of ornament and illustration, not to make up an essential part of the description. Nothing, says Aristotle, tires the reader more than too great a redundancy of epithets, or epithets placed improperly; and yet

nothing

nothing is so essential in poetry as a proper use of them. The writings of the best poets are full of them, especially Virgil.

EPITOME, in literary history. See ABRIDGEMENT.

EPITRITUS, in prosody, a foot consisting of three long syllables and one short.

EPIZEUXIS, in rhetoric, a figure which repeats the same word, without any other intervening; such is that of Virgil, *Nunc, nunc, insurgite remis*.

EPOCHA, in chronology, a term or fixed point of time, whence the succeeding years are numbered or accounted. See ASTRONOMY, p. 487.

EPODE, in lyric poetry, the third or last part of the ode; the ancient ode being divided into strophe, antistrophe, and epode. See ODE.

EPOPOEIA, in poetry, the story, fable, or subject treated of in an epic poem.

EPOTIDES, in the naval architecture of the ancients, two thick blocks of wood, one on each side the prow of a galley, for warding off the blows of the rostra of the enemy's vessels.

EPPINGEN, a town of Germany, situated about ten miles north of Halibron.

EPSOM, a town of Surry, about fifteen miles south-west of London; much resorted to on account of its medicinal waters; from which the bitter purging salt being first extracted, got the name of Epsom-salt. At present, however, the bitter purging salt is procured from the bittern, remaining after the crystallization of common salt; and this is found to answer all the purposes of that first obtained from Epsom-waters, and goes by its name. See CHEMISTRY.

EPULONES, in Roman antiquity, ministers who assisted at the sacrifices, and had the care of the sacred banquet committed to them.

EQUABLE, an appellation given to such motions as always continue the same in degree of velocity, without being either accelerated or retarded. See MECHANICS.

EQUAL, a term of relation between two or more things of the same magnitude, quantity, or quality.

Mathematicians speak of equal lines, angles, figures, circles, ratios, solids.

EQUALITY, that agreement between two or more things, whereby they are denominated equal.

EQUANIMITY, in ethics, denotes that even and calm frame of mind and temper, under good or bad fortune, whereby a man appears to be neither puffed up nor overjoyed with prosperity, nor dispirited, soured, or rendered uneasy by adversity.

EQUATION, in algebra. See ALGEBRA, p. 100.

EQUATION *of time*, in astronomy and chronology, the reduction of the apparent time or motion of the sun, to equable, mean, or true time. See ASTRONOMY, p. 459.

EQUATOR, in geography, a great circle of the terrestrial globe, equidistant from its poles, and dividing it into two equal hemispheres; one north, and the other south. See GEOGRAPHY.

EQUERRY, in the British customs, an officer of state, under the master of the horse.

There are five equerries, who ride abroad with his majesty: for which purpose they give their attendance monthly, one at a time, and are allowed a table.

As to the equerries of the crown stable, they have this distinct appellation, as being employed in mounting, managing, and breaking the saddle horses for his majesty's use, and holding his stirrup.

EQUES AURATUS, is used for a knight batchelor, called *auratus*, q. d. *gilt*, because anciently none but knights were allowed to beautify their armour, or other habiliments for war, with gold.

EQUESTRIAN STATUE, signifies the statue of a person mounted on horseback.

EQUESTRIAN ORDER, among the Romans, signified their knights, or equites; as also their troopers, or horsemen in the field; the first of which orders stood in contradistinction to the senators, as the last did to the foot, military, or infantry: each of these distinctions was introduced into the state by Romulus.

EQUIANGULAR, in geometry, an epithet given to figures, whose angles are all equal: such are a square, an equilateral triangle, *&c.*

EQUICRURAL, in geometry. See ISOSCELES.

EQUIDISTANT, an appellation given to things placed at equal distance from some fixed point, or place, to which they are referred.

EQUILATERAL, in general, something that hath equal sides, as an equilateral angle.

EQUILIBRIUM, in mechanics, is when the two ends of a lever or balance hang so exactly even and level, that neither doth ascend or descend, but keep in a position parallel to the horizon; which is occasioned by their being both charged with an equal weight.

EQUIMULTIPLES, in arithmetic and geometry, are numbers or quantities multiplied by one and the same number or quantity. Hence, equimultiples are always in the same ratio to each other, as the simple quantities before multiplication: thus, if 6 and 8 are multiplied by 4, the equimultiples 24 and 32 will be to each other as 6 to 8.

EQUINOCTIAL, in astronomy, a great circle of the celestial globe, whose poles are the poles of the world. See ASTRONOMY, and GEOGRAPHY.

EQUINOX, the time when the sun enters either of the equinoctial points, where the ecliptic intersects the equinoctial. See ASTRONOMY.

Precession of the EQUINOXES. See ASTRONOMY.

EQUISETUM, or HORSE-TAIL, in botany, a genus of the cryptogamia filices class. The fructification is disposed on an oblong spike, and of an orbicular figure. There are seven species, six of which are natives of Britain, *viz.* the sylvaticum, or wood horse-tail; the arvense, or corn horse-tail; the palustre, or marsh horse-tail; the fluviatile, or river horse-tail; the limosum, or smooth horse-tail; and the hyemale, or rough horse-tail.

EQUITY, in a general sense, the virtue of treating all other men according to common reason and justice, or as we would be gladly treated ourselves, when we understand aright what is our due. See JUSTICE.

EQUIVALENT, an appellation given to things which agree

agree in nature, or other circumſtances, as force, virtue, &c.

EQUIVOCAL TERMS or WORDS, among logicians, are thoſe which have a doubtful or double meaning.

According to Mr Locke, the doubtfulneſs and uncertainty of words has its cauſe more in the ideas themſelves, than in any incapacity of the words to ſignify them; and might be avoided, would people always uſe the ſame term to denote the ſame idea, or collection of ideas: but, adds he, it is hard to find a diſcourſe on any ſubject where this is the caſe; a practice which can only be imputed to folly, or great diſhoneſty; ſince a man, in making up his accounts, might with as much fairneſs uſe the numeral characters ſometimes for one, ſometimes for another collection of unities.

EQUIVOCAL GENERATION, the production of animals, without the intercourſe between the ſexes, by the influence of the ſun or ſtars, &c.

This kind of generation is now quite exploded by the learned.

EQUULEUS, or ECUULEUS, in antiquity, a kind of rack uſed for extorting a confeſſion, at firſt chiefly practiſed on ſlaves, but afterwards made uſe of againſt the Chriſtians.

The equuleus was made of wood, having holes at certain diſtances, with a ſcrew, by which the criminal was ſtretched to the third, ſometimes to the fourth, or fifth holes, his arms and legs being faſtened on the equuleus with cords; and thus was hoiſted aloft, and extended in ſuch a manner, that all his bones were diſlocated. In this ſtate red-hot plates were applied to his body, and he was goaded in the ſides with an inſtrument called ungula.

EQUULUS, in aſtronomy. See ASTRONOMY, p. 487.

EQUUS, the HORSE, in zoology, a genus of quadrupeds belonging to the order of belluæ. This genus comprehends the horſe, the aſs, and the zebra; they have ſix erect and parallel fore-teeth in the upper jaw, and ſix ſomewhat prominent ones in the under jaw; the dog-teeth are ſolitary, and at a conſiderable diſtance from the reſt; and the feet conſiſt of an undivided hoof. The horſe is a domeſtic animal, and the figure and dimenſions of his body are ſo well known, that a general deſcription is altogether unneceſſary. We ſhall therefore confine ourſelves to the natural hiſtory of this noble animal.

The horſe, in a domeſtic ſtate, is a bold and fiery animal; equally intrepid as his maſter, he faces danger and death with ardour and magnanimity. He delights in the noiſe and tumult of arms, and ſeems to feel the glory of victory: he exults in the chaſe; his eyes ſparkle with emulation in the courſe. But though bold and intrepid, he is docile and tractable: he knows how to govern and check the natural vivacity and fire of his temper. He not only yields to the hand, but ſeems to conſult the inclination of his rider. Conſtantly obedient to the impreſſions he receives, his motions are entirely regulated by the will of his maſter. He in ſome meaſure reſigns his very exiſtence to the pleaſure of man. He delivers up his whole powers; he reſerves nothing; he will rather die than diſobey. Who could endure to ſee a character ſo noble abuſed! Who could be guilty of ſuch groſs barbarity!

This character, though natural to the animal, is in ſome meaſure the effect of education. His education commences with the loſs of liberty, and it is finiſhed by conſtraint. The ſlavery of the horſe is ſo ancient and ſo univerſal, that he is but rarely ſeen in a natural ſtate. Several ancient writers talk of wild horſes, and even mention the places where they were to be found. Herodotus takes notice of white ſavage horſes in Scythia; Ariſtotle ſays, they are to be found in Syria; Pliny, in the northern regions; and Strabo, in Spain and the Alps. Among the moderns, Leardon ſays, that wild horſes are to be found in the Highlands of Scotland, and the Orkney Iſles; Olaus, in Muſcovy; Dapper, in the iſland of Cyprus; Leo and Marmol, in Arabia and Africa, &c. But, as Europe is almoſt equally inhabited, wild horſes are not to be met with in any part of it; and thoſe of America were originally tranſported from Europe by the Spaniards; for this ſpecies of animals did not exiſt in the new world. The Spaniards carried over a great number of horſes, left them in different iſlands, &c. with a view to propagate that uſeful animal in their colonies. Theſe have multiplied incredibly in the vaſt deſarts of thoſe thinly peopled countries, where they roam at large, without any reſtraint. M. de Salle relates, that he ſaw, in the year 1685, horſes feeding in the meadows of North America, near the bay of St Louis, which were ſo ferocious that nobody durſt come near them. Oexmelin ſays, that he has ſeen large troops of them in St Domingo running in the valleys; that when any perſon approached, they all ſtopt; and one of them would advance till within a certain diſtance, then ſnort with his noſe, take to his heels, and the whole troop after him. Every author who takes notice of theſe horſes of America, agree that they are ſmaller and leſs handſome than thoſe of Europe. Theſe relations ſufficiently prove, that the horſe, when at full liberty, though not a fierce or dangerous animal, has no inclination to aſſociate with mankind; that all the ſoftneſs and ductility of his temper proceeds entirely from the culture and poliſh he receives in his domeſtic education, which in ſome meaſure commences as ſoon as he is brought forth.

The motions of the horſe are chiefly regulated by the bit and the ſpur; the bit informs him how to direct his courſe, and the ſpur quickens his pace. The mouth of the horſe is endowed with an amazing ſenſibility: the ſlighteſt motion or preſſure of the bit gives him warning, and inſtantly determines his courſe.

The horſe has not only a grandeur in his general appearance, but there is the greateſt ſymmetry and proportion in the different parts of his body. The regularity and proportion of the different parts of the head gives him an air of lightneſs, which is well ſupported by the ſtrength and beauty of his cheſt. He erects his head, as if willing to exalt himſelf above the condition of other quadrupeds: his eyes are open and lively; his

Plate LXXV.

Fig. 1. EQUUS CABALLUS or HORSE.

Fig. 2. EQUUS ASINUS or ASS.

Fig. 3. EQUUS ZEBRA.

his ears are handfome, and of a proper height; his main adorns his neck, and gives him the appearance of ftrength and boldnefs

At the age of two years, or two years and a half, the horfe is in a condition to propagate; and the mare, like moft other females, is ready to receive him ftill fooner. But the foals produced by fuch early embraces are generally ill made and weakly. The horfe fhould never be admitted to the mare till he is four or four and a half; this is only meant with regard to draught-horfes. Fine horfes fhould not be admitted to the mare before they be fix years old; and Spanifh ftalions not till feven. The mares are generally in feafon from the beginning of April to the end of March; but their chief ardour for the horfe lafts but about 15 or 20 days, and this critical feafon fhould always be embraced. The ftalion ought to be found, well made, vigorous, and of a good breed. For fine faddle horfes, foreign ftalions, as Arabians, Turks, Barbs, and Andaloufians, are preferable to all others. Next to thefe, Britifh ftalions are the beft; becaufe they originally fprang from thofe above mentioned, and are very little degenerated. The ftalions of Italy, and efpecially the Neapolitans, are very good. The beft ftalions for draught or carriage horfes, are thofe of Naples, Denmark, Holftein, and Freezeland. The ftalions for faddle-horfes fhould be from 14 to 15 hands high, and for draught-horfes at leaft 15 hands. Neither ought the colour of ftalions to be overlooked; as a fine black, grey, bay, forrel, *&c.* Befides thefe external qualities, a ftalion ought to have courage, tractability, fpirit, agility, a fenfible mouth, fure limbs, *&c.* Thefe precautions in the choice of a ftalion are the more neceffary, becaufe he has been found by experience to communicate to his offspring almoft all his good or bad qualities, whether natural or acquired.

The mare contributes lefs to the beauty of her offfpring than the ftalion; but fhe contributes perhaps more to their conftitution and ftature: for thefe reafons, it is neceffary that the mares for breed be perfectly found, and make good nurfes. For elegant horfes, the Spanifh and Italian mares are beft; but, for draught-horfes, thofe of Britain and Normandy are preferable. However, when the ftalions are good, the mares of any country will produce fine horfes, provided they be well made and of a good breed.

Mares go with young eleven months and fome days. They bring forth ftanding; contrary to the courfe of moft other quadrupeds, who lie during this operation. They continue to bring forth till the age of 16 or 18 years; and both horfes and mares live between 25 and 30 years. Horfes caft their hair once a year, generally in the fpring, but fometimes in the autumn. At this time they are weak, and require to be better fed and taken care of than at any other feafon.

In Perfia, Arabia, and moft eaftern countries, they never geld their horfes, as is done in Europe and China. This operation greatly diminifhes their ftrength, courage, and fpirit; but it makes them good humoured, gentle, and tractable. With regard to the time of performing this operation, the practice of different countries is different: fome geld their horfes when a year old, and others at 18 months. But the beft and moft general practice is to delay the operation till they be two years old at leaft; becaufe, when the gelding is delayed for two years or more, the animals retain more of the ftrength and other qualities which naturally belong to the male.

As the utility of horfes furpaffes that of all other domeftic animals, it may be of ufe to fubjoin fome marks by which the age and other properties of horfes may be diftinguifhed.

The firft teeth that appear are four, two above and two below, which are called foal-teeth, and may be eafily diftinguifhed from the others by their whitenefs. The reft come out aftewards till they are twelve in number, fix above and fix below. When a colt is between two years and a half and three years old he cafts four of thefe teeth, two above and two below. Thefe we call nippers or gatherers, and are much longer and larger than the fore teeth; with thefe he nips off the grafs, and pulls the hay from the rack. When thefe are complete, the horfe will be three years old, or fomewhat more.

When he is about four, he cafts again two above and two below, one on each fide the nippers; fo that now there are no fore-teeth remaining but the corner-teeth; and hence it may be concluded that he is about four years old. The tufks appear next after thefe, and are a little crooked. Thofe below come out before thofe on the upper jaw, and at four years old they are very fmall. When all the colt-teeth are caft, and the corner-teeth begin to fhew themfelves, then the horfe comes five.

From five to five and a half the corner teeth remain hollow within, and are not quite filled up till the horfe is fix. At five and a half they are about a quarter of an inch high, and when he is full fix near half an inch. Every thing that is to be examined at fix years old, are the corner-teeth and the tufks. That part of the corner-teeth that had flefh in it firft turns to a brownifh fpot, like the eye of a garden-bean. At feven the mark or fpot becomes faint, and the tooth more even. At eight it quite difappears, though it poffibly may remain in a very fmall degree for two or three years more, which has deceived many. The longer the corner teeth are, the older is the horfe; and they are apt to grow foul and turn yellow. When the mark is gone, if you touch the tufks on the upper jaw with your finger, and find it worn away and equal with the palate, you may certainly judge that the horfe is ten years old at leaft. Laftly, when the flanks of a horfe are much funk, the feet broken and fpoiled, the pace bad, and the eye-pits very yellow, you may certainly conclude the horfe is confiderably advanced in years.

When the horfe is without blemifh, the legs and thighs are clean, the knees ftrait, the fkin and fhank thin, and the back finew ftrong and well braced. The finews and the bones fhould be fo diftinct, as to make the legs appear thin and lathy, not full and round. The paftern joints fhould never be large and round;

nor

nor muſt there be any ſwelling near the coronet. The hocks ſhould be lean and dry, not puffed up with wind. With regard to the hoof, the coronet ſhould be equally thick, and the horn ſhining and greyiſh. A white horn is a ſign of a bad foot, for it will wear out in a ſhort time; and likewiſe when the horn is thin, it is liable to be ſpoiled in ſhoeing, and by travelling hard on ſtony grounds. This is beſt known when the ſhoe is taken off; for then the verge all round the ſole will appear thin, and the horſe will wince at the leaſt touch of the pincers.

A ſtrong foot has the fibres of the hoof very diſtinct running in a direct line from the coronet to the toe, like the grain of wood. In this caſe care muſt be taken to keep the foot moiſt and pliable. The greateſt inconvenience attending a hard ſtrong foot, is its being ſubject to rifts and fiſſures, which cleave the hoof quite through ſometimes from the coronet down to the bottom.

A narrow heel is likewiſe a defect; and when it is not above two fingers in breadth the foot is bad. A high heel cauſes a horſe to trip and ſtumble often; and the low one, with long yielding paſterns, is very apt to be worn quite away on a journey. Too large a foot in proportion to the reſt of the body, renders a horſe weak and heavy.

The head of a horſe ſhould be ſmall, and rather lean than fleſhy. The ears ſhould be ſmall, erect, thin, ſprightly, and pointed. The forehead, or brow, ſhould be neither too broad nor too flat, and ſhould have a ſtar or ſnip thereon. The noſe ſhould riſe a little, and the noſtrils ſhould be wide that he may breath more freely. The muzzle ſhould be ſmall, and the mouth neither too deep nor too ſhallow. The jaws ſhould be thin, and not approach too near together at the throat, nor too high upwards towards the onſet, that the horſe may have ſufficient room to carry his head in an eaſy graceful poſture. The eyes ſhould be of a middle ſize, bright, lively, and full of fire. The tongue ſhould be ſmall, that it may not be too much preſſed by the bit; and it is a good ſign when his mouth is full of white froth, for it ſhews that he will not ſoon be overheated.

The neck ſhould be arched towards the middle, growing ſmaller by degrees from the breaſt and ſhoulders to the head. The hair of the main ſhould be long, ſmall, and fine; and if it be a little frizzled, ſo much the better. The ſhoulders ſhould be pretty long, the withers thin, and enlarge gradually from thence downwards; but ſo as to render his breaſt neither too narrow nor too groſs. A thick-ſhouldered horſe ſoon tires, and trips and ſtumbles every minute; eſpecially if he has a thick large neck at the ſame time. When the breaſt is ſo narrow that the fore-thighs almoſt touch, they are never good for much. A horſe of a middle ſize ſhould have the diſtance of five or ſix inches between his fore-thighs, and there ſhould be leſs diſtance between his feet than his thighs near the ſhoulders when he ſtands upright.

The body or carcaſe of a horſe ſhould be of a middling ſize in proportion to his bulk, and the back ſhould ſink a little below the withers; but the other parts ſhould be ſtrait, and no higher behind than before. He ſhould alſo be home-ribbed; but the ſhort ribs ſhould not approach too near the haunches, and then he will have room to fetch his breath. When a horſe's back is ſhort in proportion to his bulk, and yet otherwiſe well limbed, he will hold out a journey tho' he will travel ſlow. When he is tall, at the ſame time with very long legs, he is but of little value.

The wind ſhould never be overlooked in the choice of a horſe; and it may eaſily be known by his flanks, if he is broken-winded, when he ſtands quiet in the ſtable; becauſe he always pinches them in with a very ſlow motion, and drops them ſuddenly. A thick-winded horſe fetches his breath often, and ſometimes rattles and wheezes. This may be always diſcovered when he is put to briſk exerciſes.

The temper of a horſe ſhould always be obſerved; a vicious horſe generally lays his ears cloſe to his pole, ſhews the whites of his eyes, and looks ſullen and dogged. An angry horſe may be known by his frowning looks; and he generally ſeems to ſtand in a poſture of defence. When he is very vicious, he pays no regard to the groom that feeds him: However, ſome horſes that are tickliſh will lay back their year ears, and yet be of a good diſpoſition. A fearful horſe is apt to ſtart, and never leaves it off till he is old and uſeleſs. A fretful horſe is very unfit for a journey; and you may diſcover his temper as ſoon as he gets out of the ſtable. A dull, heavy, ſluggiſh horſe may be eaſily known, whatever tricks are uſed to rouſe his ſpirits.

With regard to the colour of a horſe, the bright bay, and indeed all kinds of bays in general, are accounted a good colour. The cheſnut horſe is generally preferable to the ſorrel, unleſs the former happens to be bald, or party-coloured with white legs. Brown horſes have generally black manes and tails, and their joints are of a ruſty black. Thoſe of this colour that are dappled are much handſomer than the reſt. Horſes of a ſhining black, and well-marked, without too much white, are in high eſteem for their beauty. A ſtar, or blaze, or white muzzle, or one or more feet tipped with white, are thought to be rather better than thoſe that are quite black.

Of greys, the dappled are accounted beſt; though the ſilver grey makes a more beautiful appearance, and often prove good. The iron grey with white manes and tails are thought not to be ſo hardy. Greys of every kind will turn white ſooner or later; but the nutmeg grey, when the dappled parts incline to bay or cheſnut, are ſaid to be good hardy horſes. Roan horſes have a diverſity of colours mixed together; but the white is more predominant than the reſt. They are all generally hardy, and fit for the road; and ſome are exceeding good. Thoſe of a ſtrawberry colour moſt reſemble the ſorrel, and they are often marked with white on the face and legs. When the bay is blended with it, he ſeems to be tinctured with claret; and ſome of theſe prove to be very good. Dun, ſallow, and cream-coloured horſes have a liſt down their backs; and their manes and tales are black.

Dun

Dun horſes are ſeldom choſen by gentlemen, and yet they may be very uſeful to the country farmer. The fallow and cream-coloured are better eſteemed, both for beauty and uſe. Thoſe horſes that are finely ſpotted with gay colours like leopards are a great rarity, and for that reaſon are only in the hands of great men.

There is ſome difference in horſes according to the different countries where they are bred. For inſtance, in France, thoſe of Bretagne are pretty ſtrong made, and have generally black hair, or brown bay; and they have good legs and feet, with a hardy mouth, and a head ſhort and fleſhy; but in general they are pretty clumſy. The horſes of Franche Compté are ſaid to have the legs of tigers, and the belly of a hind; but they are ſhort and thick, and of a middle ſize; being much more proper for drawing than riding. The horſes of Gaſcony are not unlike thoſe of Spain; but they are not ſo handſome, nor ſo active, and therefore they are more proper to draw carriages. The Limoſin horſes are very vicious, and are good for little till they are ſix years old. Their colour is generally bay, or a bay brown. The horſes of Normandy are much like thoſe of Bretagne; and thoſe of Poitou have good bodies, legs, feet, and eyes; but they are far from being handſome.

The horſes of Germany are much better and more handſome than thoſe of the Low countries. They are of great uſe for carriages; but much more for the army, and for drawing the artillery. They have a great deal of hair, eſpecially about the legs. They are not large, but they are well ſet; and yet they have tender feet. The Hungarian horſes are excellent for the coach, as well as for riding; but they are large, though well proportioned, and they are of all colours, and in general very ſwift.

The Britiſh horſes are of all kinds, they having been brought at firſt from different countries; but for racers no country can equal them, they having been bred from what are called barbs. The Daniſh horſes are low, ſhort, and ſquare; but they have a fine head, and ſhort hair. The horſes of the Low countries are very fit for the coach, and they are beſt known by the name of Flanders mares. The Poliſh horſes are like the Daniſh; only they have not ſo fine a fore-hand: their colour is generally a bright bay, and that of the outward peel of an onion; and they are fiery and vicious. The horſes of Switzerland are pretty much like thoſe of Germany; which is no wonder, ſince the Germans purchaſe a great number of them. The horſes of Piedmont are of a middle ſize, and of all ſorts of colours; their legs are good and handſome, their eyes fine, their ears ſmall, and their mouths good; but they do not carry their heads well.

The horſes of Naples and Italy are generally ill made, and lean; and yet they are good and uſeful; for they are light and proper for racing, though not for a long courſe; they never do well in a colder climate. The Spaniſh horſes are very well made, and handſome, as well as very active and nimble; they have good eyes, handſome legs and heads, and are eaſily managed; they are alſo good for racing if they are well kept: however, they are not ſo good in northern climates as in their own country. The Turkiſh horſes are of different ſhapes; but they are generally ſwift, though their mouths are bad. Moſt of them are white; tho' there are other colours; and they are large, hardy, ſtrong, and fit for the road.

The horſes of Barbary, commonly called barbs, have ſtrong hoofs, and are more proper for racing than any others whatever: ſome have ſaid they never grow old, becauſe they preſerve their vigour to the laſt. They are excellent ſtallions; and ſome of them are uſed as ſuch in Britain: however, the Arabian horſes are not quite ſo good as the Barbary, though ſome think they are both of the ſame kind; only thoſe that are uſed to the deſerts of Arabia are always in action. The horſes of the gold-coaſt of Guinea are very few in number, and in other parts of that coaſt there are none at all; for many of the negroes, when they have been firſt brought over to our American plantations, have expreſſed great admiration at the ſight of a horſe, and even been afraid to come near one.

The horſes of the Cape of Good Hope were originally brought from Perſia; and they are generally ſmall and of a cheſnut colour; for thoſe that are natives of that country are all wild, and could never yet be tamed. The horſes of China are good, and more particularly thoſe in the province Yun Nan, for they are very vigorous, though a little low. The horſes of the Eluth Tartars are good and full of fire; and their ſize is much the ſame as the Poliſh horſes: they are afraid of nothing, not even of lions and tigers; but perhaps this may be owing to uſe. In the country of the Mogul they are very numerous, and of all colours: they are generally of the middle ſize, tho' there are ſome as large and as handſome as thoſe in Europe. The wild horſes of Tartary differ little from the tame; but they are ſo ſwift, that they avoid the arrows of the moſt ſkilful hunters. [Plate LXXV. fig. 1.]

For the method of training and managing horſes, ſee HORSEMANSHIP; and for their diſeaſes and cure, ſee FARRIERY.

2. The aſs is likewiſe a domeſtic animal, and eaſily diſtinguiſhed from the horſe at firſt ſight; we never confound theſe two animals, even though they ſhould happen to be of the ſame colour and ſtature; however, when we view the different parts of the aſs, whether the external or internal, and compare them with the correſponding parts of the horſe, the reſemblance of theſe parts is ſo perfect, that we are ſurpriſed to find the individuals ſo different and ſo eaſily diſtinguiſhable by the eye. From this circumſtance, ſome naturaliſts have conſidered the aſs and the horſe to be the ſame ſpecies of animals; and t[illegible] the ſmall differences between them are accidental, or owing to the influence of climate, culture, &c. Linnæus's ſpecific mark of the horſe is, that the whole tail is covered with long hair; and his ſpecific mark of the aſs is, that the tail has long hair only towards the point, and a black croſs over the ſhoulders. On the other hand, when we conſider the differences in the temper, the manners and diſpoſitions of theſe two animals, and, above all, the impoſſi-

impoſſibility of mixing them ſo as to produce a common or intermediate ſpecies capable of propagating and tranſmitting in the ſame manner as other diſtinct ſpecies, the notion that the horſe and the aſs are the ſame ſpecies will appear to be without any ſolid foundation. Beſides, the aſs differs materially from the horſe in the thickneſs of the head, the length of the ears, the hardneſs of the ſkin, and in the voice, the diſpoſitions, the manner of drinking, *&c.* With regard to animals, there is perhaps but one permanent and uniform ſpecific diſtinction in nature: a male and female of different ſpecies may copulate, may produce a third animal reſembling both, but very different from either: but here nature has put a final ſtop to all further procreation: the third animal, although it be ſeemingly furniſhed with every thing neceſſary for propagating, remains for ever barren. Now, the horſe may be made to copulate with the aſs; a mule, or mixture of the two, is the fruit of the unnatural embrace: but the impregnation of a mule is found by experience to be altogether impoſſible.

The aſs, therefore, is a diſtinct ſpecies, and his race as ancient as that of the horſe. Why then ſhould this uſeful, patient, ſober animal be ſo much deſpiſed? We are apt to compare him, on every occaſion, with the horſe, and from this compariſon are led to very falſe and unfavourable concluſions. The horſe is educated with great care and expence; while the poor aſs, abandoned to the abuſe of the meaneſt ſervants or the cruelty of children, inſtead of deriving benefit from inſtruction, loſes in effect his natural good qualities by the bad treatment he ſuffers. He is the ſport and buffet-block of every ruſtic, who beat and overload him without mercy or diſcretion. They never conſider, that the aſs would be the moſt uſeful, the beſt made, and moſt diſtinguiſhed of all animals, if there were no horſes in the world.

The aſs is as humble, patient, and tranquil, as the horſe is bold, ardent, and impetuous. He ſubmits with firmneſs, perhaps with magnanimity, to ſtrokes and chaſtiſement; he is temperate both as to the quantity and quality of his food; he contents himſelf with the rigid and diſagreeable herbage which the horſe and other animals leave to him, and diſdain to eat: he is more delicate with regard to his drink, never uſing water, unleſs it be perfectly pure. As his maſter does not take the trouble of combing him, he often rolls himſelf on the turf among thiſtles, ferns, *&c.* Without regarding what he is carrying, he lies down to roll as often as he can, ſeeming to reproach his maſter for neglect and want of attention.

When very young, the aſs is a gay, ſprightly, nimble, and gentle animal. But he ſoon loſes theſe qualities, probably by the bad uſage he meets with; and becomes lazy, untractable, and ſtubborn. When under the influence of love, he becomes perfectly furious. The affection of the female for her young is ſtrong: Pliny aſſures us, that when an experiment was made to diſcover the ſtrength of maternal affection in a ſhe-aſs, ſhe run through the flames in order to come at her colt.

Although the aſs be generally ill uſed, he diſcovers a great attachment to his maſter; he ſmells him at a diſtance, ſearches the places and roads he uſed to frequent, and eaſily diſtinguiſhes him from the reſt of mankind. The aſs has a very fine eye, an excellent ſcent, and a good ear. When overloaded, he hangs his head, and ſinks his ears: when too much teaſed or tormented, he opens his mouth and retracts his lips in a diſagreeable manner, which gives him an air of ridicule and deriſion. If you cover his eyes, he will not move another ſtep; if you lay him on his ſide, and place his head ſo that one eye reſts on the ground, and cover the other with a cloth, he will remain in this ſituation without making any attempt to get up. He walks, trots, and gallops in the ſame manner as the horſe; but all his motions are ſlower. Whatever be the pace he is going at, if you puſh him, he inſtantly ſtops.

The cry of the horſe is known by the name of *neighing;* that of the aſs, by *braying*, which is a long, diſagreeable noiſe, conſiſting of alternate diſcords from ſharp to grave and from grave to ſharp: he ſeldom cries but when preſſed with hunger or love: the voice of the female is clearer and more piercing than that of the male.

The aſs is leſs ſubject to vermin than other animals covered with hair; he is never troubled with lice, probably owing to the hardneſs and drineſs of his ſkin; and it is probably for the ſame reaſon, that he is leſs ſenſible to the whip and ſpur than the horſe.

The teeth of the aſs fall out and grow at the ſame age and in the ſame manner as thoſe of the horſe; and he has nearly the ſame marks in his mouth.

Aſſes are capable of propagating when two years old. The females are in ſeaſon during the months of May and June. The milk appears in the dugs ten months after impregnation; ſhe brings forth in the twelfth month, and always one at a time. Seven days after the birth, the ſeaſon of the female returns, and ſhe is again in a condition to receive the male. The colt ſhould be taken from her at the end of five or ſix months, that the growth and nouriſhment of the fœtus may not be obſtructed. The ſtallion or jack-aſs ſhould be the largeſt and ſtrongeſt that can be found; he ſhould be at leaſt three years old, and never ought to exceed ten.

The aſs, like the horſe, takes three or four years in growing, and lives till he be 25 or 30: he ſleeps leſs than the horſe, and never lies down to ſleep but when exceſſively fatigued. He is more robuſt, and leſs ſubject to diſeaſes than the horſe.

Travellers inform us that there are two ſorts of aſſes in Perſia; one of which is uſed for burdens, they being ſlow and heavy; and the other is kept like horſes for the ſaddle, for they have ſmooth hair, carry their head well, and are much quicker in their motion; but when they ride them, they ſit nearer their buttocks than when on a horſe: they are dreſſed like horſes, and are taught to amble like them; but they generally cleave their noſtrils to give them more room for breathing. Dr Ruſſell likewiſe tells us they have two ſorts in Syria, one of which is like ours, and the other very large, with remarkable long ears; but they are both put to the ſame uſe, which is, to carry burdens.

The

The onager, or wild aſs, has, by ſome authors, been confounded with the zebra; but very improperly, for this laſt is a diſtinct ſpecies; for the onager is not ſtreaked like this, nor is his ſhape ſo beautiful. Wild-aſſes are ſaid to be very ſwift of courſe; and when they ſee a man, they make a bound, and immediately fly away; inſomuch, that there is no taking of them, but by traps and gins. They have much the ſame ſhape as common aſſes; but they are of a brighter colour, and there runs a white liſt from the head to the tail. Of the hide of theſe aſſes, and particularly of that part next the rump, they make that excellent leather which we call ſhagreen, and which is put to ſo many curious uſes.

In America they have no aſſes at all, nor yet horſes; but they have been carried thither long ago, at firſt by the Spaniards, and afterwards by other nations, where they have multiplied greatly; inſomuch, that, in ſome places, there are whole droves of them that run wild, and are very hard to be caught. Aſſes in general carry the heavieſt burdens in proportion to their bulk; and, as their keeping coſts little or nothing, it is a great wonder they are not put to more uſes than they generally are among us.

The fleſh of the common aſs is never eaten in theſe parts of the world; though ſome pretend their colts are tender, and not diſagreeable. [Plate LXXV. fig. 2.]

3. The zebra.—This animal has the figure and gracefulneſs of the horſe, joined to the ſwiftneſs of the ſtag. He is about 7 feet long, from the point of the muzzle to the origin of the tail, and about 4 feet high. The colour of his ſkin is beautiful and uniform, conſiſting of alternate parallel rings of black and white diſpoſed in the moſt regular manner, as repreſented in the plate, [LXXV. fig. 3.] He is generally leſs than the horſe, and larger than the aſs.

The Zebra is found no where but in the eaſtern and ſouthern provinces of Africa, from Æthiopia to the Cape of Good Hope, and from the Cape of Good Hope to Congo. The Dutch have been at great pains to tame and uſe them for domeſtic purpoſes, but with little ſucceſs. He is hard-mouthed, and kicks when any perſon attempts to touch or come near him. He is reſtleſs and obſtinate as a mule: but perhaps the wild horſe is naturally as untractable as the Zebra; for, it is probable, if he were early accuſtomed to obedience and a domeſtic life, he would become as docile as the horſe.

ERANARCHA, a public officer among the ancient Greeks, whoſe buſineſs was to preſide over and direct the alms and proviſions made for the poor. Cornelius Nepos, in his life of Epaminondas, deſcribes his office thus: when any perſon was reduced to poverty, taken captive, or had a daughter to marry, which he could not effect for want of money, *&c.* the eranarcha called an aſſembly of friends and neighbours, and taxed each according to his means and eſtate, to contribute towards his relief.

ERANTHEMUM, in botany, a genus of the diandria monogynia claſs. The calix is divided into five ſegments; the tube is filiform; and the ſtigma is ſimple. There is but one ſpecies, a native of Æthiopia.

ERASED, in heraldry. See ARRACHE.

ERECTION, in a general ſenſe, the art of raiſing or elevating any thing, as the erection of a perpendicular, *&c.* It is alſo uſed in a figurative ſenſe, as the erection of a biſhopric, marquiſate, *&c.*

ERECTOR CLITORIS. See CLITORIS.

ERECTOR PENIS. See PENIS.

EREMIT. See HERMIT.

EREMITA, in zoology. See SCARABÆUS.

ERFURT, a large and beautiful city of Upper Saxony in Germany, capital of Thuringia, and ſubject to the elector of Mentz: E. long. 11° 6′, N. lat. 51°.

ERGOT, in farriery, is a ſtub, like a piece of ſoft horn, about the bigneſs of a cheſnut, placed behind and below the paſtern joint, and commonly hid under the tuft of the fetlock.

ERICA, or HEATH, in botany, a genus of the octandria monogynia claſs. The calix conſiſts of four leaves, and the corolla of four ſegments; the filaments are inſerted into the receptacle; the antheræ are bifid; and the capſule has four cells. There are thirty-eight ſpecies, five of which are natives of Britain, *viz.* the vulgaris, or common heath; the cinerea, or fine-leaved heath; the tetralix, or croſs-leaved heath; the ciliaris, or rough-leaved heath; and the multiflora, or fir-leaved heath.

ERIDANUS, in aſtronomy. See Vol I. p. 487.

ERIE, a vaſt lake to the weſtward of Penſilvania, in North America, ſituated between 80° and 87° W. long. and between 41° and 42° N lat.

ERIGERON, or SWEET FLEA BANE, in botany, a genus of the ſyngeneſia polygamia ſuperflua claſs. The receptacle is naked; the pappus is hairy; and the radii of the corolla are linear and very narrow. There are ſixteen ſpecies, two of which are natives of Britain, *viz.* the acre, or blue-flowered flea-bane; and the canadenſe, or Canada flea-bane.

ERINACEUS, or HEDGE-HOG, in zoology, a genus of quadrupeds belonging to the order of feræ, the characters of which are theſe: they have two foreteeth in the upper-jaw, at a conſiderable diſtance from one another, and two in the under jaw, leſs diſtant; and they have two recumbent dog-teeth, one on each ſide. There are three ſpecies, *viz.* 1. The europæus, or common hedge-hog, with round ears, and creſted noſtrils. It is about nine inches long; the upper part of the body is totally covered with ſharp prickles, and the under part is covered with hair. The hedge-hog, even when ſtanding on his legs, has a very ugly aſpect. His body is an oblong maſs, convex above, terminated on the fore-part by a very ſharp muzzle, and mounted on four ſhort legs, of which nothing appears but the feet, and the tail is not diſcernible. His ears are broad, round, and ſhort; and his eyes are ſmall and protuberant. The length of his body, from the point of the muzzle to the anus, is about nine inches.

The hedge-hog has a very uncommon method of defending himſelf from the attacks of other animals: being poſſeſſed of little ſtrength or agility, he does not attempt to fly from or aſſail his enemies; but erects his briſtles, and rolls himſelf up like a ball, expoſing no

part

part of his body that is not furnished with sharp weapons of defence; he will not unfold himself, unless thrown into water: the more he is frightened or harassed, the closer he shuts himself up, and frequently discharges his urine, which has a very fœtid an loathsome smell. While in this state, most dogs, instead of biting him, stand off and bark, not daring to seize him; or, if they attempt it once, their mouths are so pricked with his bristles, that they cannot be prevailed on to attempt it a second time. Both the male and female are covered with bristles from the head to the tail. These bristles are of great use in defending them from other animals; but must be very inconvenient when they incline to copulate. This operation they cannot perform in the manner of other quadrupeds; but do it face to face, either standing on end, or the female lying on her back. The females come in season in the spring, and bring forth their young in the beginning of summer. They commonly bring forth three or four, and sometimes five, at a time. The young ones are of a whitish colour, and only the points of the bristles appear above the skin. It is impossible to tame them: the mother and her young have frequently been confined together, and furnished with plenty of provisions: but, instead of nourishing them, she uniformly devoured them one after another. Males and females have likewise been kept in one apartment, where they lived, but never copulated. Hedge-hogs feed upon fallen fruits, some roots, and insects: they are very fond of flesh-meat, whether raw or roasted. They frequent woods, and live under the trunks of old trees, in the chinks of rocks, or under large stones. Naturalists alledge that they go into gardens, mount the trees, and come down with pears, apples, or plumbs, stuck upon their bristles. But this is a mistake: although kept in a garden, they never attempt to climb trees, or stick even fallen fruit upon their bristles, but lay hold of their food with their mouth. They never come out of their holes in the day, but go about in quest of food during the night. They eat but little, and can live very long without taking any nourishment. They do not lay up any store of provisions in harvest; such an instinct would be useless, as they sleep all the winter. See Plate LXXIV. fig. 6.

2. The inauris, or white hedge-hog, has no external ears. It is a native of America.

3. The malacensis, has hanging ears, and is a native of Asia

ERINGO, in botany. See ERYNGIUM.

ERIOCAULON, in botany, a genus of the triandria trigynia class. The common calix has an imbricated capitulum; it has three equal petals: and the stamina are above the germen. There are five species, none of them natives of Britain.

ERIOCEPHALUS, in botany, a genus of the syngenesia polygamia necessaria class. The receptacle is somewhat hairy; it has no pappus; the calix consists of six equal petals: and there are five floscules in the radius. There are two species, none of them natives of Britain.

ERIOPHORUM, in botany, a genus of the triandria monogynia class. The gluma is paleaceous, and imbricated on each side; the corolla is wanting; and there is but one seed, surrounded by long down.

ERITHACUS, in ornithology See MOTACILLA.

ERIVAN, a city of Persia, on the frontiers of Turky, situated on the south end of a lake of the same name: E. long. 45°, N. lat. 40° 16′.

ERKELENS, a city of Westphalia, in Germany, ten miles north of Juliers: E. long. 6°, N. lat. 51°.

ERMIN, in zoology. See MUSTELA.

ERMIN, in heraldry, is always argent and sable, that is, a white field, or fur, with black spots. These spots are not of any determinate number, but may be more or less, at the pleasure of the painter, as the skins are thought not to be naturally so spotted; but serving for lining the garments of great persons, the furriers were wont, in order to add to their beauty, to sew bits of the black tails of the creatures that produced them, upon the white of their skin, to render them the more conspicuous, which alteration was introduced into armory. See Plate LXXIV. fig. 7.

ERMIN, or EARS OF CORN, an order of knights in France, instituted by Francis the last of that name, duke of Britany.

This order was so called on account that the collar of it was made up of ears of corn, lying athwart one another in saltier, bound together, both above and below, each ear being crossed twice, the whole of gold. To this collar there hung a little white beast, called an ermin, running over a bank of grass diversified with flowers.

ERMINE′, or CROSS ERMINE′, is one composed of four ermin spots, placed as represented in Plate LXXIV. fig. 8.

It is to be observed, that the colours in these arms are not to be expressed, because neither this cross nor these arms can be of any other colour but white and black.

ERMINITES should signify little ermines, but it is otherwise; for it expresses a white field powdered with black, only that every such spot hath a little red hair on each.

Erminites also signify a yellow field powdered with black, which the French express much better by *or semée d'ermine de sable*.

EROSION, among physicians, denotes much the same with corrosion, only in a stronger degree. See CORROSION, and CORROSIVES.

EROTIC, in general, any thing relating to the passion love.

ERRATIC, in general, something that wanders, or is not regular: hence it is the planets are called erratic stars.

ERRHINES, in pharmacy, medicines which, when snuffed up the nose, promote a discharge of mucus from that part.

ERROUR, ERROR, a mistake of our judgment, giving assent to that which is not true.

Mr Locke reduces the causes of error to these four; first

first, want of proofs; secondly, want of ability to use them: thirdly, want of will to use them; and fourthly, wrong measures of probability.

ERUCA, in general, denotes caterpillars of all kinds. See Natural History, *Of insects*.

Eruca, the White rocket, in botany. See Brassica.

Eruca marina. See Aphrodita.

ERUCAGO, in botany. See Bunias.

ERUDITION denotes an extensive acquaintance with books, especially such as treat of the belles lettres.

ERVI species, in botany. See Sophora.

ERUPTION, in medicine, a sudden and copious excretion of humours, as pus or blood: it signifies also the same with exanthema, any breaking out, as the pustules of the plague, small-pox, measles, *&c.* See Medicine.

ERVUM, in botany, a genus of the diadelphia decandria class. The calix consists of five segments of an equal length with the corolla. There are six species, three of which are natives of Britain, *viz.* the soloniense, or spring tare; the tetraspermum, or smooth tare; and the hirsutum, or hairy tare.

ERINGIUM, Eringo, in botany, a genus of the pentandria digynia class. The flowers are capitated, and the receptacle is paleaceous. There are ten species, two of which are natives of Britain, *viz.* the maritimum, or sea-holly eringo; and the campestre, or common eringo. The root of the sea-holly is said to be aperient, diuretic, and aphrodisiac.

ERYSIMUM, in botany, a genus of the tetradynamia siliquosa class. The pod is four-sided, divided into two cells. There are six species, four of which are natives of Britain, *viz.* the officinale, or hedge-mustard; the cheirianthoides, or treacle worm-seed; the barbarea, rocket, or winter-cresses; and the alliaria, Jack-by-the-hedge, or sawce-alone. The leaves of the hedge-mustard are said to promote expectoration, and to excite urine and other excretions.

ERYSIPELAS, in medicine, an eruption of a fiery or acrid humour, from which no part of the body is exempted, though it chiefly attacks the face. See Medicine.

ERYTHRINA, in botany, a genus of the diadelphia decandria class. The calix is bilabiated; and the corolla consists of a long lanceolated vexillum. There are three species. none of them natives of Britain.

ERYTHRINUS, in ichthyology, a species of sparus. See Sparus.

ERYTHROIDES, in anatomy, the first of the proper tunics or coats which cover the testicles. See Anatomy, p. 170.

ERYTHRONIUM, Dog's-tooth violet, in botany, a genus of the hexandria monogynia class. The corolla is bell-shaped, and consists of six petals; there are two nectariferous tubercles at the base of every second petal. There is but one species, a native of Germany.

ERYTHROPHTHALMUS, in ichthyology, a species of cyprinus. See Cyprinus.

ERZERUM, the capital of the province of Turcomania, or Armenia: E. long. 41°, N. lat. 40°. It is a great thoroughfare from Persia and India to Constantinople, by the way of Trebisond and the Black-sea.

ESCHAR, in surgery, the crust or scab occasioned by burns or caustic medicines.

ESCHAROTICS, in pharmacy, medicines which produces eschars. See Eschar.

ESCHEAT, in Scots law, is that forfeiture which is incurred upon a person's being denounced rebel. It is either single or liferent: single escheat is the forfeiture of the rebel's moveable estate; liferent escheat is the forfeiture of the rents of his heritable estate, during his life. See Scots Law, title 12.

ESCHRAKITES, in matters of religion, a sect of Mahometans, who believe that man's sovereign good consists in the contemplation of God. They avoid all manner of vice, and appear always in good humour, despising the sensual paradise of Mahomet. The most able preachers, in the royal mosques, are of this sect.

ESCLATTE', in heraldry, signifies a thing forcibly broken, or rather a shield that has been broken and shattered with the stroke of a battle-ax.

ESCUAGE, in our old customs, a kind of knight-service, called service of the shield, by which the tenant was bound to follow his lord to the wars at his own charge.

ESCULENT, an appellation given to such plants as may be eaten. See Botany, p. 628.

ESCULUS, in botany. See Quercus.

ESCURIAL, a palace of the king of Spain, twenty-one miles north-west of Madrid; being one of the largest and most beautiful in the world. It has eleven thousand windows, fourteen thousand doors, one thousand eight hundred pillars, seventeen cloysters or piazzas, and twenty-two courts; with every convenience and ornament that can render a place agreeable in so hot a climate, as an extensive park, groves, fountains, cascades, grottos, *&c.*

ESCUTCHEON, or Scutcheon, in heraldry, is derived from the French *escusson*, and that from the Latin *scutum*, and signifies the shield whereon coats of arms are represented.

Most nations, of the remotest antiquity, were wont to have their shields distinguished by certain marks painted on them; and to have such on their shields was a token of honour, none being permitted to have them till they had performed some honourable action.

The escutcheon, as used at present is square, only rounded off at the bottom.

ESDRAS, the name of two apocryphal books, usually bound up with the scriptures. They were always excluded the Jewish canon, and are not admitted as canonical by the papists themselves.

ESENS, a town of Westphalia, twenty-five miles north of Embden.

ESK, a river which forms part of the boundary between England and Scotland; and, running from north east to south-west, falls into the Solway frith: it gives name to the country of Eskdale.

ESKIMAUX, ſometimes called New Britain, and Terra de Labrador, is an extenſive country of North America, ſituated between 59° and 80° W. long. and between 50° and 64° N. lat.

It is bounded by Hudſon's ſtraits, which ſeparate it from Greenland, on the north; by the Atlantic ocean, on the eaſt; by the river and bay of St Laurence, on the ſouth-eaſt; and by Hudſon's bay, on the weſt.

ESLINGEN, an imperial city of Swabia in Germany, ſeven miles ſouth-eaſt of Stutgard.

ESOX, in ichthyology, a genus belonging to the order of abdominales. The body is elongated; the head is plainiſh above; the upper jaw is plain, and ſhorter than the under one, which is dotted; and the branchioſtege membrane has from ſeven to twelve rays. There are nine ſpecies.

ESPALIERS, in gardening, are rows of trees planted about a whole garden or plantation, or in hedges, ſo as to incloſe quarters or ſeparate parts of a garden; and are trained up regularly to a lattice of wood-work in a cloſe hedge, for the defence of tender plants againſt the injuries of wind and weather.

The trees chiefly planted for eſpaliers, are apples, pears, and ſome plumbs. See GARDENING.

ESPERIE, a city of Hungary, forty miles north of Tockay: it is remarkable for its ſalt mines.

ESPINAL, a town of Lorrain on the Moſelle, thirty-five miles ſouth-eaſt of Nancy.

ESPLANADE, in fortification, the ſloping of the parapet of the covered way towards the campaign.

ESPLEES, in law, the general products which lands yield, or the profit or commodity that is to be taken or made of a thing.

ESPOUSALS, in law, ſignify a contract or promiſe made between a man and a woman, to marry each other; and in caſes where marriage may be conſummated, eſpouſals go before. Marriage is termed an eſpouſal *de præſenti.*

ESQUIRE was anciently the perſon that attended a knight in time of war, and carried his ſhield.

This title has not for a long time, had any relation to the office of the perſon, as to carry arms, *&c.* Thoſe to whom the title of eſquire is now of right due, are all noblemens younger ſons, and the eldeſt ſons of ſuch younger ſons; the eldeſt ſons of knights, and their eldeſt ſons; the officers of the king's courts, and of his houſehold; counſellors at law, juſtices of the peace, *&c.* though thoſe latter are only eſquires in reputation: beſides, a juſtice of the peace holds this title no longer than he is in commiſſion, in caſe he is not otherwiſe qualified to bear it: but a ſheriff of a county, who is a ſuperior officer, retains the title of eſquire during life, in conſequence of the truſt once repoſed in him: the heads of ſome ancient families are ſaid to be eſquires by preſcription.

ESQUIRES *of the king*, are ſuch as have that title by creation, wherein there is ſome formality uſed, as the putting about their necks a collar of SS, and beſtowing on them a pair of ſilver-ſpurs, *&c.*

ESSAY, a trial or experiment for proving the quality of any thing; or an attempt to learn, whether or no any invention will ſucceed.

ESSAY, in literature, a peculiar kind of compoſition, the character whereof is to be free, eaſy, and natural; not tied to ſtrict order or method, nor worked up and finiſhed like a formal ſyſtem.

ESSAY-HATCH is the miner's term for a little trench or hole, which they dig to ſearch for ſhoad or ore.

ESSECK, a town of Hungary, near the confluence of the rivers Drave and Danube, with a bridge five miles over: it lies about eighty miles north-weſt of Belgrade.

ESSEN, a town of Weſtphalia, about ten miles north-eaſt of Duſſeldorp.

ESSENCE, in metaphyſics, that which conſtitutes the particular nature of each genus or kind, and diſtinguiſhes it from all others; being nothing but that abſtract idea to which this name is affixed; ſo that every thing contained in it, is eſſential to that particular kind.

ESSENES, or ESSENIANS, in Jewiſh antiquity, one of the three ancient ſects among that people. They allowed a future ſtate, but denied a reſurrection from the dead. Their way of life was very ſingular: they did not marry, but adopted the children of others, whom they bred up in the inſtitutions of their ſect: they deſpiſed riches, and had all things in common, and never changed their cloaths till they were entirely worn out. When initiated, they were ſtrictly bound not to communicate the myſteries of their ſect to others; and if any of their members were found guilty of enormous crimes, they were expelled.

Pliny tells us, that they dwelt on the weſt ſide of the lake of Aſphaltites; and that they were a ſolitary kind of men, living without women or money, and feeding upon the fruit of the palm-tree: he adds, that they were conſtantly recruited by new-comers, whom the ſurges of ill fortune had made weary of the world; in which manner the ſect was kept up for ſeveral thouſands of years, without any being born among them. The reaſon why we find no mention made of them in the New Teſtament, may be their recluſe and retired way of life, no leſs than their great ſimplicity and honeſty, whereby they lay open to no cenſure or reproof.

ESSENTIAL, ſomething neceſſarily belonging to a thing, from which it cannot be conceived diſtinct: thus the primary qualities of bodies, as extenſion, figure, number, *&c* are eſſential or inſeparable from them in all their changes and alterations.

ESSENTIAL OIL. See CHEMISTRY, p. 93.

ESSEX, a county of England, bounded by Suffolk, on the north; by the German ſea, on the eaſt; by the river Thames, which divides it from Kent, on the ſouth; and by Middleſex and Hertfordſhire, on the weſt.

ESSOIN, in law, an excuſe for a perſon ſummoned to appear and anſwer to an action, on account of the ſickneſs or other juſt cauſe of his abſence.

ESSORANT, in heraldry, denotes a bird ſtanding on the

the ground with its wings expanded, as if it had been wet, and were drying itſelf.

ESTATE, in law, ſignifies the title or intereſt that a perſon has in lands, tenements, or other effects.

Estates, in a political ſenſe, is uſed either to denote the dominions of ſome prince, or the general claſſes into which the people are divided.

In Britain, the eſtates are the king, lords, and commons; or rather the lords and commons, who meet the king in parliament, for reforming abuſes, and enacting good and wholeſome laws.

ELSETE', in heraldry, denotes the heads of beaſts torn off by main force. See Arache' and Erased.

ESTHER, a canonical book of the Old Teſtament, containing the hiſtory of a Jewiſh virgin, dwelling with her uncle Mordecai at Shuſhan, in the reign of Ahaſuerus, one of the kings of Perſia.

ESTOILE'E, or Cross estoille'e, in heraldry, a ſtar with only four long rays in form of a croſs; and, accordingly, broad in the centre, and terminating in ſharp points.

ESTONIA, a province ſubject to Ruſſia, on the north of Livonia.

ESTRAY, in law, any beaſt not wild that is found within a lordſhip, and owned by nobody.

ESTREMADURA, a province of Spain, bounded by Leon, on the north; by the two Caſtiles, on the eaſt; by Andaluſia, on the ſouth; and by the province of Alentejo, in Portugal, on the weſt.

Estremadura is alſo a province of Portugal, lying north of Alentejo, and weſtward of Spaniſh Eſtremadura. Liſbon is its capital, as alſo of the kingdom.

ESTREMOS, a town of Alentejo, in Portugal, eighty-five miles ſouth-eaſt of Liſbon.

ETCHING, a method of engraving on copper, in which the lines or ſtrokes, inſtead of being cut with a tool or graver, are eaten in with aquafortis.

Etching is done with more eaſe and expedition than engraving: it requires fewer inſtruments, and repreſents moſt kind of ſubjects better and more agreeable to nature, as landſcapes, ruins, grounds, and all ſmall, faint, looſe, remote objects, buildings, *&c.* See Engraving.

The method of etching is as follows: Chuſe the copperplate as directed for engraving, and furniſh yourſelf with a piece of ground, tied up in a bit of thin ſilk, kept very clean, to be laid upon the plate, when both have been warmed; proper needles, to hatch with on the ground; a pencil or bruſh, to wipe away the bits of ground which riſe after its hatching; a poliſher; two or three gravers; a pair of compaſſes, to meaſure diſtances and draw circles; a ruler, to hatch ſtraight lines; green wax, to make the wall round the edges of the plate, to contain the aquafortis; an oil-ſtone; a bottle of aquafortis; ſome red lead, to colour the back ſide of the copy; a ſtift, and a hand-vice, to hold the plate over the candle. See Needle, Graver, Polisher, Compass, *&c.*

To make the ground, take three ounces of aſphaltum, two ounces of clean roſin, half an ounce of Burgundy-pitch, three ounces of black wax, and three ounces of virgin-wax: let all theſe be melted in a clean earthern pipkin over a ſlow fire, ſtirring it all the time with a ſmall ſtick; if it burn to the bottom, it is ſpoiled. After the ingredients are well melted, and it boils up, put it into a pan of fair water; and before it be quite cold, take it out, and roll it into ſmall lumps to be kept from duſt: this ground is what others call the varniſh. The next thing is to clean the plate to receive the ground: take a piece of liſting, roll it up as big as an egg, tie it very tight, ſo as to make it a rubber; and having dropped a ſmall quantity of ſweet oil, and added a little powder of rotten ſtone on the plate, rub it with this ball, till it will almoſt ſhew your face, Then wipe it all off with a clean rag; and after that, make it quite dry with another clean rag and a little fine whitening.

The next thing is to lay on the varniſh; to do which aright you muſt take a hand-vice, and fix it at the middle of one part of the plate, with a piece of paper between the teeth of the hand-vice and the plate, to prevent the marks of the teeth: then laying the plate on a chaffing-diſh, with a ſmall charcoal fire in it, till the plate be ſo hot that, by ſpitting on the back-ſide, the wet will fly off: rub the plate with the ground tied up in ſilk, till it be covered all over; and after that daub the plate with a piece of cotton wrapped up in ſilk, till the ground be quite ſmooth, keeping the plate a little warm all the time. The varniſh being thus ſmoothed upon the plate, it muſt be blacked in the following manner: take a thick tallow candle that burns clear, with a ſhort ſnuff; and having driven two nails into the wall, to let it reſt upon, place the plate againſt the wall with the varniſh ſide downward, and take care not to touch the ground with your fingers: then taking the candle, apply the flame to the varniſh as cloſe as poſſible, without touching the varniſh with the ſnuff of the candle, and guide the flame all over it, till it become perfectly black. After this is done, and the plate dry, the deſign is traced with a needle through the varniſh, and a rim or border of wax is raiſed round the circumference of the plate; and then the artiſt has a compoſition of common varniſh and lamp-black made very thin, wherewith he covers the parts that are not to be bitten, by means of a hair-pencil. And he is every now and then covering or uncovering this or that part of the deſign, as occaſion may require; the conduct of the aquafortis being the principal concern, on which the effect of the print very much depends The operator muſt be attentive to the ground, that it does not fail in any part, and where it does to ſtop up the place with the above compoſition. The plate is defended from the aquafortis every where, but in the lines or hatches cut through it with the needle, through which the water eats into the copper to the depth required; remembering to keep it ſtirring with a feather all the while; which done, it is to be poured off again.

Single aquafortis is moſt commonly uſed; and if it be too ſtrong, mix it with vinegar, otherwiſe it will make the work very hard, and ſometimes break up the ground: the aquafortis having done its part, the ground

ground is taken off, and the plate washed and dried: after which nothing remains for the artist, but to examine the work with his graver, to touch it up, and heighten it where the aquafortis has missed.

And, lastly, it is to be remembered, that a fresh dip of aquafortis is never given, without first washing out the plate in fair water, and drying it at the fire.

ETERNITY, an attribute of God, expressing his infinite or endless duration.

According to Mr Locke, we come by the idea of eternity, by being able to repeat any part of time, as a year, as often as we will, without ever coming to an end.

ETHER. See ÆTHER.

ETHICS. See MORALS.

ETHIOPIA, or ÆTHIOPIA, a very extensive country of Africa, comprehending Abyssinia, Nubia, and Abex: it is bounded by Egypt, and the desart of Barca, on the north; by the Red sea and Indian ocean, on the east; by Anian, and the unknown parts of Africa, on the south; and by other unknown countries on the west.

ETHMOIDAL, in anatomy. See ANATOMY, p. 152.

ETHMOIDES os, in anatomy. See ANAT. p. 157.

ETNA, or mount GIBELLO, a vulcano, or burning mountain of Sicily, situated fifty miles south-west of Messina, and twenty west of Catania. See VULCANO.

ETYMOLOGY, that part of grammar which considers and explains the origin and derivation of words, in order to arrive at their first and primary signification. See GRAMMAR.

EVACUANTS, in pharmacy, are properly such medicines as diminish the animal fluids, by throwing out some morbid or redundant humour, or such as thin, attenuate, and promote the motion and circulation thereof.

EVACUATION, in medicine, the art of diminishing, emptying, or attenuating the humours of the body. See MEDICINE

EVANGELIST, a general name given to those who write or preach the gospel of Jesus Christ.

The word is of Greek origin, signifying one who publishes glad tiding, or is the messenger of good news.

According to Hooker, evangelists were presbyters of principal sufficiency, whom the apostles sent abroad, and used as agents in ecclesiastical affairs, wheresoever they saw need.

The term evangelist however is at present confined to the writers of the four gospels.

EVANID, a name given by some authors to such colours as are of no long duration, as those in the rainbow, in clouds before and after sun set, *&c.*

Evanid colours are also called fantastical and emphatical colours.

EVANTES, in antiquity, the priestesses of Bacchus, thus called, by reason, that in celebrating the orgia, they ran about as if distracted, crying, *Evan, evan, ohé evan.* See BACCHANALIA

EVAPORATION, in chemistry, the setting a liquor in a gentle heat to discharge its superfluous humidity, reduce it to a proper consistence, or obtain its dry remainder. See CHEMISTRY.

EVATES, a branch or division of the druids, or ancient Celtic philosophers. Strabo divides the British and Gaulish philosophers into three sects; bards, evates, and druids. He adds, that the bards were the poets and musicians; the evates, the priests and naturalists; and the druids were moralists as well as naturalists: But Marcellus and Hornius reduce them all to two sects, *viz.* the bards and druids.

EUBAGES, an order of priests, or philosophers, among the ancient Celtæ, or Gauls: some will have the eubages to be the same with the druids and saronidæ of Diodorus; and others, that they were the same with what Strabo calls evates.

EUCHARIST, the sacrament of the Lord's supper, properly signifies giving thanks.

This sacrament was instituted by Christ himself, and the participation of it called communion.

As to the manner of celebrating the eucharist among the ancient Christians, after the customary oblations were made, the deacon brought water to the bishops and presbyters, standing round the table, to wash their hands, according to that of the psalmist, "I will wash my hands in innocency, and so will I "compass thy altar, O Lord." Then the deacon cried out aloud, "Mutually embrace and kiss each "other;" which being done, the whole congregation prayed for the universal peace and welfare of the church, for the tranquillity and repose of the world, for the prosperity of the age, for wholesome weather, and for all ranks and degrees of men. After this followed mutual salutations of the minister and people; and then the bishop or presbyter having sanctified the elements by a solemn benediction, he brake the bread, and delivered it to the deacon, who distributed it to the communicants; and after that the cup. Their sacramental wine was usually diluted or mixed with water. During the time of administration, they sang hymns and psalms; and, having concluded with prayer and thanksgiving, the people saluted each other with a kiss of peace, and so the assembly broke up.

EVER-GREEN, in gardening, a species of perennials, which continue their verdure, leaves, *&c.* all the year: such are hollies, phillyria's, laurustinus's, bays, pines, firs, cedars of Lebanon, *&c.*

EVERLASTING PEA, a genus of plants, otherwise called lathyrus. See LATHYRUS.

EVESDROPPERS, in law, persons who stand under the eves, walls, or windows of a house, by day or by night, to listen after news, and carry it to others, thereby raising strife and contention in the neighbourhood.

EVESHAM, a borough town thirteen miles south-east of Worcester, which sends two members to parliament.

EUGENIA, the SILVER TREE, in botany, a genus of the icosandria monogynia class. The calix is above the fruit, and consists of four segments; the petals are four; and the drupa is quadrangular, and contains

one

one feed. There are five fpecies, none of them natives of Britain.

EVIAN, a town of Savoy, fituated twenty-five miles north-eaft of Geneva, on the fouth fide of the lake of Geneva.

EVICTION, in law, fignifies a recovery of lands, or tenements by law.

EVIDENCE, that perception of truth which arifes either from the teftimony of the fenfes, or from an induction of reafon. See METAPHYSICS, and MORALS.

EVIDENCE, in law, any proof, whether it be by teftimony of men on oath, or by writings and records fo called, becaufe hereby the point in iffue is made evident by a jury.

EVIL. See MORALS.

King's-EVIL, in medicine. See MEDICINE.

EULOGY, in church-hiftory, a name by which the Greeks call the *panis benedictus*, or bread over which a bleffing is pronounced, and which is diftributed to thofe who are unqualified to communicate.

EUMENIDES, in antiquity. See FURIES.

EUNOMIANS, in church-hiftory, Chriftian heretics, in the fourth century. They were a branch of Arians, and took their name from Eunomius, bifhop of Cyzicus, who was inftructed by Ætius, in the points which were then controverted in the church, after having at firft followed the profeffion of arms. Eunomius fo well anfwered the defigns of his mafter, and declaimed fo vehemently againft the divinity of the WORD, that the people had recourfe to the authority of the prince, and had him banifhed; but the Arians obtained his recall, and elected him bifhop of Cyzicus. The manners and doctrines of the Eunomians were the fame with thofe of the Arians.

EUNUCH, a caftrated perfon. See CASTRATION.

EUNUCHS, in church-hiftory, a fect of heretics in the third century, who were mad enough to caftrate, not only thofe of their own perfuafion, but even all others that they could lay hold of: they took their rife from the example of Origen, who, mifunderftanding the following words of our Saviour,—" And eunuchs who " made themfelves eunuchs for the kingdom of hea-" ven,"—caftrated himfelf.

EVOLUTION, in algebra. See ALGEBRA, p. 86.

EVOLUTION, in the art of war, the motion made by a body of troops, when they are obliged to change their form and difpofition, in order to preferve a poft, or occupy another, to attack an enemy with more advantage, or to be in a condition of defending themfelves the better.

EUONYMOIDES, in botany. See CELASTRUS.

EUONYMUS, the SPINDLE-TREE, in botany, a genus of the pentandria monogynia clafs. The corolla confifts of five petals; the capfule is five-fided, and has five coloured cells; and the feeds have calyptra. There are two fpecies, one of which, *viz.* the europæus, fpindle-tree, or prickwood, is a native of Britain.

EVORA, or EBORA, a city of Portugal, feventy miles fouth-eaft of Lifbon.

EUPATORIOPHALACRON, in botany. See VERBESINA.

EUPATORIUM, HEMP-AGRIMONY, in botany, a genus of the fyngenefia polygamia æqualis clafs. The receptacle is naked; the pappus is plumofe; the calix is oblong and imbricated; and the ftylus is long and femi-bifid. There are twenty-one fpecies, only one of which is a native of Britain, *viz.* the cannabinum, hemp-agrimony, or Dutch agrimony. The leaves are faid to ftrengthen the ftomach.

EUPHYMISM, in rhetoric, a figure which expreffes things in themfelves difagreeable and fhocking, in terms implying the contrary quality.

EUPHORBIA, in botany, a genus of the dodecandria trigynia clafs. The corolla confifts of four or five petals; and the calix has but one leaf. There are fixty-two fpecies, twelve of which are natives of Britain, *viz.* the peplus, or fmall purple fea-fpurge; the peplus, or petty fpurge; the exigua, or dwarf-fpurge; the fegetalis, or corn-fpurge; the helioscopia, funfpurge, or wart-wort; the portlandica, or Portland fpurge; the paralias, or fea-fpurge; the verrufca, or rough fruited fpurge; the platyphyllus, or broad-leaved fpurge; the amygdaloides, or wood-fpurge; the characias, or red fpurge; and the hyberna, or knotty-rooted fpurge. The fpurges are exceedingly acrid, and are now rejected both by the Edinburgh and London difpenfatories.

EUPHORBIUM, in pharmacy, a gum refin brought us always in loofe, fmooth, and gloffy gold-coloured drops or granules. It is the produce of the euphorbium antiquorum verum, which grows to ten or twelve feet high. Its principal ufe is externally in finapifms, and plafters applied to the feet, which are intended to ftimulate, but not abfolutely to raife blifters: for it is obferved by Avifenna, that when taken internally in large dofes, it has been found to exulcerate the inteftines, and bring on death itfelf, after the moft terrible fymptoms.

EUPHRASIA, in botany, a genus of the didynamia angiofpermia clafs. The calix is cylindrical, and confifts of four fegments; and the capfule is oblong and bilocular. There are fix fpecies, two of which are natives of Britain, *viz.* the officinalis, or eye-bright; and the odentites, or red eye bright. The eye-bright was formerly celebrated as an ophthalmic, but is now totally difregarded.

EUPHRATES, the fineft river in Turky in Afia, has two fources, northward of the city of Erzerum, in 40° N. lat. After paffing through Armenia, it divides Syria from Diarbec or Affyria, runs through Eyraca or Chaldea; and uniting with the Tygris, it paffes by the city of Baffora, fifty miles below which it falls into the gulf of Perfia.

EUREUX, a city of Normandy in France, twenty-five miles fouth of Rouen.

EURIPUS, a ftrait between the ifland of Negropont, and the continent of Greece, remarkable for its irregular tides.

The term euripus is fometimes ufed, in a more general

general ſenſe, for any ſtraits where the water is much agitated.

EUROPE, the leaſt of the four grand diviſions of the earth, is ſituated between 36° and 72° N. lat.; and between 10° degrees W. long. and 65° E. long. being about 3000 miles long from north to ſouth, and 2500 miles broad from eaſt to weſt. It is bounded by the frozen ocean on the north, by Aſia on the eaſt, by the Mediterranean, which ſeparates it from Africa, on the ſouth, and by the Atlantic ocean on the weſt.

Europe is commonly ſubdivided into three grand diviſions, north, middle, and ſouth. The north or upper diviſion comprehends Ruſſia, or Muſcovy, Sweden, Denmark, and Norway, and the iſlands of Britain, Iceland, Greenland, and thoſe of the Baltic. The middle diviſion contains Poland, Germany, and the hereditary dominions of the houſe of Auſtria, the Low Countries, or Netherlands, and France. The ſouthern diviſion comprehends Turky in Europe, the ancient Greece chiefly, Switzerland, Italy, Spain and Portugal, and the iſlands of Sicily, Sardinia, Corſica, Majorca, Minorca, Ivica, and thoſe of the Archipelago.

EURYTHMY, in architecture, painting, and ſculpture, is a certain majeſty, elegance, and eaſineſs, appearing in the compoſition of divers members, or parts of a body, painting, or ſculpture, and reſulting from the fine proportion of it.

EUSTACE, or EUSTATIA, one of the Caribbee iſlands, four miles weſt of St Chriſtopher's, and ſubject to the Dutch

EUSTYLE, in architecture, a ſort of building in which the pillars are placed at the moſt convenient diſtance one from another, the intercolumniations being juſt two diameters and a quarter of the column, except thoſe in the middle of the face, before and behind, which are three diameters diſtant.

EUTYCHIANS, in church-hiſtory, heretics in the Vth century, who embraced the errors of the monk Eutyches, maintaining that there was only one nature in Jeſus Chriſt.

EUXINE, the ſame with the Black Sea. See BLACK SEA.

EWAGE, a toll paid for the paſſage of water, and otherwiſe called aquage.

EWE, the Engliſh name of a female ſheep. See OVIS.

EWRY, in the Britiſh cuſtoms, an office in the king's houſhold, which has the care of the table-linen, of laying the cloth, and ſerving up water in ſilver ewers after dinner.

EXACERBATION. See PAROXYSM.

EXACUM, in botany, a genus of the tetrandria monogynia claſs. The calix conſiſts of four leaves, and the corolla of four ſegments, with a roundiſh tube; the capſule is biſulcated, and has two cells containing many ſeeds. There are two ſpecies, none of them nativ s of Britain.

EXÆRESIS, in ſurgery, the operation of extracting or taking away ſomething that is hurtful to the human body.

EXAGGERATION, in rhetoric, a kind of hyperbole, whereby things are augmented or amplified, by ſaying more than the truth, either as to good or bad.

EXAGGERATION, in painting, a method by which the artiſt, in repreſenting things, changes them too much, or makes them too ſtrong, either in reſpect of the deſign or the colouring.

EXALTATION, in chemiſtry, ſignifies an operation by which a ſubſtance has its properties changed, and raiſed to a higher degree of dignity and virtue.

EXAMINERS, in chancery, two officers of that court, who examine, upon oath, witneſſes produced in cauſes depending there, by either the complainant or defendant, where the witneſſes live in London, or near it. Sometimes parties themſelves, by particular order, are examined. In the country, above twenty miles from London, on the parties joining in commiſſion, witneſſes are examined by commiſſioners, being uſually counſellors or attornies not concerned in the cauſe.

EXANTHEMA among phyſicians, denotes any kind of efflorescence or eruption, as the meaſles, purple ſpots in the plague, or malignant fevers, &c.

EXARCH, in antiquity, an officer ſent by the emperors of the eaſt into Italy, in quality of vicar, or rather præfect, to defend that part of Italy which was yet under their obedience, and particularly the city of Ravenna, againſt the Lombards. The exarch reſided at Ravenna, which place, with Rome, was all that was left to the emperors of their Italian dominions. The firſt exarch was under Juſtin the younger, in the year 567, after Beliſarius and Narſes had driven the barbarians out of Italy. The laſt was Eutychius, defeated by Adolphus king of the Lombards in 752.

EXCELLENCY, a title anciently given to kings and emperors, but now to embaſſadors, and other perſons who are not qualified for that of *highneſs*, and yet are to be elevated above the other inferior dignities.

EXCENTRIC, in geometry, a term applied to circles and ſpheres which have not the ſame centre, and conſequently are not parallel; in oppoſition to concentric, where they are parallel, having one common centre.

EXCENTRICITY, in aſtronomy, is the diſtance of the centre of the orbit of a planet from the centre of the ſun; that is, the diſtance between the centre of the ellipſis and the focus thereof. See ASTRONOMY.

EXCEPTION, in law, denotes a ſtop or ſtay to an action.

EXCERPTA, in matters of literature. See EXTRACT.

EXCESS, in arithmetic and geometry, is the difference between any two unequal numbers or quantities, or that which is left after the leſſer is taken from or out of the greater. See ARITHMETIC.

EXCHANGE, in a general ſenſe, a contract or agreement, whereby one thing is given or exchanged for another.

EXCHANGE, in commerce, is the receiving or paying of money in one country for the like ſome in another, by means of bills of exchange.

The ſecurity which merchants commonly take from one another when they circulate their buſineſs, is a bill

bill of exchange, or a note of hand: these are looked upon as payment.

The punctuality of acquitting those obligations is essential to commerce; and no sooner is a merchant's accepted bill protested, than he is considered as a bankrupt. For this reason, the laws of most nations have given very extraordinary privileges to bills of exchange. The security of trade is essential to every society; and were the claims of merchants to linger under the formalities of courts of law when liquidated by bills of exchange, faith, confidence, and punctuality would quickly disappear, and the great engine of commerce would be totally destroyed.

A regular bill of exchange is a mercantile contract, in which four persons are concerned, *viz.* 1. The drawer, who receives the value: 2. His debtor in a distant place, upon whom the bill is drawn, and who must accept and pay it: 3. The person who gives value for the bill, to whose order it is to be paid: and, 4. The person to whom it is ordered to be paid, creditor to the third.

By this operation, reciprocal debts, due in two distant parts, are paid by a sort of transfer, or permutation of debtors and creditors.

(A) in London is creditor to (B) in Paris, value 100*l.* (C) again in London is debtor to (D) in Paris for a like sum. By the operation of the bill of exchange, the London creditor is paid by the London debtor, and the Paris creditor is paid by the Paris debtor; consequently, the two debts are paid, and no money is sent from London to Paris, nor from Paris to London.

In this example, (A) is the drawer, (B) is the acceptor, (C) is the purchaser of the bill, and (D) receives the money. Two persons here receive the money, (A) and (D), and two pay the money, (B) and (C); which is just what must be done when two debtors and two creditors clear accounts.

This is the plain principle of a bill of exchange. From which it appears, that reciprocal and equal debts only can be acquitted by them.

When it therefore happens that the reciprocal debts of London and Paris (to use the same example) are not equal. there arises a balance on one side. Suppose London to owe Paris a balance, value 100*l.* How can this be paid? Answer, It may either be done with or without the intervention of a bill.

With a bill, if an exchanger, finding a demand for a bill upon Paris for the value of 100*l.* when Paris owes no more to London, sends 100*l.* to his correspondent at Paris in coin, at the expence (suppose) of 1*l.* and then, having become creditor on Paris, he can give a bill for the value of 100*l* upon his being repaid his expence, and paid for his risk and trouble.

Or it may be paid without a bill, if the London debtor sends the coin himself to his Paris creditor, without employing an exchanger.

This last example shews of what little use bills are in the payment of balances. As far as the debts are equal, nothing can be more useful than bills of exchange; but the more they are useful in this easy way of business, the less profit there is to any person to make a trade of exchange, when he is not himself concerned either as debtor or creditor.

When merchants have occasion to draw and remit bills for the liquidation of their own debts, active and passive, in distant parts, they meet upon change; where, to pursue the former example, the creditors upon Paris, when they want money for bills, look out for those who are debtors to it. The debtors to Paris again, when they want bills for money, seek for those who are creditors upon it.

This market is constantly attended by brokers, who relieve the merchant of the trouble of searching for those he wants. To the broker every one communicates his wants, so far as he finds it prudent; and by going about among all the merchants, the broker discovers the side upon which the greater demand lies, for money, or for bills.

He who is the demander in any bargain, has constantly the disadvantage in dealing with him of whom he demands. This is no where so much the case as in exchange, and renders secrecy very essential to individuals among the merchants. If the London merchants want to pay their debts to Paris, when there is a balance against London, it is their interest to conceal their debts, and especially the necessity they may be under to pay them; from the fear that those who are creditors upon Paris would demand too high a price for the exchange over and above par.

On the other hand those who are creditors upon Paris, when Paris owes a balance to London, are as careful in concealing what is owing to them by Paris, from the fear that those who are debtors to Paris would avail themselves of the competition among the Paris creditors, in order to obtain bills for their money, below the value of them, when at par. A creditor upon Paris, who is greatly pressed for money at London, will willingly abate something of his debt, in order to get one who will give him money for it.

From the operation carried on among merchants upon change, we may discover the consequence of their separate and jarring interests They are constantly interested in the state of the balance. Those who are creditors on Paris, fear the balance due to London; those who are debtors to Paris, dread a balance due to Paris. The interest of the first is to dissemble what they fear; that of the last, to exaggerate what they wish The brokers are those who determine the course of the day: and the most intelligent merchants are those who dispatch their business before the fact is known.

Now, how is trade in general interested in the question, Who shall outwit, and who shall be outwitted, in this complicated operation of exchange among merchants?

The interest of trade and of the nation is principally concerned in the proper method of paying and receiving the balances. It is also concerned in preserving a just equality of profit and loss among all the merchants, relative to the real state of the balance. Unequal competition among men engaged in the same pursuit, constantly draws along with it bad consequences to the general undertaking; and secrecy in trade will be found, upon examination, to be much more useful to merchants in their

private

private capacity, than to the trade they are carrying on.

Merchants endeavour to ſimplify their buſineſs as much as poſſible ; and commit to brokers many operations which require no peculiar talents to execute. This of exchange is of ſuch a nature, that it is hardly poſſible for a merchant to carry on the buſineſs of his bills, without their aſſiſtance, upon many occaſions. When merchants come upon change, they are ſo full of fears and jealouſies, that they will not open themſelves to one another, leſt they ſhould diſcover what they want to conceal. The broker is a confidential man, in ſome degree, between parties, and brings them together.

Beſides the merchants who circulate among themſelves their reciprocal debts and credits ariſing from their importation and exportation of goods, there is another ſet of merchants who deal in exchange ; which is the importation and exportation of money and bills.

Were there never any balance on the trade of nations, exchangers and brokers would find little employment: reciprocal and equal debts would eaſily be tranſacted openly between the parties themſelves. No man feigns and diſſembles, except when he thinks he has an intereſt in ſo doing.

But when balances come to be paid, exchange becomes intricate; and merchants are ſo much employed in particular branches of buſineſs, that they are obliged to leave the liquidation of their debts to a particular ſet of men, who make it turn out to the beſt advantage to themſelves.

Whenever a balance is to be paid, that payment coſts, as we have ſeen, an additional expence to thoſe of the place who owe it, over and above the value of the debt.

If, therefore, this expence be a loſs to the trading man, he muſt either be repaid this loſs by thoſe whom he ſerves, that is, by the nation; or the trade he carries on will become leſs profitable.

Every one will agree, that the expence of high exchange upon paying a balance, is a loſs to a people, no way to be compenſated by the advantages they reap from enriching the few individuals among them who gain by contriving methods to pay it off: and if an argument is neceſſary to prove this propoſition, it may be drawn from this principle, to wit, whatever renders the profit upon trade precarious or uncertain, is a loſs to trade in general: this loſs is the conſequence of high exchange ; and although a profit does reſult from it upon one branch of trade, the exchange-buſineſs, yet that cannot compenſate the loſs upon every other.

We may, therefore, here repeat what we have ſaid above, that the more difficulty is found in paying a balance, the greater is the loſs to the nation.

The courſe of EXCHANGE.

The courſe of exchange is the current price betwixt two places, which is always fluctuating and unſettled, being ſometimes above and ſometimes below par, according to the circumſtances of trade.

When the courſe of exchange riſes above par, the country where it riſes may conclude for certain, that the balance of trade runs againſt them. The truth of this will appear, if we ſuppoſe Britain to import from any foreign place goods to the value of 100,000 l. at par, and export only to the value of 80,000. ; in this caſe, bills on the ſaid foreign place will be ſcarce in Britain, and conſequently will riſe in value ; and after the 80,0000 l. is paid, bills muſt be procured from other places at a high rate to pay the remainder, ſo that perhaps 120,000 l. may be paid for bills to diſcharge a debt of 100,000 l.

Though the courſe of exchange be in a perpetual flux, and riſes or falls according to the circumſtances of trade, yet the exchanges of London, Holland, Hamburgh, and Venice, in a great meaſure regulate thoſe of all other places in Europe.

I. *Exchange with Holland.*

MONEY-TABLE.

		Par in Sterling.		*s.*	*d.*
8 Pennings, or 2 duytes,	make	1 groat or penny	=	0	0.54
2 Groats, or 16 pennings,		1 ſtiver	=	0	1.09
6 Stivers, or 12 pence,		1 ſchilling	=	0	6.56
20 Schillings,		1 pound Flemiſh	=	10	11.18
20 Stivers, or 40 pence,		1 guilder or florin	=	1	9.86
6 Guilders, or florins,		1 pound Flemiſh	=	10	11.18
$2\frac{1}{2}$ Guilders, or florins,		1 rixdollar	=	4	6.66

In Holland there are two ſorts of money, bank and current. The bank is reckoned good ſecurity ; demands on the bank are readily anſwered ; and hence bank-money is generally rated from 3 to 6 *per cent.* better than the current. The difference between the bank and current money is called the *agio*.

Bills on Holland are always drawn in bank-money; and if accounts be ſent over from Holland to Britain in current money, the Britiſh merchant pays theſe accounts by bills, and in this caſe has the benefit of the agio.

PROB. I. *To reduce bank money to current money.*

RULE. As 100 to 100+agio, ſo the given guilders to the anſwer.

EXAMPLE. What will 2210 guilders in bank money amount to in Holland currency, the agio being $3\frac{1}{8}$ *per cent.*?

Guild.

```
              Guild.
As 100 : 103⅛ :: 2210
     8      8     825
   ———    ———    ———
   800    825   11050
                 4420
               17680
          ————————Guild. ſt. pen.
     8|00)18232|50(2279  1   4 cur.
          16 ··· 20
          ————
            22 10|00(
            16  8
            ————
            63  2
            56 16
            ————
            72 32
            72 32
            ————
```

Or, by practice,

```
50)2210
     44.2    = 2 per cent.
     22.1    = 1 per cent.
      2.7625 = ⅛ per cent.
   ————————
   2279.0625
```

If the agio only be required, make the agio the middle term, thus:

```
                       Guil. ſt. pen.
As 100  :  3⅛ :: 2210 : 69   1   4 agio.
```

Or, work by practice, as above.

Prob. II. *To reduce current money to bank money.*

Rule. As 100+agio to 100, ſo the given guilders to the anſwer.

Example. What will 2279 guilders 1 ſtiver 4 pennings, Holland currency, amount to in bank money, the agio being $3\frac{1}{8}$ *per cent.*?

```
Guild.  Guild.  Guild.ſt.pen.
As 103⅛ : 100 :: 2279 1 4
     8       8       20
   ———     ———     ————
   825     800     45581
    20                16
   ————            ——————
  16500            273490
    16              45581
  ————             ——————
   990             729300
   165                800
  ————             ——————
8)264|000        8)583440|000
3)33               3)72930 Guild.
  11              11)24310(2210 bank.
```

In Amſterdam, Rotterdam, Middleburgh, *&c.* books and accounts are kept by ſome in guilders, ſtivers, and pennings, and by others in pounds, ſhillings, and pence, Flemiſh.

Britain gives 1 l. Sterling for an uncertain number of ſhillings and pence Flemiſh. The par is 1l. Sterling for 36.59 s. Flemiſh; that is, 1 l. 16 s. 7.08 d. Flemiſh.

When the Flemiſh rate riſes above par, Britain gains and Holland loſes by the exchange, and *viee verſa.*

Sterling money is changed into Flemiſh, by ſaying,

As 1 l. Sterling to the given rate,
So is the given Sterling to the Flemiſh ſought.
Or, the Flemiſh money may be caſt up by practice.

Dutch money, whether pounds, ſhillings, pence Flemiſh, or guilders, ſtivers, pennings, may be changed into Sterling, by ſaying,

As the given rate to 1 l. Sterling,
So the given Dutch to the Sterling ſought.

Example. 1. A merchant in Britain draws on Amſterdam for 782 l. Sterling: How many pounds Flemiſh, and how many guilders will that amount to, exchange at 34 s. 8 d. *per* pound Sterling?

```
 L.  s. d.    L.         |        Decimally.
If 1 : 34 8 :: 782       |     L.   s.      L.
           12            |   If 1 : 34 6̸ :: 782
         ————            |           782
          416            |         ————
          782            |           693
         ————            |         27733
          832            |        242666
         3328            |       ————————
        2912             |   2|0)2710|9.3
       ————————          |   ——————————
     12)325312           |   L.1355 9 4 Flem.
        ———————— d.      |
     2|0) 2710|9 4       |
       ——————————        |
    L. 1355  9 4 Flem.   |

 By practice.                    Or thus:
           | L.  s. d.           |  L.  s. d.
           | 782                 |  782
 10 s. = ½ | 391        14 s. = 7/10 | 547 8
  4 s. = ⅕ | 156 8       8 d. = 1/30 |  26 1 4
  8 d. = ⅙ |  26 1 4              |  ————————
           | ————————             |  1355 9 4 Fl.
           | 1355 9 4 Fl.
```

Multiply the Flemiſh pounds and ſhillings by 6, and the product will be guilders and ſtivers; and if there be any pence, multiply them by 8 for pennings; or, divide the Flemiſh pence by 40, and the quot will be guilders, and the half of the remainder, if there be any, will be ſtivers, and 1 penny odd will be half a ſtiver, or 8 pennings, as follows.

```
     L.   s. d.                  Flem. pence.
   1355   9 4             4|0)32531|2(32 rem.
          6
  ——————————
Guild. 8132 16 ſtiv.      Guild. 8132  16 ſtiv.
```

2. Change 591 l. 5 s. Flemiſh into Sterling money, exchange at 37 s. 6 d. Flemiſh *per* l. Sterling?

```
      Flem.  Ster.   Flem.
       s. d.  L.     L.  s.
    If 37 6 : 1 :: 591  5
        2            20
       ---         -------
     5)75          11025
       ---             2
     4)15         -------
       ---       5)23650
         3        -------
                 5) 4730
                  -------
                 3)  946
                  -------
   L. s. d.          315⅓
Anſ. 315 5 8 Ster.
```

Decimally.

```
      5) L.    L.   5) L.
  If 1.875  :  1 :: 591.25
     -----          ------
  5) .375          5)118.25
  5) .075          5) 23.65
     .015    .015)  4.73(313.3̇
                    45
                    ---
                     23
                     15
                     ---
                      80
                      75
                      ---
                       50
                       45
                       ---
                       * 5
```

Holland exchanges with other nations as follows, *viz.* with

		Flem d.
Hamburgh, on the dollar,	=	$66\frac{2}{3}$
France, on the crown,	=	54
Spain, on the ducat,	=	$109\frac{4}{5}$
Portugal on the cruſade,	=	50
Venice, on the ducat,	=	93
Genoa, on the pezzo,	=	100
Leghorn, on the piaſtre,	=	100
Florence, on the crown,	=	120
Naples, on the ducat,	=	$74\frac{2}{3}$
Rome, on the crown,	=	136
Milan, on the ducat,	=	102
Bologna, on the dollar,	=	$94\frac{4}{9}$

Exchange between Britain and Antwerp, as alſo the Auſtrian Netherlands, is negociated the ſame way as with Holland, only the par is ſomewhat different, as will be deſcribed in article 2d, following.

II. *Exchange with Hamburgh.*

MONEY-TABLE.

		Par in Sterling.		*s.*	*d.*
12 Phennings	make	1 ſchilling-lub	=	0	$1\frac{1}{8}$
16 Schilling-lubs		1 mark	=	1	6
2 Marks		1 dollar	=	3	0
3 Marks		1 rixdollar	=	4	6
$6\frac{1}{4}$ Marks		1 ducat	=	9	$4\frac{1}{2}$

Books and accounts are kept at the bank, and by moſt people in the city, in marks, ſchilling-lubs, and phennings; but ſome keep them in pounds, ſchillings, and groots Flemiſh.

The agio at Hamburgh runs between 20 and 40 *per cent.* All bills are paid in bank-money.

Hamburgh exchanges with Britain by giving an uncertain number of ſchillings and groots Flemiſh for the pound Sterling. The groot or penny Flemiſh here, as alſo at Antwerp, is worth $\frac{54}{96}$ of a penny Sterling; and ſo ſomething better than in Holland, where it is only $\frac{54}{100}$ d. Sterling.

		Flemiſh.
6 Phennings	make	1 groot or penny
6 Schilling lubs		1 ſchilling
1 Schilling-lub		2 pence or groots
1 Mark		32 pence or groots
$7\frac{1}{2}$ Marks		1 pound.

The par with Hamburgh, and alſo with Antwerp, is 35 s. $6\frac{2}{3}$ d. Flemiſh for 1 l. Sterling.

Examples. 1. How many marks muſt be received at Hamburgh for 300 l. Sterling, exchange at 35 s. 3 d. Flemiſh *per* l. Sterling?

```
     L.   s. d.   L.
  If 1 : 35 3 :: 300
            12
          -----
           423
            300
          ------ M. ſch.
   32)126900(3965 10
       96...
       ----
        309
        288
        ----
         210
         192
         ----
          180
          160
          ----
          (20)
           16
          ----
          )320
           32
          ----
          (00)
```

Decimally.

Decimally.

Flem. s. Marks. Flem. s.

If 20 : 7.5 :: 35.25

4 : 1.5 :: 35.25

1.5

17625

3525

4)52.875

Marks in 1 l. Sterling 13.21875

300

Marks in 300 l. Sterling 3965.62500

16

3750

625

Schilling-lubs 10.000

2. How much Sterling money will a bill of 3965 marks 10 schilling-lubs amount to, exchange at 35 s. 3 d. Flemish *per* l. sterling?

Fl. s. d. L. St. Mks. sch.

If 35 3 : 1 :: 3965 10

12 32 2

423 7930 20 d.

11897

423)126900(300 l. ster.

Decimally.

4 : 1.5 :: 35.25

1.5

17625

3525

4)52.875(14.21875

13.21875)3965.62500(300 l. ster.

3965625

III. *Exchange with France.*

MONEY-TABLE.

			Par in Ster.		*s.*	*d.*
12 deniers	make	1 fol		=	0	$0\frac{39}{80}$
20 fols		1 livre		=	0	$9\frac{3}{4}$
3 livres		1 crown		=	2	$5\frac{1}{4}$

At Paris, Rouen, Lyons, &c. books and accounts are kept in livres, fols, and deniers; and the exchange with Britain is on the crown, or ecu, of 3 livres, or 60 fols Tournois. Britain gives for the crown an uncertain number of pence, commonly between 30 and 34, the par, as mentioned above, being $29\frac{1}{4}$ d.

EXAMP. 1. What Sterling money must be paid in London to receive in Paris 1978 crowns 25 fols, exchange at $31\frac{5}{8}$ d. *per* crown?

Sols. d. Cr. fols.

If 60 : $31\frac{5}{8}$ :: 1978 25

60

253

118705

253

356115

573525

237410

6|0)3003236|5 *Rem.*

8)500539 3

12)62567 11

2|0)521|3 13

L. 260 13 $11\frac{3}{8}$. *Ans.*

By Practice.

d.		*Cr.* 1978	*fols.* 25,	at $31\frac{5}{8}$ d.
30	$= \frac{1}{8}$	247	5	0
$1\frac{1}{2}$	$= \frac{1}{20}$	12	7	3
$\frac{1}{8}$	$= \frac{1}{12}$	1	0	$7\frac{1}{4}$
Sols 20	$= \frac{1}{3}$	0	0	$10\frac{1}{2}$
5	$= \frac{1}{4}$	0	0	$2\frac{1}{2}$
		260	13	$11\frac{1}{4}$

If you work decimally, say,

Cr. d. Ster. Cr. d. Ster.

As 1 : 31.625 :: 1978 41$\dot{6}$: 62567.42708$\dot{3}$

2. How many French livres will L. 121 : 18 : 6 Sterling amount to, exchange at $32\frac{7}{8}$ d. *per* crown?

d. Liv. L. s. d.

If $32\frac{7}{8}$: 3 :: 121 18 6

8 8 20

263 24 2438

12

29262

24

117048

58524

Liv. fols den.

263)702288(2670 5 11 *Ans.*

Rem. (78) = 5 fols 11 deniers.

IV.

IV. *Exchange with Portugal.*

MONEY-TABLE.

		Par in Ster.	*s. d. f.*
		1 ree	= 0 0 0.27
400 rees	make	1 crusade	= 2 3
1000 rees	make	1 millree	= 5 $7\frac{1}{2}$

In Lisbon, Oporto, *&c.* books and accounts are generally kept in rees and millrees; and the millrees are distinguished from the rees by a mark set between them thus, 485 ♆ 372; that is, 485 millrees and 372 rees.

Britain, as well as other nations, exchanges with Portugal on the millree, the par, as in the table, being $67\frac{1}{2}$ d. Serling. The course with Britain runs from 63 d. to 68 d. Sterling *per* millree.

EXAMP. I. How much Sterling money will pay a bill of 827 ♆ 160 rees, exchange at $63\frac{3}{8}$ d. Serling *per* millree?

```
      Rees.  d.      Rees.
   If 1000 : 68⅜ :: 827.160
      8              507
      ————   ————    ————
      8000   507     579012
                    413580
                    ———————— Rem.
           8000)419370.120  2
                ——————
             12) 52421  —  5 d.
                ——————
             20) 4368   —  8 s.
                ——————
             L. 218 8 5¼  Ans.
```

By Practice.

```
          Rees.
         | 827.160, at 63⅜ d.
  d.     |————————
 60 = ¼  | 206.790
  3 = 1/20| 10.3395
  ¼ = 1/12|  .861625
  ⅛ = ½  |  .4308125
         |——————————
         | 218.4219375
```

The rees being thousandth parts of the millrees, are annexed to the integer, and the operation proceeds exactly as in decimals.

2. How many rees of Portugal will 500 l. Sterling amount to, exchange at 5 s. $4\frac{5}{8}$ d. *per* millree?

```
     d.    Rees.    L.
  If 64⅝ : 1000 :: 500
     ————  8        20
     517   ————     ————
           8000     10000
                    12
                    ————
                    120000
                    8000
                    ——————————— Rees.
          517)960000000(1856.866 Ans.
```

V. *Exchange with Spain.*

MONEY-TABLE.

		Par in Ster.	*s. d.*
34 mervadies	make	1 rial	= 0 $5\frac{3}{8}$
8 rials	make	1 piastre	= 3 7
375 mervadies	make	1 ducat	= 4 $11\frac{1}{4}$

In Madrid, Bilboa, Cadiz, Malaga, Seville, and most of the principal places, books and accounts are kept in piastres, called also *dollars*, rials, and mervadies; and they exchange with Britain generally on the piastre, and sometimes on the ducat. The course runs from 35 d. to 45 d. Sterling for a piastre or dollar of 8 rials.

EXAMP. I. London imports from Cadiz, goods to the value of 2163 piastres and 4 rials: How much Sterling will this amount to, exchange at $38\frac{3}{8}$ d. Sterling *per* piastre?

```
           | Piast. Rials.
           | 2163   4, at 38⅜ d.      |  d.
  d.       |————————        Rials.    | 38⅜ each.
 24 = 1/10 | 216    6         4 =     | 19 3/16
 12 = ½    | 108    3
  2 = 1/6  |  18    0  6
  ⅜ = ⅛    |   2    5  0¾
  ⅛ = ½    |   1    2  6⅜
           |———————————
           | 345   17  1⅛
                    1  7 3/16
           ———————————
         L. 345   18  8 5/16  Ans.
```

2. London remits to Cadiz 345 l. 18 s. $8\frac{5}{16}$ d. How much Spanish money will this amount to, exchange at $38\frac{3}{8}$ d. Sterling *per* piastre?

```
     d.  Piast. L.  s.  d.
  If 38⅜ : 1 :: 345 18 8 5/16
     ————        20
     307         ————        614)1328389(2193 piastres.
       2         6918            1228 ···
     ————          12            ————
     614         ————            1003
                 83024            614
                   16            ————
                 ————            3898
                 498149          3684
                 83024           ————
                 ———————         2149
                 1328389         1842
                                 ————
                                  307
                                    8
                                 ————
                              614)2456(4 rials.
                                  2446
                                  ————
```

VI. *Exchange with Venice.*

MONEY-TABLE.

$5\frac{1}{6}$ Soldi	make	1 gros	
24 Gros	make	1 ducat	= $50\frac{1}{4}$ d. Sterling.

The

The money of Venice is of three ſorts, *viz.* two of bank money, and the picoli money. One of the banks deals in banco money, and the other in banco current. The bank money is 20 *per cent.* better than the banco current, and the banco current 20 *per cent.* better than the picoli money. Exchanges are always negotiated by the ducat banco, the par being 4 s. $2\frac{1}{4}$ d. Sterling, as in the table.

Though the ducat be commonly divided into 24 gros, yet bankers and negotiators, for facility of computation, uſually divide it as follows, and keep their books and accounts accordingly.

12 Deniers d'or	make	1 ſol d'or
20 Sols d'or		1 ducat = $50\frac{1}{4}$ d. Sterling.

The courſe of exchange is from 45 d. to 55 d. Sterling *per* ducat.

Examp. 1. How much Sterling money is equal to 1459 ducats 18 ſols 1 denier, bank money of Venice, exchange at $52\frac{3}{4}$ d. Sterling *per* ducat?

```
Duc.  d.      Duc. ſol. den.                    d.
If 1 : 52¾ :: 1459  18   1                  52¾ rate.
              52¾              Sols.
           ———————             10 = ½     |  26⅜
              2918              5 = ½     |  13⅛
             7295               2 = ⅕     |    ²⁄₈
           ———————              1 = ½     |    ⁵⁄₈
        d. 75868         den.   1 = ¹⁄₁₂  |   0²⁄₈
        ½ = 729⁴⁄₈                          ————
        ¼ = 364⁶⁄₈                           47⅝
           ———————
           76962²⁄₈
              47⅝
           —————— Rem.
       12)77010(6 d.

       2|0)641|7(17 s.

      L. 320  17  6 Sterling.  Anſ.
```

2. How many ducats at Venice are equal to 385 l. 12 s. 6 d. Sterling, exchange at 4 s. 4 d. *per* ducat?

```
      L.  Duc.  L.
  If .216 : 1 :: 385.625
       .216)385.625
        21  385625
       ——— ——— ——— Duc.
    195)347062.5(1779.8  Anſ.
        195
        ————
        1520
        1365
        ————
         1556
         1365
         ————
          1912
          1755
          ————
           1575
           1560
           ————
            (15)
```

Bank money is reduced to current money, by allowing for the agio, as was done in exchange with Holland; *viz.* ſay, As 100 to 120, or as 10 to 12, or as 5 to 6, ſo the given bank money to the current ſought. And current money is reduced to bank money by reverſing the operation. And in like manner may picoli money be reduced to current or to bank money, and the contrary.

100 ducats banco of Venice.

In Leghorn = 93 pezzos	In Lucca = 77 crowns
In Rome = $68\frac{1}{2}$ crowns	In Francfort = $139\frac{1}{2}$ florins

VII. *Exchange with Genoa.*

MONEY-TABLE.

			s.	*d.*
12 Denari	make	1 ſoldi		
20 Soldi		1 pezzo =	4	6 Sterling.

Books and accounts are generally kept in pezzos, ſoldi, and denari; but ſome keep them in lires, ſoldi, and denari; and 12 ſuch denari make 1 ſoldi, and 20 ſoldi make 1 lire.

The pezzo of exchange is equal to $5\frac{3}{4}$ lires; and, conſequently, exchange money is $5\frac{3}{4}$ times better than the lire money. The courſe of exchange runs from 47 d. to 58 d. Sterling *per* pezzo.

Examp. How much Sterling money is equivalent to 3390 pezzos 16 ſoldi, of Genoa, exchange at $51\frac{7}{8}$ d. Sterling *per* pezzo?

```
  Soldi.  d.      Pez. ſoldi.
  If 20 : 51⅞ :: 3390  16
      8   ————        20
    ————   415     ————————
     160             67816
                       415
                    ———————
                    339080
                    67816
                   271264
                   ———————      d.             L.  s.  d.
  160)28143640(175897¾ = 732  18  1¾
```

If Sterling money be given, it may be reduced or changed into pezzos of Genoa, by reverſing the former operation.

Exchange money is reduced to lire money, by being multiplied by $5\frac{3}{4}$, as follows:

```
          Pez. ſoldi.              Decimally.
           3390  16                  3390.8
                 5¾                    5.75
          ———————————              ——————————
          16954   0                  169550
    ½ =    1695   8                 237356
    ¼ =     847  14                 169540
          ———————————              ——————————
  Lires   19497   2          Lires 19497.100
```

And lire money is reduced to exchange money by dividing it by $5\frac{3}{4}$.

		Soldi of Genoa.
In Milan, 1 crown	=	80
In Naples, 1 ducat	=	86
In Leghorn, 1 piaſtre	=	20
In Sicily, 1 crown	=	$127\frac{2}{9}$

VIII. *Exchange with Leghorn.*

MONEY-TABLE.

			s. d.
12 Denari	make	1 foldi	
20 Soldi		1 piaftre =	4 6 *Ster.*

Books and accounts are kept in piaftres, foldi, and denari. The piaftre here confifts of 6 lires, and the lire contains 20 foldi, and the foldi 12 denari, and confequently exchange money is 6 times better than lire money. The courfe of exchange is from 47 d. to 58 d. Sterling *per* piaftre.

Example. What is the Sterling value of 731 piaftres, at $55\frac{1}{2}$d. each.

s. d.	731 piaftres, at $55\frac{1}{2}$d.
4 or 48 = $\frac{1}{6}$	146 4
7 = $\frac{1}{8}$	18 5 6
$1\frac{1}{2}$ = $\frac{1}{4}$	4 11 $4\frac{1}{2}$
	L. 169 0 $10\frac{1}{2}$ *Anf.*

Sterling money is reduced to money of Leghorn, by reverfing the former operation; and exchange money is reduced to lire money by multiplying by 6, and lire money to exchange money by dividing by 6.

100 piaftres of Leghorn are

In Naples = 134 ducats. | In Geneva = $185\frac{1}{3}$ crowns.

Soldi of Leghorn.

In Sicily, 1 crown = $133\frac{1}{3}$

In Sardinia, 1 dollar = $95\frac{5}{9}$

The above are the chief places in Europe with which Britain exchanges directly; the exchanges with other places are generally made by bills on Hamburg, Holland, or Venice. We fhall here however fubjoin the par of exchange betwixt Britain and moft of the other places in Europe, with which we have any commercial intercourfe.

		Par in Sterling.		L.	s.	d.
Rome	1	crown	=		6	$1\frac{1}{3}$
Naples,	1	ducat	=		3	$4\frac{1}{2}$
Florence,	1	crown	=		5	$4\frac{5}{8}$
Milan,	1	ducat	=		4	7
Bologna,	1	dollar	=		4	3
Sicily,	1	crown	=		5	0
Vienna,	1	rixdollar	=		4	8
Aufburgh,	1	florin	=		3	$1\frac{1}{3}$
Francfort,	1	florin	=		3	0
Bremen,	1	rixdollar	=		3	6
Breflau,	1	rixdollar	=		3	3
Berlin,	1	rixdollar	=		4	0
Stetin,	1	mark	=		1	6
Embden,	1	rixdollar	=		3	6
Bolfenna,	1	rixdollar	=		3	8
Dantzic,	$13\frac{1}{2}$	florins	=	1	0	0
Stockholm,	$34\frac{4}{7}$	dollars	=	1	0	0
Ruffia,	1	rubble	=		4	5
Turkey,	1	afper	=		4	6

The following places, *viz.* Switzerland, Noremburgh, Leipfic, Drefden, Ofnaburgh, Brunfwic, Cologn, Liege, Strafburgh, Cracow, Denmark, Norway, Riga, Revil, Narva, exchange with Britain, when direct exchange is made, upon the rixdollar, the par being 4s. 6d. Sterling.

IX. *Exchange with America and the Weft Indies.*

In North America and the Weft Indies, accounts, as in Britain, are kept in pounds, fhillings, and pence. In North America they have few coins circulating among them, and on that account have been obliged to fubftitute a paper-currency for a medium of their commerce; which having no intrinfic value, is fubjected to many difadvantages, and generally fuffers a great difcount. In the Weft Indies coins are more frequent, owing to their commercial intercourfe with the Spanifh fettlements.

Exchange betwixt Britain and America, or the Weft Indies, may be computed as in the following examples:

1. The neat proceeds of a cargo from Britain to Bofton amount to 845 l. 17 s. 6d. currency: How much is that in fterling money, exchange at 80 *per cent.?*

```
If 180 : 100
    18 :  10     L.  s. d.
     9 :   5 :: 845 17 6
                        5
             -----------
            9)4229  7 6
             -----------
          L. 469 18 7⅓ Ster. Anf.
```

2. Bofton remits to Britain a bill of 469 l. 18 s. $7\frac{1}{3}$d. Sterling: How much currency was paid for the bill at Bofton, exchange at 80 *per cent.?*

```
If 100 : 180    L.  s. d.
     5 :   9 :: 469 18 7⅓
                        9
             -----------
            5)4229  7 6
               845 17 6 currency. Anf.
```

3. How much Sterling money will 1780 l. Jamaica currency amount to, exchange at 40 *per cent.?*

```
If 140 : 100
    14 :  10     L.
     7 :   5 :: 1780
                   5
                ----
              7)8900
              ----  s. d.
              1271  8 6¼ Ster. Anf.
```

Bills of exchange from America, the rate being high, is an expenfive way of remitting money to Britain; and therefore merchants in Britain generally chufe to have the debts due to them remitted home in fugar, rum, or other produce.

X. *Exchange with Ireland,*

At Dublin, and all over Ireland, books and accounts are kept in pounds, fhillings, and pence, as in Britain; and they exchange on the 100 l. Sterling.

The

The par of one shilling Sterling is one shilling and one penny Irish: and so the par of 100 l. Sterling is 108 l. 6 s. 8 d. Irish. The course of exchange runs from 6 to 15 *per cent*.

EXAMP. 1. London remits to Dublin 586 l. 10 s. Sterling: How much Irish money will that amount to, exchange at $9\frac{5}{8}$ *per cent.*?

L.
If 100 : $109\frac{5}{8}$ :: 586.5
8 877

800 : 877 41055
41055
46920

800)514360.5

542.950625

Ans. 642 l. 19 s. Irish.

By practice.

p. cent.	586.5
10 = $\frac{1}{10}$	58.65
2 = $\frac{1}{5}$	11.73 sub.
8 =	46.92
1 = $\frac{1}{8}$	5.865
$\frac{4}{8}$ = $\frac{1}{2}$	2.9325
$\frac{1}{8}$ = $\frac{1}{4}$	.733125
$9\frac{5}{8}$	56.450625 add
	642.950625

2. How much Sterling will 625 l. Irish amount to, exchange at $10\frac{3}{8}$ *per cent.*?

If $110\frac{3}{8}$: 100 :: 625
8 800
L. s. d.
883 800 883)500000(566 5 $0\frac{1}{4}$ Ster. *Ans.*

XI. *Exchange betwixt London and other places in Britain.*

The several towns in Britain exchange with London for a small premium in favour of London; such as, 1, $1\frac{1}{4}$, *&c. per cent.* The premium is more or less according to the demand for bills.

EXAMP. Edinburgh draws on London for 860 l. exchange at $1\frac{3}{8}$ *per cent.*: How much money must be paid at Edinburgh for the bill?

per cent.	*L.* 860
1 = $\frac{1}{100}$	8 12
$\frac{2}{8}$ = $\frac{1}{4}$	2 3
$\frac{1}{8}$ = $\frac{1}{2}$	1 1 6
	11 16 6 premium.
	871 16 6 paid for the bill.

To avoid paying the premium, it is an usual practice to take the bill payable at London a certain number of days after date; and in this way of doing, 73 days is equivalent to 1 *per cent.*

XII. *Arbitration of Exchanges.*

The course of exchange betwixt nation and nation naturally rises or falls according as the circumstances and balance of trade happen to vary. Now to draw upon and remit to foreign places, in this fluctuating state of exchange, in the way that will turn out most profitable, is the design of arbitration. Which is either simple or compound.

I. *Simple Arbitration.*

In simple arbitration the rates or prices of exchange from one place to other two are given; whereby is found the correspondent price between the said two places, called the *arbitrated price*, or *par of arbitration*: and hence is derived a method of drawing and remitting to the best advantage.

EHAMP. 1. If exchange from London to Amsterdam be 33 s. 9 d. *per* l. Sterling; and if exchange from London to Paris be 32 d. *per* crown; what must be the rate of exchange from Amsterdam to Paris, in order to be on a par with the other two?

Ster. Flem. Ster.
s. s. d. d.
If 20 : 33 9 :: 32
12 12

240 405
32

810
1215

240)12560(54 d. Flem. *per* crown. *Ans.*

2. If exchange from Paris to London be 32 d. Sterling *per* crown; and if exchange from Paris to Amsterdam be 54 d. Flemish *per* crown; what must be the rate of exchange between London and Amsterdam, in order to be on a par with the other two?

Ster. Flem. Ster.
d. d. d.
If 32. : 54 :: 240
240

216
108
12) *s. d.*
32)12960(405 (33 9 Flem. *per* l. Ster. *Ans.*

From these operations it appears, that if any sum of money be remitted, at the rates of exchange mentioned, from any one of the three places to the second, and from the second to the third, and again from the third to the first, the sum so remitted will come home entire, without increase or diminution.

From

From the par of arbitration thus found, and the course of exchange given, is deduced a method of drawing and remitting to advantage, as in the following example.

3. If exchange from London to Paris be 32 d. Sterling *per* crown, and to Amsterdam 405 d. Flemish *per* l. Sterling; and if, by advice from Holland or France, the course of exchange between Paris and Amsterdam is fallen to 52 d Flemish *per* crown; what may be gained *per cent.* by drawing on Paris, and remitting to Amsterdam?

The par of arbitration between Paris and Amsterdam in this case, by Ex. 1. is 54 d. Flemish *per* crown. Work as under.

d. St. Cr. L. St. Cr.
If 32 : 1 :: 100 : 750 debit at Paris

Cr. d. Fl. Cr. d. Fl.
If 1 : 52 :: 750 : 39000 credit at Amsterdam.

d. Fl. L. St. d. Fl. L. s. d. Ster.
If 405 : 1 :: 39000 : 96 5 11$\frac{1}{9}$ to be remitted.
100
———————
3 14 0$\frac{8}{9}$

But if the course of exchange between Paris and Amsterdam, instead of falling below, rise above the par of arbitration, suppose to 56 d. Flemish *per* crown; in this case, if you propose to gain by the negotiation, you must draw on Amsterdam, and remit to Paris. The computation follows.

L. St. d. Fl. L. St. d. Fl.
If 1 : 405 :: 100 : 40500 debit at Amsterdam.
d. Fl. Cr. d. F. Cr.
If 56 : 1 :: 40500 : 723$\frac{3}{14}$ credit at Paris.
Cr. d. St. Cr. L. s. d. Ster.
If 1 : 32 :: 723$\frac{3}{14}$: 96 8 6$\frac{6}{7}$ to be remitted.
100
———————
3 11 5$\frac{1}{7}$ gained *per cent.*

In negotiations of this sort, a fund for remittance is afforded out of the sum you receive for the draught; and your credit at the one foreign place pays your debit at the other.

II. *Compound Arbitration.*

In compound arbitration the rate or price of exchange between three, four, or more places, is given, in order to find how much a remittance passing through them all will amount to at the last place; or to find the arbitrated price, or par of arbitration, between the first place and the last. And this may be done by the following

RULES. I. Distinguish the given rates or prices into antecedents and consequents; place the antecedents in one column, and the consequents in another on the right, fronting one another by way of equation.

II. The first antecedent, and the last consequent to which an antecedent is required, must always be of the same kind.

III. The second antecedent must be of the same kind with the first consequent, and the third antecedent of the same kind with the second consequent, &c.

IV. If to any of the numbers a fraction be annexed, both the antecedent and its consequent must be multiplied into the denominator.

V. To facilitate the operation, terms that happen to be equal or the same in both columns, may be dropped or rejected, and other terms may be abridged.

VI. Multiply the antecedents continually for a divisor, and the consequents continually for a dividend, and the quot will be the answer or antecedent required.

EXAMP. 1. If London remit 1000 l. Sterling to Spain, by way of Holland, at 35 s. Flemish *per* l. Sterling; thence to France, at 58 d. Flemish *per* crown; thence to Venice, at 100 crowns *per* 60 ducats; and thence to Spain, at 360 mervadies *per* ducat; how many piastres, of 272 mervadies, will the 1000 l. Sterling amount to in Spain?

Antecedents.		*Consequents.*	*Abridged.*
1 l. Sterling	=	35 s. or 420 d. Fl.	1=210
58 d. Flemish	=	1 crown France	29= 1
100 crowns France	=	60 ducats Venice	1= 30
1 ducat Venice	=	360 mervadies Spain	1= 45
272 mervadies	=	1 piastre	17= 1
How many piastres	=	1000 l. Sterling	= 10

In order to abridge the terms, divide 58 and 420 by 2, and you have the new antecedent 29, and the new consequent 210; reject two ciphers in 100 and 1000; divide 272 and 360 by 8, and you have 34 and 45; divide 34 and 60 by 2, and you have 17 and 30; and the whole will stand abridged as above.

Then, 29 × 17=493 divisor; and, 210 × 30 × 45 × 10=2835000 dividend; and, 493)2835000(5750$\frac{1}{2}$ piastres. *Ans.*

Or, the consequents may be connected with the sign of multiplication, and placed over a line by way of numerator; and the antecedents, connected in the same manner, may be placed under the line, by way of denominator; and then abridged, as follows:

$$\frac{420\times60\times360\times100}{58\times100\times272}=\frac{210\times60=360\times10}{29\times1\times272}$$
$$=\frac{210\times60\times45\times100}{29\times34}=\frac{210\times30\times45\times10}{29\times17}$$
$$=\frac{2835000}{493},$$

And, 493)2835000(5750$\frac{1}{2}$ piastres. *Ans.*

The placing the terms by way of antecedent and consequent, and working as the rules direct, save so many statings of the rule of three, and greatly shortens the operation. The proportions at large for the above question would stand as under.

L. St. d. Fl. L. St. d. Fl.
If 1 : 420 :: 1000 : 420000

d. Fl. Cr. d. Fl. Cr.
If 58 : 1 :: 420000 : 7241$\frac{11}{29}$

Cr.

	Cr.		*Duc.*		*Cr.*		*Duc.*
If	100	:	60	::	$7241\frac{11}{29}$	:	$4344\frac{24}{29}$

	Duc.		*Mer.*		*Duc.*		*Mer.*
If	1	:	360	::	$4344\frac{24}{29}$	:	$1564137\frac{27}{29}$

	Mer.		*Piaſt.*		*Mer.*		*Piaſt.*
If	272	:	1	::	$1564137\frac{27}{29}$	:	$5750\frac{250}{493}$

If we ſuppoſe the courſe of direct exchange to Spain to be $42\frac{1}{2}$ d. Sterling *per* piaſtre, the 1000l. remitted would only amount to $5647\frac{1}{2}$ piaſtres; and, conſequently, 103 piaſtres are gained by the negociation; that is, about 2 *per cent.*

2. A banker in Amſterdam remits to London 400 l. Flemiſh; firſt to France at 56 d. Flemiſh *per* crown; from France to Venice at 100 crowns *per* 60 ducats; from Venice to Hamburgh at 100 d. Flemiſh *per* ducat; from Hamburgh to Liſbon at 50 d. Flemiſh *per* cruſade of 400 rees; and, laſtly, from Liſbon to London at 64 d. Sterling *per* milree: How much Sterling money will the remittance amount to? and how much will be gained or ſaved, ſuppoſing the direct exchange from Holland to London at 36 s. 10 d. Flemiſh *per* l. Sterling?

Antecedents.		*Conſequents.*
56 d. Flem.	=	1 crown
100 crowns	=	60 ducats.
1 ducat	=	100 d. Flem.
50 d. Flem.	=	400 rees.
1000 rees	=	64 d. Sterling.
How many d. Ster	=	400 l. or 96000 d. Flemiſh?

This, in the fractional form, will ſtand as follows.

$$\frac{60 \times 100 \times 400 \times 64 \times 96000}{56 \times 100 \times 50 \times 1000} = \frac{368640}{7}, \text{ and}$$

7)368640($52662\frac{6}{7}$ d. Ster. = 219 l. 8. s. $6\frac{6}{7}$ d. St. *Anſ.*

To find how much the exchange from Amſterdam directly to London, at 36 s. 10 d. Flemiſh *per* l. Sterling, will amount to, ſay,

s.	*d.*		*d. Fl.*		*L. St.*		*d. Fl.*		*L.*	*s.*	*d. St.*
36	10	If	442	:	1	::	96000	:	217	3	$10\frac{1}{2}$
12									219	8	$6\frac{3}{4}$
442		Gained or ſaved,							2	4	$8\frac{1}{4}$

In the above example, the par of arbitration, or the arbitrated price, between London and Amſterdam, *viz.* the number of Flemiſh pence given for 1 l. Sterling, may be found thus:

Make 64 d. Sterling, the price of the milree, the firſt antecedent; then all the former conſequents will become antecedents, and all the antecedents will become conſequents. Place 240, the pence in 1 l. Sterling, as the laſt conſequent, and then proceed as taught above, *viz.*

Antecedents.		*Conſequents.*
64 d. Ster.	=	1000 rees.
400 rees	=	50 d. Flem.
100 d. Flem.	=	1 ducat.
60 ducats	=	100 crowns.
1 crown	=	56 d. Flem.
How many d. Flem.	=	240 d. Ster.?

$$\frac{1000 \times 50 \times 100 \times 56 \times 240}{64 \times 400 \times 100 \times 60} = \frac{875}{2}, \text{ and}$$

2)875($437\frac{1}{2}$ d. = 36 s. $5\frac{1}{2}$ d. Flem. *per* l. Ster. *Anſ.*

Or the arbitrated price may be found from the anſwer to the queſtion, by ſaying,

	d. Ster.		*d. Flem.*		*d. St.*
If	$\frac{368640}{7}$	:	96000	::	240
			7		
			672000		
			240		
			2688		
			1344		

368640)161280000($437\frac{1}{2}$ *d.* = 36 *s.* $5\frac{1}{2}$ *d. Flem.* as before.

The work may be proved by the arbitrated price thus: As 1 l. Sterling to 36 s. $5\frac{1}{2}$ d. Flemiſh, ſo 219 l. 8 s. $6\frac{6}{7}$ d. Sterling to 400 l. Flemiſh.

The arbitrated price compared with the direct courſe ſhows whether the direct or circular remittance will be moſt advantageous, and how much. Thus the banker at Amſterdam will think it better exchange to receive 1 l. Sterling for 36 s. $5\frac{1}{2}$ d. Flemiſh, than for 36 s. 10 d. Flemiſh.

EXCHANGE ſignifies alſo a place in moſt conſiderable trading cities, wherein the merchants, negociants, agents, bankers, brokers, interpreters, and other perſons concerned in commerce, meet on certain days, and at certain times thereof, to confer and treat together of matters relating to exchanges, remittances, payments, adventures, aſſurances, freightments, and other mercantile negociations, both by ſea and land.

EXCHEQUER, in the Britiſh juriſprudence, an ancient court of record, in which all cauſes concerning the revenues and rights of the crown are heard and determined, and where the crown-revenues are received.

It took this name from the cloth that covered the table of the court, which was party-coloured, or chequered.

This court is ſaid to have been erected by William the conqueror, its model being taken from a like court eſtabliſhed in Normandy long before that time. Anciently its authority was ſo great, that it was held in the king's palace, and the acts thereof were not to be examined or controlled in any other of the king's courts; but, at preſent, it is the laſt of the four courts at Weſtminſter.

In the exchequer, some reckon seven courts, *viz.* those of pleas, accounts, recepts, exchequer-chamber, (which is an assembly of all the judges on difficult matters in law) errors in the exchequer, errors in the king's bench, and, lastly, the court of equity in the exchequer.

But the exchequer, for dispatch of business, is generally divided into two parts; one of which is chiefly conversant in the judicial hearing and deciding of all causes relating to the king's coffers, formerly termed the exchequer of accounts: the other is called the receipt of the exchequer, as being principally employed in receiving and payment of money.

Officers of the receipt may take one penny in the pound, as their fee for sums issued out; and they are obliged, without delay, to receive the money brought thither; and the money received is to be put in chests under three different locks and keys, kept by three several officers. All sheriffs, bailiffs, *&c.* are to account in the exchequer; and in the lower part, termed the receipt, the debtors of the king, and persons in debt to them, the king's tenants, and the officers and ministers of the court, are privileged to sue one another, or any stranger, and to be sued in the like actions as are brought in the courts of king's bench and common-pleas.

The judicial part of the exchequer, is a court both of law and equity. The court of law is held in the office of pleas, according to the course of common law, before the barons: in this court, the plaintiff ought to be a debtor or accountant to the king; and the leading process is either a writ of subpœna, or quo minus, which last goes into Wales, where no process out of our courts of law ought to run, except a capias utlagatum.

The court of equity is held in the exchequer-chamber before the treasurer, chancellor, and barons; but, generally, before the barons only; the lord chief baron being the chief judge to hear and determine all causes. The proceedings in this part of the exchequer, are by English bill and answer, according to the practice of the court of chancery; with this difference, that the plaintiff here must likewise set forth that he is a debtor to the king, whether he be so or not. It is in this court of equity that the clergy exhibit bills for the recovery of their tythes, *&c.* Here too the attorney-general exhibits bills for any matters concerning the crown; and a bill may be exhibited against the king's attorney by any person aggrieved in any cause prosecuted against him on behalf of the king, to be relieved therein: in which case, the plaintiff is to attend on the attorney-general with a copy of the bill, and procure him to give in an answer thereto; in the making of which he may call in any person interested in the cause, or any officer, or others, to instruct him, that the king be not prejudiced thereby, and his answer is to be put in without oath.

But besides the business relating to debtors, farmers, receivers, accountants, *&c.* all penal punishments, intrusion, and forfeitures upon popular actions, are matters likewise cognizable by this court; where there also sits a puisne-baron, who administers the oaths to high-sheriffs, bailiffs, auditors, receivers, collectors, comptrollers, surveyors and searchers of all the customs, *&c.*

The exchequer in Scotland, has the same privileges and jurisdiction as that of England; and all matters competent to the one, are likewise competent to the other.

Black book of the EXCHEQUER, a book containing a description of the court of England in 1175, and its officers, with their ranks, wages, privileges, perquisites, *&c.* also the revenues of the crown, both in money and cattle.

EXCIPIENT, in pharmacy, denotes the ingredient, which, in compound medicines, receives all the rest; as the conserve in electuaries, the syrup in boluses, *&c.*

EXCISE, a certain duty or impost charged upon liquors, as beer, ale, cyder, *&c.* malt, and several other commodities, within the kingdom of Great Britain, and town of Berwick upon Tweed.

The excise is one of the most considerable branches of the king's revenue. It was formerly farmed out, but is now managed for the king by commissioners in both kingdoms, who receive the whole product of the excise, and pay it into the exchequer. These commissioners are nine in number in England, and four in Scotland. The former have a salary of 1000 l. a year, the later 500 l. They are obliged by oath to take no fee or reward but from the king himself; and from them there lies an appeal to five other commissioners called commissioners of appeals.

The duty of excise was first granted to king Charles II. by act of parliament in the year 1660, during the life of that monarch. 1. It was 15 d. *per* barrel upon every barrel of beer or ale above 6 s. the barrel, and 3 d. *per* barrel for every barrel of 6 s. or under, brewed for retail; 15 d. for every hogshead of cyder or perry sold by retail; 1 d. for every gallon of strong water, aqua vitæ, *&c.* 2. A new excise was granted for ever by the fifth money-act of William and Mary, being for every barrel of beer or ale above 6 s. the barrel, 9 d; and for every barrel of 6 s. or under, 3 d.; for every hogshead of cyder or perry, 1 s. *per* hogshead. In this excise, the price of the liquor is to be reckoned exclusive of the duty. 3. An excise was granted of 6 d. a bushel on malt in the reign of king William, which by subsequent statutes has been continued yearly ever since. But such malt as shall be made for exportation, and be so entered and kept separate from other malt, is exempted from the payment of this duty. 4. Another new excise upon home-made liquors was granted in queen Anne's reign; being an additional excise upon every barrel of beer or ale brewed for sale above 6s. the barrel, 3 d. exclusive of the duties; and for every barrel at 6s. or under, 1 d.; for every hogshead of cyder or perry, 5 d.; for every gallon of strong waters or aqua vitæ, 1 d. This excise was not laid upon any such liquors imported. 5. An excise on candles was first granted in the reign of queen Anne, and continued for ever, being a duty of 4 d. a pound on wax, and a halfpenny the pound on tallow candles, made in Great Britain for sale or not for sale; but makers for their own use may compound for 1 s. a head for every person in their family. An additional excise on candles was afterwards granted,

granted, being the same with the former in every respect. 6. An excise upon hides and skins tanned in Britain, first granted in queen Anne's reign, was an excise of seventeen different kinds, upon so many different kinds of hides and skins particularly named, and upon all others not named, 13 l. *per cent. ad valorem.* An additional excise was afterwards granted, being an additional duty of different kinds, upon so many different sorts of hides and skins particularly named, and on all others not named, 15 l. *per cent.* on the value. 7. An excise on home-made vellum and parchment, first granted by the same act, being 1 s. *per* dozen on vellum, and 6 d. the dozen on parchment. And afterwards an additional excise on vellum, *&c.* was granted, being an additional duty of 2 s. the dozen on vellum, and 1 s. the dozen on parchment. 8. An excise on hops of home growth was first granted in queen Anne's reign, being 1 d. *per* pound. 9. An excise on paper, pasteboards, milled-boards, and scale-boards, was first granted in the reign of queen Anne, being a duty of eleven different kinds on so many different sorts of paper particularly named, made in Great Britain; on pasteboards, *&c.* 3 s. the hundred weight, and on all sorts of paper not named, 12 l. *per cent.* on the value. An additional duty on paper, *&c.* was granted of eleven different kinds, *&c.* on pasteboard, 1 s. 6 d. the hundred weight, and on all sorts of paper not named, 6 l. *per cent.* on the value; and on painted paper for hangings, a halfpenny the yard square. 10. An excise of 1 d. *per* pound on soap made in Great Britain, was granted by the same act; to which an additional excise has been added of a halfpenny *per* pound. 11. An excise upon printed silks, callicoes, linens and stuffs made in Great Britain, and printed, painted, stained or dyed here, was first granted in queen Anne's reign, being a duty of 3 d. on silks and callicoes, and $1\frac{1}{2}$ d. on linen and stuffs the yard square, excepting silk-handkerchiefs, linens and fustains dyed of one colour, and stuffs made of woollen, or the greatest part in value of woollen. And an additional excise was granted of 6 d. the yard of half-yard broad silks; 1 d. the yard square of silk handkerchiefs; 3 d. the yard square of callicoes, and $1\frac{1}{2}$ d. the yard square of linens and stuffs, excepting, as before, callicoes, *&c.* dyed of one colour, and woollen stuffs. 12. An excise on starch was first granted for 1 d. the pound; and afterwards an additional excise of 1 d. the pound. 13. The excise on gilt and silver wire made in Great Britain, is 8 d. the ounce on gilt wire, and 6 d. the ounce on silver wire.

If any brewers do not make true entries of their liquors brewed, once a-week at the excise-office, they forfeit 10 l. but this is subject to mitigation, so as not to be less than double the duty; and the retailers of beer and ale and strong waters, neglecting to make their entries once a-month of what liquors they retail, are liable to 40 s. penalty. In case any brewer erects or alters any back, copper, cooler, *&c.* or keeps a private store-house, or if any maltster keeps any private vessel for steeping barley, without giving proper notice to the officers of excise, such brewer or maltster forfeit 50 l. and where they bribe a gauger, it is 10 l. The officers of excise may go on board ships, and search for any exciseable liquors, as officers of the customs do, and seize commodities forfeited, *&c.* and complaints made at the chief office of excise are to be heard by three or more commissioners; but two justices of the peace have the power to determine in seizures out of the limits of the excise-office in London.

EXCLAMATION, in rhetoric, a figure that expresses the violent and sudden breaking out, and vehemence of any passion.

EXCOMMUNICATION, an ecclesiastical penalty or censure, whereby such persons as are guilty of any notorious crime or offence, are separated from the communion of the church, and deprived of all spiritual advantages.

Excommunication among the Jews, according to Elias, a German rabbin, was distinguished into three kinds: 1. Niddui, which was a separation of but a few days; 2. Cherem, a separation attended with execration and malediction; and, 3. Shammatha, which was the last and greater excommunication. But Selden says, that niddui and shammatha are the same thing; and therefore that there were but two kinds of excommunication among the Jews, *viz.* the greater and the lesser. They made also another distinction in excommunication, into total or universal, by which a man was excommunicated with regard to all men; and partial, by which a man was excommunicated in one city, and with regard to certain persons, and not others.

It is observable, that not only the judges had the power of excommunicating, but that each particular person in conversation might excommunicate another, and himself likewise; and this excommunication, if well grounded, was of force: nay, if a man dreamed that he was excommunicated by himself or by another, he was considered as an excommunicated person, because this dream was supposed to be sent from God.

As to the effects of the Jewish excommunication, the lesser excluded the excommunicated person from the society of men; that is, he was not to come nearer them than four cubits, neither he, his wife, children, or domestics, according to Buxtorf. The greater absolutely sequestered the person from the conversation of others; and sometimes he was shut up in a small chamber or prison, where he lived alone. Baronius and Beza pretend, that the greater excommunication excluded men from the use of sacred things. Selden, on the contrary, affirms, that they were allowed to be present in the temple, and partake of the public worship. Buxtorf, who is of the same opinion, adds, that whereas others came into the temple at the right hand, and went out at the left, the excommunicated were obliged both to go in and out at the left.

Excommunication, among the modern Jews, is attended with the most terrible consequences. The excommunicated person is refused all human assistance: if there be a corpse in his house, or a child to be circumcised, none must help him. He is cursed by the book of the law, by the curse of Joshua against Jericho, by that of Elisha against the children, by heaven and earth,

earth, and God is besought that a whirlwind may dash him to pieces. He is pelted with stones if he appear in the streets; and if he obtains absolution, it is upon the most mortifying conditions; for he is publicly tied to a post and whipped, after which he lays himself down at the door of the synagogue, and all those who go out pass over him. This was the very case of the famous Jew Acosta.

In the ancient Christian church, the power of excommunication, as well as other acts of ecclesiastical discipline, was lodged in the hands of the clergy, who distinguished it into the greater and lesser. The lesser excommunication, simply called *aphorismos*, separation or suspension, consisted in excluding men from the participation of the eucharist, and the prayers of the faithful. But they were not expelled the church; for they had the privilege of being present at the reading of the scriptures, the sermons, and the prayers of the catechumens and penitents. This excommunication was inflicted for lesser crimes, such as neglecting to attend the service of the church, misbehaviour in it, and the like.

The greater excommunication, called *panteles aphorismos*, total separation and anathema, consisted in an absolute and intire exclusion from the church and the participation of all its rites. When any person was thus excommunicated, notice was given of it by circular letters to the most eminent churches all over the world, that they might all confirm this act of discipline, by refusing to admit the delinquent to their communion. The consequences of this latter excommunication was very terrible. The excommunicated person was avoided in civil commerce and outward conversation. No one was to receive him into his house, nor eat at the same table with him; and when dead, he was denied the solemn rites of burial. It has been a question, whether the ancient church used to add execration to her censures. Grotius thinks this was done, though very seldom, as in the case of Julian the apostate, for whose destruction the ancient Christians absolutely prayed to God. St Chrysostom was utterly against this practice, affirming that we ought not to pray against the sinner, but against his opinions or actions.

The Romish pontifical takes notice of three kinds of excommunication. 1. The minor, incurred by those who have any correspondence with an excommunicated person. 2. The major, which falls upon those who disobey the commands of the holy see, or refuse to submit to certain points of discipline; in consequence of which they are excluded from the church militant and triumphant, and delivered over to the devil and his angels. 3. Anathema, which is properly that pronounced by the pope against heretical princes and countries. In former ages, these papal fulminations were most terrible things; but at present, they are formidable to none but a few petty states of Italy.

Excommunication in the Greek church, cuts the offender off from all communion with the 318 fathers of the first council of Nice, and with the saints; consigns him over to the devil, and the traitor Judas; and condemns his body to remain after death as hard as a flint or piece of steel, unless he humbles himself and makes atonement for his sins by a sincere repentance. The form abounds with dreadful imprecations; and the Greeks assert, that if a person dies excommunicated, the devil enters into the lifeless corpse; and therefore, in order to prevent it, the relations of the deceased cut his body in pieces, and boil them in wine. It is a custom for the patriarch of Jerusalem annually to excommunicate the pope and the church of Rome; on which occasion, together with a great deal of idle ceremony, he drives a nail into the ground with a hammer, as a mark of malediction.

The form of excommunication in the church of England anciently ran thus: "By the authority of God the Father Almighty, the Son and Holy Ghost, and of Mary the blessed mother of God, we excommunicate, anathematize, and sequester from the pale of holy mother church," *&c.* The causes of excommunication in England are, contempt of the bishop's court, heresy, neglect of public worship and the sacraments, incontinency, adultery, simony, *&c.* It is published in the church; and if the offender does not submit in forty days, the civil magistrate interposes, and the excommunicated person is imprisoned till he submits and obtains absolution. Excommunication disables a person from doing any judicial act, as suing in an action at law, being a witness, *&c.*

Excommunication, among the Pagans, excluded the person from the sacrifices and the temples, and delivered him over to the furies, which was called *exsecrare*, and *diris devovere.* When Marcus Crassus set out on his expedition against the Parthians, Atteius, tribune of the people, not being able to prevent him, ran to the gate of the city through which the general was to pass, and setting a chaffing-dish in the middle of the way with fire in it, when Crassus drew near, he threw some perfumes into the chaffing-dish, and pronounced curses against Crassus with great exclamation, and thus excommunicated him.

EXCORIATION, in medicine and surgery, the galling or rubbing off of the cuticle, especially of the parts between the thighs, and about the anus.

EXCREMENT, whatever is discharged out of the body of animals after digestion, or the fibrous parts of the aliment, mixed with the bile, saliva, and other fluids. Urine and the fæces are the gross excrements that are discharged out of the bladder or belly. Other excrements are the various humours that are secreted from the blood through the various strainers in the body, and which serve for several uses, such as the saliva, sweat, bile, the pancreatic juice, lymph, the semen, nails, the hair, the horns and hoofs of animals.

EXCRESCENCE, in surgery, denotes every preternatural tumour which arises upon the skin, either in the form of a wart or tubercle. If they are born with a person, as they frequently are, they are called *nævi materni*, or marks from the mother; but if the tumour is large, so as to depend from the skin like a fleshy mass, it is then called a sarcoma.

EXCRETION, or SECRETION, in medicine, a separation of some fluid, mixed with the blood, by means of the

the glands. Excretions, by which we mean thofe that evacuate fuperfluous and heterogeneous humours, purify the mafs of blood: the humours which are generated in the blood are excreted by the glands, and are replaced by a fufficient quantity of aliment.

EXCRETORY, in anatomy, a term applied to certain little ducts or veffels, deftined for the reception of a fluid, fecreted in certain glandules, and other vifcera, for the excretion of it in the appropriated places.

Letters of EXCULPATION, in Scots law, a writ or fummons iffued by authority of the court of jufticiary, at the inftance of a panel, for citing witneffes to prove his defences, or his objections to any of the jury or witneffes cited againft him. See tit. 33.

EXCURSION, in aftronomy, is ufed in a fynonymous fenfe with elongation. See ELONGATION.

EXECRATION, in antiquity, a kind of punifhment, confifting of direful curfes and marks of infamy: fuch was that ufed againft Philip king of Macedon, by the Athenians. A general affembly of the people being called, they made a decree, that all the ftatues and images of that king, and of all his anceftors, fhould be demolifhed, and their very names razed; that all the feftivals, facred rites, priefts, and whatever elfe had been inftituted in honour of him, fhould be prophaned; that the very places where there had been any monument or infcription to his honour, fhould be deteftable; that nothing fhould be fet up, or dedicated in them, which could be done in clean places: and, laftly, that the priefts, as often as they prayed for the Athenian people, allies, armies, and fleets, fhould as many times deteft and execrate Philip, his children, kingdom, land and fea forces, and the whole race and name of the Macedonians.

EXECUTION, in a general fenfe, the act of accomplifhing, finifhing, or atchieving any thing.

EXECUTION of fummonfes or letters, in Scots law, fee LAW, tit. 12. Execution of teftaments; fee tit. 28. Execution of civil fentences and decrees; fee tit. 32. Execution of criminal fentences; fee tit. 33.

EXECUTOR, in Scots law, fignifies either the perfon intitled to fucceed to the moveable eftate of one deceafed, or who by law or fpecial appointment is intrufted with the adminiftration of it. See tit. 28.

EXECUTRY, in Scots law, is the moveable eftate falling to the executor. Under executry, or moveables, is comprehended every thing that moves itfelf, or can be moved; fuch as corns, cattle, furniture, ready money, *&c.* See tit. 9. and 28.

EXEDRÆ, in antiquity, a general name for fuch buildings as were diftinct from the main body of the churches, and yet within the limits of the church taken in its largeft fenfe. Among the exedræ the chief was the baptiftory. See BAPTISTORY.

EXEGESIS, a difcourfe by way of explanation or comment upon any fubject. In the Scotch univerfities, there is an exercife among the ftudents in divinity, called an exegefis, in which a queftion is ftated by the refpondent, who is then oppofed by two or three other ftudents in their turns; during which time the profeffor moderates, and folves the difficulties which the refpondent cannot overcome.

EXEMPLAR, denotes much the fame with model. See MODEL.

EXEMPLIFICATION *of letters patent*, a tranfcript or duplicate of them, made from the inrollment thereof, and fealed with the great feal.

EXEMPTION, in law, a privilege to be free from fome fervice or appearance: thus, barons and peers of the realm are, on account of their dignity, exempted from being fworn upon inquefts; and knights, clergymen, and others, from appearing at the fheriff's turn. Perfons of feventy years of age, apothecaries, *&c.* are alfo by law exempted from ferving on juries; and juftices of the peace, attorneys, *&c.* from parifh-offices.

EXERCISE, among phyficians, fuch an agitation of the body, as produces falutary effects in the animal œconomy. See MEDICINE.

EXERCISE, in military affairs, is the ranging a body of foldiers in form of battle, and making them perform the feveral motions and military evolutions with different management of their arms, in order to make them expert therein.

EXERCITOR, in Scots law, he who employs a fhip in trade, whether he be owner, or only freights her from the owner.

EXERGUM, among antiquarians, a little fpace around or without the figures of a medal, left for the infcription, cypher, device, date, *&c.*

EXETER, the capital city of Devonfhire, fituated on the river Ex, ten miles north of the Britifh channel: W. long. 3° 40′, N. lat. 50° 44′.

EXFOLIATION, a term ufed by furgeons for the fcaling of a bone, or its rifing and feparating into thin laminæ or fcales.

EXHALATION, a general term for all effluvia or fteams raifed from the furface of the earth in form of vapour.

EXHIBIT, in law, is where a deed, or other writing, being produced in a chancery fuit, to be proved by witneffes, the examiner, or commiffioner appointed for the examination of any fuch, certifies on the back of the deed or writing, that the fame was fhewn to the witnefs at the time of his examination, and by him fworn to.

EXHORTATION, in rhetoric, differs only from fuafion, as being more directly addreffed to the paffions.

EXIGENT, in law, a writ which lies where the defendant in a perfonal action cannot be found, nor any effects of his within the county, by which he may be attached or diftrained.

EXIGENTERS, four officers in the court of common-pleas, who make all exigents and proclamations, in all actions where procefs of outlawry lies. Writs of fuperfedeas, as well as the prothonotaries upon exigents, were likewife drawn up in their office.

EXILE. See BANISHMENT.

EXISTENCE, that whereby any thing has an actual effence, or is faid to be. See METAPHYSICS.

EXIT, in a theatrical fenfe, the action of a player in going off the ftage, after he has played his part.

EXLEGALITUS, among lawyers, the fame with an outlawed perfon.

EXOCOETUS, the FLYING-FISH, in ichthyology, a genus belonging to the order of abdominales. The head is fcaly, and it has no teeth; it has ten radii in the branchioftege membrane; the body is whitifh, and the

the belly is angular: the pectoral fins are very large. When purfued by any other fifh, it raifes itfelf from the water by means of thefe long fins, and flies in the air to a confiderable diftance, till the fins dry, and then it falls down into the water. There are two fpecies, *viz.* 1. The volitans, with the belly carinated on each fide. It is a native of the European and American feas. 2. The evolans, with a cylindrical belly. It is a native of the German ocean.

EXODIARY, in the ancient Roman tragedy, was the perfon who, after the drama or play was ended, fung the exodium. See Exodium.

EXODIUM, in the ancient Greek drama, one of the four parts or divifions of tragedy, being fo much of the piece as included the cataftrophe and unravelling of the plot, and anfwering nearly to our fourth and fifth acts.

Exodium, among the Romans, confifted of certain humourous verfes rehearfed by the exodiary at the end of the Fabulæ Atellanæ.

Exodium, in the Septuagint, fignifies the end or conclufion of a feaft. Particularly it is ufed for the eighth day of the feaft of tabernacles, which, it is faid, had a fpecial view to the commemoration of the exodus, or departure out of Egypt.

EXODUS, a canonical book of the Old Teftament; being the fecond of the pentateuch, or five books of Mofes.

It is fo called, from the Greek, [*exodos*], the going out, or departure of the children of Ifrael from the land of Egypt; the hiftory of which is delivered in this book, together with the many miracles wrought on that occafion.

EX OFFICIO, among lawyers, fignifies the power a perfon has, by virtue of his office, to do certain acts without being applied to.

EXOMPHALUS, in furgery, called alfo omphalocele, and hernia umbilicalis, is a preternatural tumour of the abdomen, at the navel, from a rupture, or diftenfion of the parts which inveft that cavity. See Surgery.

EXORCISM, among ecclefiaftical writers, the expelling devils from perfons poffeffed, by means of conjurations and prayers.

Exorcifm makes a confiderable part of the fuperftition of the church of Rome, the rituals of which forbid the exorcifing any perfon without the bifhop's leave.

The ceremony is performed at the lower end of the church, towards the door. The exorcift firft figns the poffeffed perfon with the fign of the crofs, makes him kneel, and fprinkles him with holy water. Then follow the litanies, pfalms, and prayer; after which the exorcift afks the devil his name, and adjures him by the myfteries of the Chriftian religion not to afflict the perfon any more: then, laying his right hand on the dæmoniac's head, he repeats the form of exorcifm, which is this: "I exorcife thee, unclean fpirit, in "the name of Jefus Chrift: tremble, O Satan! "thou enemy of the faith, thou foe of mankind, who "haft brought death into the world, who haft deprived men of life, and haft rebelled againft juftice; "thou feducer of mankind, thou root of evil, thou "fource of avarice, difcord, and envy.

The Romanifts likewife exorcife houfes and other places, fuppofed to be haunted by unclean fpirits; and the ceremony is much the fame with that for perfons poffeffed.

EXORCISTS, in church-hiftory, an order of men, in the ancient church, whofe employment it was to exorcife or caft out devils. See the preceding article.

EXORDIUM, in rhetoric, is the preamble or beginning, ferving to prepare the audience for the reft of the difcourfe.

Exordiums are of two kinds, either juft and formal, or vehement and abrupt. The laft are moft fuitable on occafions of extraordinary joy, indignation, or the like.

EXOTIC, an apellation denoting a thing to be the produce of foreign countries.

EXPANSION, among metaphyficians, denotes the idea we have of lafting diftance, all whofe parts exift together.

Expansion, in phyfiology, the fwelling or increafe of the bulk of bodies when heated.

EXPECTORANTS, in pharmacy, medicines which promote expectoration. See the next article.

EXPECTORATION, the act of evacuating or bringing up phlegm or other matters out of the trachea, lungs, *&c.* by coughing, hauking, fpitting, *&c.*

EXPERIENCE, a kind of knowledge acquired by long ufe, without any teacher. Mr Locke fays, that men receive all the materials of knowledge from experience and obfervation.

EXPERIMENT, in philofophy, is the trial of the refult or effect of the applications and motions of certain natural bodies, in order to difcover fomething of their motions and relations, whereby to afcertain fome of their phænomena, or caufes.

EXPERIMENTAL philosophy, that philofophy which proceeds on experiments, which deduces the laws of nature, and the properties and powers of bodies, and their actions upon each other, from fenfible experiments and obfervations. The bufinefs of experimental philofophy is to inquire into, and to inveftigate the reafons and caufes of, the various appearances and phænomena of nature; and to make the truth or probability thereof obvious and evident to the fenfes, by plain, undeniable, and adequate experiments, reprefenting the feveral parts of the grand machinery and agency of nature. See Mechanics, Hydrostatics, Optics, and the other branches of Natural Philosophy.

EXPIATION, a religious act, by which fatisfaction, atonement, or amends, is made for the commiffion of fome crime, the guilt done away, and the obligation to punifhment cancelled.

The method of expiation among the Jews was chiefly by facrifice, whether for fins of ignorance, or to purify themfelves from certain pollutions.

Great day of Expiation, an annual folemnity of the Jews, upon the tenth day of the month Tifri, which anfwers to our September. On this occafion the high-prieft laid afide his breaft-plate and embroidered ephod, as being a day of humiliation. He firft offered a bullock and a ram for his own fins, and thofe of the priefts;

priests; then he received from the heads of the people two goats for a sin-offering, and a ram for a burnt-offering, to be offered in the name of the whole multitude. It was determined by lot which of the goats should be sacrificed, and which set at liberty. After this he perfumed the sanctuary with incense, and sprinkled it with blood: then, coming out, he sacrificed the goat upon which the lot had fallen. This done, the goat which was to be set at liberty being brought to him, he laid his hands upon its head, confessed his sins, and the sins of the people, and then sent him away into some desart place: it was called azazel, or the scape-goat.

As to the expiations among the heathens, they were of several kinds, as sacrifices, and religious washings.

Expiation, in a figurative sense, is applied by divines to the pardon procured to mens sins, by the merits of Christ's death.

EXPIRATION, in physic, that part of respiration whereby the air is expelled, or driven out of the lungs.

EXPLICITE, in the schools, something clear, distinct, formal, and unfolded.

EXPLOSION, in physics, is properly applied to the going off of gun-powder and the report made thereby. Hence, it is used to express such sudden actions of bodies as generate air instantaneously.

EXPONENT, in algebra. See Algebra.

Exponent is also used in arithmetic, in the same sense as index or logarithm.

EXPORTATION, the shipping and carrying out of the the kingdom wares and commodities for other countries. See Commerce.

EXPOSITION, in general, denotes the setting a thing open to public view: thus it is the Romanists say, the host is exposed, when shewn to the people.

Exposition, in a literary sense, the explaining an author, passage, writing, or the like, and setting their meaning in an obvious and clear light.

EXPOSITOR, or Expository, a title given to small dictionaries, serving to explain the hard words of a language.

EXPOSTULATION, in rhetoric, a warm address to a person, who has done another some injury, representing the wrong in the strongest terms, and demanding redress.

EXPOSURE, in gardening, the situation of a garden, wall, or the like, with respect to the points of the compass, as south or east.

EXPRESS, something that is determinate or precise, or in such formal terms as leaves no room for doubt.

Express also denotes a courier. See Courier.

EXPRESSED oils, in chemistry. See Chemistry, p. 93.

Expression, in rhetoric, the elocution, diction, or choice of words in a discourse. See Composition.

Expression, in painting, a natural and lively representation of the subject, or of the several objects intended to be shewn.

The expression consists chiefly in representing the human body and all its parts, in the action suitable to it: in exhibiting in the face the several passions proper to the figures, and observing the motions they impress on the external parts.

EXPULSION, in a general sense, the act of violently driving a person out of any city, society, &c.

Expulsion, in medicine, the act whereby any thing is forcibly driven out of the place in which it is: thus we say, the expulsion of the foetus in delivery.

EXTASY, a transport which suspends the function of the senses, by the intense contemplation of some extraordinary or supernatural object.

Extasy, in medicine, a species of catalepsy, when a person perfectly remembers, after the paroxysm is over, the ideas he conceived during the time it lasted.

EXTENSION, in philosophy, one of the common and essential properties of body, or that by which it possesses or takes up some part of universal space, which is called the place of that body. See Metaphysics.

EXTENSOR, an appellation given to several muscles, from their extending or stretching the parts to which they belong. See Anatomy, Part II.

Old and new EXTENT, in Scots law. The *old extent* was a valuation or estimate of the annual value of all the lands in Scotland, taken (it is thought before the reign of Alexander III.) for the purpose of proportionating the public subsidies, and ascertaining the rates of certain feudal casualties. By improvement, and the alteration in the nominal value of money, this valuation, or old extent, became, in length of time, too low a standard for computing their feudal casualties; wherefore, about the reign of Robert I. all inquests for serving heirs were ordained to take proof also of the *present value* of the lands contained in the brief. This last was called the *new extent*. See Scots Law, title 12.——None of these extents is the rule by which the land-tax is now proportioned in Scotland. See Valuation, or Valued Rent.

EXTERIOR, or External. See External.

EXTERMINATION, in general, the extirpating or destroying something.

Extermination, in Algebra. See Algebra, p. 104.

EXTERNAL, a term of relation applied to the surface or outside of a body; or that part which appears or presents itself to the eye, touch, &c. in contradistinction to internal.

External is also used to signify any thing that is without-side a man, or that is not within himself, particularly in his mind, in which sense we may say external objects, &c.

EXTINCTION, in general, denotes the putting out or destroying something, as a fire or flame.

EXTINGUISHMENT, in law, is a consolidation or union, as where one has due to him a yearly rent out of lands, and afterwards purchases the lands out of which the rent arises: in this case, both the property and the rent being united in one possessor, the rent is said to be extinguished.

EXTIRPATION, the same with extermination. See Extermination.

EXTISPEX, in antiquity, the person who drew presages from viewing the intrails of animals offered in sacrifice.

crifice. See SACRIFICE, HARUSPEX, and DIVINATION.

EXTORTION, in law, is an illegal manner of wresting any thing from a man either by force, menace, or authority.

EXTRACT, in pharmacy, is a solution of the purer parts of a mixed body inspissated, by distillation or evaporation, nearly to the consistence of honey. See CHEMISTRY.

EXTRACT, in matters of literature, is something copied or collected from a book or paper.

EXTRACTION, in chemistry and pharmacy, the operation by which essences, tinctures, *&c.* are drawn from natural bodies. See CHEMISTRY.

EXTRACTION, in surgery, is the drawing any foreign matter out of the body by the hand, or by the help of instruments. See SURGERY.

EXTRACTION, in genealogy, implies the stock or family from which a person is descended.

EXTRACTION *of roots*, in algebra and arithmetic. See ALGEBRA, p. 86. and ARITHMETICK, p. 420.

EXTRACTOR, in midwifery, an instrument, or forceps, for extracting children by the head. See MIDWIFERY.

EXTRAVAGANTES, those decretal epistles, which were published after the clementines. See CLEMENTINES.

They were so called because, at first, they were not digested, or ranged, with the other papal constitutions, but seemed to be, as it were, detached from the canon law. They continued to be called by the same name when they were afterwards inserted in the body of the canon law. The first extravagantes are those of John XXII. successor of Clement V. the last collection was brought down to the year 1483, and was called the common extravagantes, notwithstandinng that they were likewise incorporated with the rest of the canon law.

EXTRAVASATION, in contusions, fissures, depressions, fractures, and other accidents of the cranium, is when one or more of the blood-vessels, that are distributed on the dura mater, is broke or divided, whereby there is such a discharge of blood as greatly oppresses the brain, and disturbs its office; frequently bringing on violent pains, and other mischiefs; and at length death itself, unless the patient is timely relieved. See SURGERY, and MEDICINE.

EXTREMES, in logic, the terms expressing the two ideas whose relation we inquire after in a syllogism.

EXTREME UNCTION. See UNCTION.

EXTRINSIC, among metaphysicians, is taken in various senses: sometimes it signifies a thing's not belonging to the essence of another; in which sense, the efficient cause and end of a thing are said to be extrinsic. Sometimes it signifies a thing's not being contained within the capacity of another; in which sense, these causes arc called extrinsic which introduce something into a subject from without, as when a fire introduces heat. Sometimes it signifies a thing added or applied to another; in which sense accidents and adherents are said to be extrinsic to the subjects to which they adhere. Sometimes the vision is said to be extrinsic from some form which does not exist in that thing, but is adjacent to it, or by some means or other without it.

EXULCERATION, in surgery. See ULCER.

EXUVIÆ, among naturalists, denote the cast-off parts or coverings of animals, as the skins of serpents, caterpillars, and other insects.

EYE, in anatomy. See ANATOMY, p. 289.

Bull's EYE, in astronomy. See ALDEBARAN.

EYE-GLASS, in the microscope. See MICROSCOPE and OPTICS.

EYEMOUTH, or AYMOUTH, a port-town of Scotland, about six miles north of Berwick.

EYRAC, or IZACA ARABIC, a province of Asiatic Turky, situated on the river Euphrates, being the ancient Chaldea or Babylonia.

EYRAC, or IRAC AGEM, the ancient Parthia, now the principal province of Persia, is situated almost in the centre of that kingdom, its capital city being Ispahan, the metropolis of the whole kingdom.

EYRE, or EIRE, in law, the court of itinerant justices. See JUSTICES.

EYSENACH, a city of Germany, in the circle of Upper Saxony: E. long. 10° 12′, and N. lat. 51°.

EZEKIEL, a canonical book of the Old Testament, referring chiefly to the degenerate manners and corruptions of the Jews of those times.

It abounds with fine sentences and rich comparisons, and discovers a good deal of learning in profane matters.

Ezekiel was carried captive to Babylon with Jechoniah, and began his prophecies in the fifth year of the captivity. He was cotemporary with Jeremiah, who prophesied at the same time in Judea He foretold many events, particularly the destruction of the temple, the fatal catastrophe of those who revolted from Babylon to Egypt, and the happy return of the Jews to their own land.

EZRA, a canonical book of the Old Testament, comprehending the history of the Jews from the time of Cyrus's edict for their return, to the twentieth year of Artaxerxes Longimanus. It specifies the number of Jews who returned, and Cyrus's proclamation for the rebuilding the temple, together with the laying its foundation, the obstructions it met with, and the finishing thereof in the reign of Darius.

The illustrious author of this book, was also the restorer and publisher of the canon of the Old Testament.

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FABA, in botany. See Vicia.

FABAGO, in botany. See Zygophillum.

FABER, in ichthyology. See Zeus.

FABLE, a tale, or feigned narration, defigned either to inftruct or divert, difguifed under the allegory of an action, *&c.*

Fables were the firft pieces of wit that made their appearance in the world, and have been ftill highly valued, not only in times of the greateft fimplicity, but among the moft polite ages of the world. Jotham's fable of the trees is the oldeft that is extant, and as beautiful as any that have been made fince. Nathan's fable of the poor man is next in antiquity. We find Æfop, in the moft diftant ages of Greece; and in the early days of the Roman commonwealth, we read of a mutiny appeafed by the fable of the belly and the members. As fables had their rife in the very infancy of learning, they never flourifhed more than when learning was at its greateft height; witnefs Horace, Boileau, and Fontaine.

Fable, is alfo ufed for the plot of an epic or dramatic poem; and is, according to Ariftotle, the principal part, and, as it were, the foul of a poem. See Composition.

FACE, in anatomy, comprehends all that part of the head which is not covered with the common long hair. See Anatomy, Part I. II. and VI.

Face, in the military art, a word of command, intimating to turn about; thus, *face to the right*, is to turn upon the left heel a quarter-round to the right; and, *face to the left*, is to turn upon the right heel a quarter-round to the left.

FACET, or Facette, among jewellers, is the name of the little faces or planes to be found in brilliant and rofe diamonds.

FACTION, a cabal or party formed in a ftate, city, or company.

Faction, in antiquity, a name given to the different companies of combatants in the circus. They were four, *viz.* the white, the red, the green, and the blue; to which Domitian added another of purple colour. They were fo denominated from the colour of the liveries they wore, and were dedicated, according to M. Aur. Caffiodorus, to the four feafons of the year, the green being confecrated to fpring, the blue to winter, the red to fummer, and the white to autumn. It appears from ancient infcriptions, that each faction had its procurators and phyfician; and from hiftory, that party rage ran fo high among them, that in a diffenfion between two factions, in the time of Juftinian, almoft forty thoufand men loft their lives in the quarrel.

FACTITIOUS, any thing made by art, in oppofition to what is the produce of nature. Thus, factitious cinnabar is oppofed to native cinnabar.

FACTOR, in commerce, is an agent or correfpondent refiding beyond the feas, or in fome remote part, commiffioned by merchants to buy or fell goods on their account, or affift them in carrying on their trade.

A factor receives from the merchants, his conftituents, in lieu of wages, a commiffion or factorage, according to the ufage of the place where he refides, or the bufinefs he tranfacts, this being various in different countries, on the purchafes and fales of different commodities. He ought to keep ftrictly to the tenor of his orders; as a deviation from them, even in the moft minute particular, expofes him to make ample fatisfaction for any lofs that may accrue from his non-obfervance of them. When unlimited orders are given to factors, and they are left to fell or buy on the beft conditions they can, whatever detriment occurs to their conftituents, they are excufed, as it is to be prefumed they acted for the beft, and were governed by the dictates of prudence. But a bare commiffion to fell is not fufficient authority for the factor to truft any perfon, wherefore he ought to receive the money on the delivery of the goods; and, by the general power, he may not truft beyond one, two, or three months, *&c.* the ufual time allowed for fales, otherwife he fhall be anfwerable out of his own eftate. If a factor fells on the ufual truft to a perfon of good credit, who afterwards becomes infolvent, he is difcharged; but not if the man's credit was bad at the time of fale. If a factor gives a man time for payment of money contracted on fale of his principal's goods, and, after that time is elapfed, fell him goods of his own for ready money, and the man becomes infolvent, the factor in equity ought to indemnify his principal; but he is not compellable by the common law. A factor fhould always be punctual in the advices of his tranfactions, in fales, purchafes, freights, and more efpecially in draughts by exchange. If he purchafes goods for another at a price limited, and afterwards they rife, and he fraudulently takes them for his own account, and fends them to another part, in order to fecure an advantage that feemingly offers, he will, on proof, be obliged, by the cuftom of merchants, to fatisfy his principal for damages. If a factor, in conformity with a merchant's orders, buys with his money, or on his credit, a commodity he fhall be directed to purchafe; and, without giving advice of the tranfaction, fells it again to profit, and appropriates to himfelf the advantage, the merchant fhall recover it from him, and befides have him amerced for his fraud. When factors have obtained a profit for their principal, they muft be cautious how they difpofe of it; for, if they act without commiffion, they are refponfible: and if a merchant remits goods to his factor, and about a month after draws a bill on him, the factor, having effects in his hands, accepts the bill, then the principal breaks, and the goods are feized in the factor's hands for

for the behalf of the creditors, it has been conceived the factor muſt anſwer the bill notwithſtanding, and come in a creditor for ſo much as he was obliged, by reaſon of his acceptance, to pay. A factor who enters into a charter-party with a maſter for freight, is obliged by the contract; but if he loads aboard generally, the principal and the lading are liable for the freightment, and not the factor. If a factor, having money in his hands belonging to his principal, neglect to inſure a ſhip and goods, according to order; if the ſhip miſcarry, the factor, by the cuſtom of merchants, ſhall make good the damage; and if he make any compoſition with the inſurers after inſurance, without orders ſo to do, he is anſwerable for the whole inſurance.

As fidelity and diligence are expected from the factor, ſo the law requires the like from the principal: if, therefore, a merchant remits counterfeit jewels to his factor, who ſells them as if true; if he receive loſs or prejudice by impriſonment or other puniſhment, the principal ſhall not only make full ſatisfaction to the factor, but to the party who bought the jewels.

What is here ſaid of factors, is meant of ſuch as reſide abroad to act for merchants, and may be applied to ſupercargoes, who go a voyage to diſpoſe of a cargo, and afterwards return with another to their principals: but it is alſo the cuſtom of the merchants of the higheſt credit throughout the world, to act mutually in the capacity of factors for each other. The buſineſs ſo executed is called commiſſion buſineſs, and is generally deſirable by all merchants, provided they have always effects in their hands, as a ſecurity for all the affairs which they tranſact for the account of others. And this claſs of traders of eſtabliſhed reputation, have current as well as commiſſion account, conſtantly between them, and draw on, remit to, and ſend commiſſions to each other only by the intercourſe of letters, which, among men of honour, are as obligatory and authoritative as all the bonds and ties of law.

FACTOR, in arithmetick. See ARITHMETICK, p. 371.

FACTORAGE, called alſo commiſſion, is the allowance given to factors by the merchant who employs them. The gain of factorage is certain, however the voyage or ſale prove to the merchant: but the commiſſions vary; at Jamaica, Barbadoes, Virginia, and moſt of the weſtern parts of the world, the commiſſion runs at 8 *per cent.* generally through Italy, 2½; in France, Spain, and Portugal, &c. 2; and in Holland and other places near home, 1½ *per cent.*

FACTORY is a place where a conſiderable number of factors reſide, to negociate for their maſters or employers. See FACTOR.

The moſt conſiderable factories belonging to the Britiſh are thoſe eſtabliſhed in the Eaſt-Indies, Portugal, Turky, &c.

FACTUM, in arithmetic, the product of two quantities multiplied by each other.

FACULÆ, in aſtronomy, certain bright and ſhining parts, which the modern aſtronomers have, by means of teleſcopes, obſerved upon or about the ſurface of the ſun: they are but very ſeldom ſeen.

FACULTY, in law, a privilege granted to a perſon, by favour and indulgence, of doing what, by law, he ought not to do.

For granting theſe privileges, there is a court under the archbiſhop of Canterbury, called the court of the faculties, the chief officer whereof is ſtyled maſter of the faculties; who has a power of granting diſpenſations in divers caſes, as to marry without the bans being firſt publiſhed; to eat fleſh on days prohibited; to ordain a deacon under age; for a ſon to ſucceed his father in his benefice; a clerk to hold two or more livings, &c.

FACULTY, in the ſchools, a term applied to the different members of an univerſity, divided according to the arts and ſciences taught there: thus in moſt univerſities there are four faculties, *viz.* 1. Of arts, which include humanity and philoſophy. 2. Of theology. 3. Of phyſic. And 4. Of civil law.

FACULTY *of Advocates.* See ADVOCATES.

FACULTY is alſo uſed to denote the powers of the human mind, *viz.* underſtanding, will, memory, and imagination. See METAPHYSICS.

FÆCES, in chemiſtry, the groſs matter, or ſediment, that ſettles at the bottom after diſtillation, fermentation, and the like.

FÆCES, in medicine, the excrements voided by ſtool.

FÆCULENT, in general, is applied to things abounding with fæces, or dregs: thus the blood and other humours of the human body, are ſaid to be fæculent, when without that purity which is neceſſary to health.

FAENSA, a city and biſhop's ſee of Italy, ſituated in the pope's territories, about thirty miles eaſt of Bologna: E. long. 12° 38′, and N. lat. 44° 30′.

FAGARA, in botany, a genus of the tetrandria monogynia claſs. The calix conſiſts of four ſegments, and the corolla of four petals; and the capſule has four cells, two valves, and contains one ſeed. There are three ſpecies, none of them natives of Britain.

FAGGOT, in times of popery here, was a badge worn on the ſleeve of the upper garment of ſuch perſons as had recanted, or abjured what was then termed hereſy; being put on after the perſon had carried a faggot, by way of penance, to ſome appointed place of ſolemnity. The leaving off the wear of this badge was ſometimes interpreted a ſign of apoſtacy.

FAGGOTS, among military men, perſons hired by officers, whoſe companies are not full, to muſter and hide the deficiencies of the company; by which means they cheat the king of ſo much money.

FAGONIA, in botany, a genus of the decandria monogynia claſs. The calix conſiſts of five leaves, and the corolla of five cordated petals; the capſule has five cells with one ſeed in each, and ten valves. There are three ſpecies, none of them natives of Britain.

FAGOPYRUM. See POLYGONUM.

FAGUS, the BEECH, in botany, a genus of the monœcia polyandria claſs. The calix of the male is bell-ſhaped, and conſiſts of five ſegments; it has no corolla, but twelve ſtamina: the calix of the female conſiſts of four teeth; it has no corolla; the ſtyli are three; and the capſule is muricated, has four cells and two ſeeds. There are three ſpecies, two of them natives of Britain, *viz.* the caſtanea, or cheſnut-tree; and the ſylvatica, or beech-tree.

FAINTING. See LIPOTHYMIA.

FAIR, a greater kind of market, granted to a town, by privilege, for the more ſpeedy and commodious providing of ſuch things as the place ſtands in need of. See MARKET.

It is incident to a fair, that perſons ſhall be free from being arreſted in it for any other debt contracted than what was contracted in the ſame; or, at leaſt, promiſed to be paid there. Theſe fairs are generally kept once or twice a year, and, by ſtatute, they ſhall not be held longer than they ought, by the lords thereof, on pain of their being ſeized into the king's hands, *&c.* Alſo proclamation is to be made how long they are to continue; and no perſon ſhall ſell any goods after the time of the fair is ended, on forfeiture of double the value, one fourth to the proſecutor, and the reſt to the king. There is a toll uſually paid in fairs, on the ſale of things, and for ſtallage, picage, *&c.* See TOLL.

FAIRFIELD, a town of New England, in the province of Connecticut, about an hundred miles ſouth-weſt of Boſton: W. long. 72°, and N. lat. 41°.

FAIRFORD, a market-town about nineteen miles ſouth-eaſt of Gloceſter.

FAIRY, in ancient traditions and romances, ſignifies a ſort of deity, or imaginary genius, converſant on earth, and diſtinguiſhed by a variety of fantaſtical actions, either good or bad.

The fairies are a peculiar ſpecies of divinities, that have but little relation to any of thoſe of the ancient Greeks or Romans, unleſs perhaps to the larvæ; tho' others, with great reaſon, will not have them ranked among gods, but ſuppoſe them an intermediate kind of beings, neither gods, angels, men, or devils. They are of oriental extraction, and ſeem to have been invented by the Perſians and Arabs, whoſe religion and hiſtory abound with relations concerning them: theſe have a particular country which they ſuppoſe the fairies to inhabit, called Fairy-land.

Spencer's Fairy Queen is an epic poem, under the perſons and characters of fairies. In this ſort of writing the poet loſes ſight of nature, and entertains the reader's imagination with the characters of fairies, witches, magicians, dæmons, and departed ſpirits. It requires an odd turn of thought, and a peculiar caſt of fancy, with an imagination naturally fruitful and ſuperſtitious.

This ſort of poetry raiſes a pleaſing kind of horror in the mind of the reader, and amuſes his imagination with the ſtrangeneſs and novelty of the perſons who are repreſented in it; but the judicious object to it, as not having probability enough to affect the imagination.

FAIRY CIRCLE or RING, a phænomenon pretty frequent in the fields, *&c.* ſuppoſed by the vulgar to be traced by the fairies in their dances: there are two kinds of it, one of about ſeven yards in diameter, containing a round bare path, a foot broad, with green graſs in the middle of it. The other is of different bigneſs, encompaſſed with a circumference of graſs. Meſſ. Jeſſop and Walker, in the Philoſophical Tranſact. aſcribe them to lightning, which is confirmed by their being moſt frequently produced after ſtorms of that kind, as well as by the colour and brittleneſs of the graſs-roots, when firſt obſerved.

Lightning, like all other fires, moves round, and burns more in the extremity than in the middle: the ſecond circle ariſes from the firſt, the graſs burnt up growing very plentifully afterwards. Others maintain that theſe circles are made by ants, which are frequently found in great numbers therein.

FAITH, in divinity and philoſophy, the firm belief of certain truths upon the teſtimony of the perſon who reveals them.

The grounds of a rational faith are, 1. That the things revealed be not contrary to, though they may be above natural reaſon. 2. That the revealer be well acquainted with the things he reveals. 3. That he be above all ſuſpicion of deceiving us.

Where theſe criterions are found, no reaſonable perſon will deny his aſſent: thus, we may as well doubt of our own exiſtence, as of the truth of a revelation coming from God, who can neither be deceived himſelf, nor deceive others by propoſing things to be believed that are contradictory to the faculties he has given us. Whatever propoſitions, therefore, are beyond reaſon, but not contrary to it, are, when revealed, the proper matter of faith.

Confeſſion of FAITH. See CONFESSION.

FAITHFUL, an appellation aſſumed by the Mahometans. See MAHOMETANS.

FAKENHAM, a market-town of Norfolk, about ſixteen miles north-weſt of Norwich.

FAKIR, in Pagan theology, a kind of Indian monks, who even outdo the mortifications and ſeverities of the ancient Chriſtian anachorets. See ANACHORET.

Some of them mangle their bodies with ſcourges and knives others never lie down; and others remain all their lives in one poſture.

There are alſo another kind of fakirs, who do not practice ſuch ſeverities: theſe flock together in companies, and go from village to village, propheſying and telling fortunes. It is ſaid that even perſons of fortune, in India, become fakirs, and that there are more than two millions of them.

FALCADE, in the menage, the motion of a horſe when he throws himſelf upon his haunches two or three times, as in very quick corvets: which is done in forming a ſtop and half ſtop. See STOP.

FALCATED, ſomething in the form of a ſickle: thus, the moon is ſaid to be falcated when ſhe appears horned. See MOON and PHASES.

FALCO, in ornithology, a genus belonging to the order of accipitres, the characters of which are theſe: the beak is crooked, and furniſhed with wax at the baſe; the head is thick-ſet with feathers, and the tongue is cloven, There are thirty-two ſpecies, *viz.* 1. The coronatus, or crowned eagle of Edwards, with aſh-coloured wax; the legs are covered with white downy feathers, interſperſed with black ſpots; the breaſt is reddiſh; and there are black belts on the ſides. It is a native of Guinea. 2. The melanæetus, or

black eagle of Ray, has yellowifh-wax on the beak; the legs are half covered with feathers; and the body is afh-coloured and ftreaked with yellow. It is a native of Europe. 3. The leucocephalus, or white-headed eagle of Catefby, is afh-coloured, with the head and tail white; the iris of the eye is white, over which is a prominence covered with a yellow fkin; the bill and the fear or wax are yellow, as are likewife the legs and feet; and the talons are black. Though it is an eagle of fmall fize, it weighs nine pounds, is ftrong and full of fpirit, preying on lambs, pigs, and fawns. They always make their nefts near the fea, or great rivers, and ufually upon old, dead pine or cyprefs trees, continuing to build annually on the fame tree till it falls. Tho' he is fo formidable to all birds; yet he fuffers them to build near his royal neft without moleftation; particularly the fifhing hawk, herons, *&c.* which all build on high-trees, and in fome places are fo near one another that they appear like a rookery. It is a native both of Europe and America. *Pl.* 76. *fig.* 1. 4. The offifragus, with yellow wax, and half-feathered legs; it is about the fize of a peacock; the feathers are white at the bafe, iron-coloured in the middle, and black at the points; and the legs are yellow: it is a native of Europe. 5. The chryfaëtos, or golden eagle, has yellow wax on the beak, and feathered legs; the body is variegated with a brown and iron colour; and the bafe of the tail is undulated with an afh-colour: it is a bird of Europe. 6. The fulvus, with yellow wax, feathered legs, a brown back, and a white ftreak on the tail; the face is bare betwixt the eyes and noftrils: it is a native of Europe and Canada. 7. The rufticolus, with a yellow wax, yellow ring round the eyes, and yellow legs; the body is afh-coloured undulated with white, and a white ring round the neck: it is a native of Sweden. 8. The barbarus, with yellow wax, and yellow legs; the body is blueifh, and fpotted with brown: it is a native of Barbary. 9. The cærulefcens, with yellow wax, a yellow ring round the eyes, and the feet yellow underneath; the back is of a blackifh blue colour; and the temples are furrounded with a white line. This is the fmalleft bird of the genus, and is a native of Afia. 10. The cyaneus, with white wax, yellow legs, a whitifh blue body, and a white ring round the eyes and throat. It is the blue hawk of Edwards, and is a native of Europe and Africa. 11. The pygargus, with yellow wax and legs; the body is afh-coloured, with pale red fpots along the belly, and white orbits. It is a bird of Europe. 12. The milvus, or kite, with yellow wax on the back, a forked tail, and iron-coloured bill, and the head of a lighter colour. It is a bird of Europe, Afia, and Africa. Bellonius relates, that, about the end of April, in lefs than fourteen days, incredible numbers of them are feen flying over the Black Sea into Afia. They feed upon offals, young-birds, *&c.* Like all the fpecies of this genus, they fly remarkably high, and are endowed with uncommon acutenefs of vifion. 13. The gentilis, with yellow wax and legs; the body is afh-coloured, with brown fpots; and the tail has four blackifh ftreaks. It is a native of the Alps, and is peculiarly fond of larks. 14. The fubbuteo, with yellow wax and legs; the back is brown, the nape of the neck white, and the belly is pale, with oblong brown fpots. It is called the hobby by Englifh authors, and is a native of Europe. 15. The buteo, with yellowifh wax and legs, a brown body, and a pale belly, with brown fpots. He feeds upon rabbits, toads, *&c.* and is a bird of Europe. 16. The tinnunculus, with yellow wax and legs; the back is reddifh, and fpotted with black; it has brownifh ftreaks on the breaft, and a roundifh tail. It inhabits old buildings, and lives upon fmall birds and mice. 17. The fufflator, with yellowifh wax and legs; the body is of a brownifh white colour; and the covers of the eyes are bony. He has a flefhy lobe between the noftrils, which, when angry or terrified, he inflates till his head becomes as large as his whole body. He is a native of Surinam. 18. The cachinnans, or laughing hawk, has yellowifh legs and wax, and white eye-brows; the body is variegated with brown and white; and it has a black ring round the top of the head. It makes a laughing kind of noife when it obferves any perfon, and is a native of America. 19. The hudfonius, has yellow wax, and yellow legs, a brown back, and white eye-brows. It is found at Hudfon's bay. 20. The fparverius, has yellow wax, a brown head, a red belly, and blueifh wings. It is a native of America. 21. The columbarius, or pigeon-hawk of Catefby, weighs about fix ounces. The bill is black at the point, and whitifh at the bafe; the iris of the eye is yellow; the bafe of the upper mandible is covered with a yellow fear or wax; all the upper part of the body, wings, and tail, are brown. The interior vanes of the quill-feathers have large red fpots. The tail is marked with four regular tranfverfe white lines; the throat, breaft, and belly are white, mixed with brown; the fmall feathers that cover the thighs reach within half an inch of the feet, and are white, with a tincture of red, befet with long fpots of brown; the legs and feet are yellow. It is a very fwift and bold hawk, preying on pigeons, young turkeys, *&c.* and is a native of Carolina. *Pl.* 76. *fig.* 3. 22. The fuperciliofus has yellow legs and wax, and yellow eye-brows; and the body is brown, waved with white. It is a native of Surinam. 23. The vefpertinus, is about the fize of a pigeon; the body is of a blueifh brown colour; and the bill is yellow, and brown at the point. It is a native of Ingria, and flies both in the day and in the night. 24. The lanarius, has yellowifh wax, and the bill and legs, which are fhort, are blueifh. It is a native of Europe. 25. The furcatus, or fwallow-tailed hawk, weighs about 14 ounces; the bill is black; the eyes are large and black, with a red iris; the head, neck, breaft, and belly are white; the upper part of the back and wings a dark purple; but more dufky towards the lower parts, with a tincture of green. The wings are long in proportion to the body, and, when extended, are four feet. The tail is dark purple mixed with green, and remarkably forked. Like fwallows, they continue long on the wing, catching, as they fly, beetles, flies, and other infects. They are faid to prey upon lizards and ferpents, and are found in America. *Pl.* 76. *fig.* 2. 26. haliætus, or fifhing hawk of Catefby, weighs three pounds and a quarter; it meafures, from one end of the wing to the other, five feet and a half. The bill is black, with a blue fear or wax; the iris of the eye is yellow, and the crown of the head brown, with a mixture of white feathers; from each eye, backwards, runs a brown ftripe:

Fig. 1.
FALCO LEUCOCEPHALUS
or
WHITE HEADED EAGLE

Fig. 2.
FALCO FURCATUS
or
SWALLOW TAILD HAWK

Fig. 3.
FALCO COLUMBARIUS
or
PIGEON HAWK

A. Bell Sculp.t

Fig. 1. FALCO HALIÆTUS
or
FISHING HAWK

Fig. 2. FELIS DOMESTICUS
CAT of ANGORA

A. Bell Sculp.

the back, wings, and tail, are of a dark brown; the throat, neck, and belly white; the legs and feet are rough and ſcaly, and of a pale blue colour; the talons are black, and nearly of an equal ſize; the feathers of the thighs are ſhort, and adhere cloſe to them, contrary to others of the hawk-kind, which nature ſeems to have deſigned for their more eaſy penetrating the water. Their manner of fiſhing is, after hovering a while over the water, to precipitate into it with prodigious ſwiftneſs, where they remain for ſome minutes, and ſeldom riſe without a fiſh. The white-headed eagle, who is generally on the watch, no ſooner ſpies him with his fiſh, than he flies furiouſly upon him: the hawk immediately mounts, and ſcreams out; but the eagle always ſoars above him, and compells him to let the fiſh fall; the eagle inſtantly darts down upon the fiſh, and ſeldom fails to catch it before it reaches the water. It is remarkable, that, whenever the hawk catches a fiſh, he calls out, as if it were to give warning to his enemy the eagle, who always obeys the call when within hearing. The lower parts of the rivers and creeks near the ſea in America, abound with thoſe eagles and hawks, where theſe diverting conteſts are frequently ſeen. *Pl.* 77 *fig.* 1. 27. The gyrfalco, with blue wax on the beak, yellow legs, a brown body, marked with aſh-coloured ſtreaks underneath, and the ſides of the tail white. It is the gyrfalco of Ray, lives upon cranes, pigeons, *&c.* and is a native of Europe. 28. The aviporus, with black wax, yellow legs, half naked, the head of an aſh-colour, and having an aſh-coloured ſtripe on the tail, which is white at the end It is the honey-buzzard of Ray, and is a native of Europe; it feeds upon mice, lizards, frogs, bees, and other inſects. 29. The æruginoſus, with greeniſh wax, a greyiſh body; and the top of the head, nape of the neck, and legs, are yellowiſh. It is a native of Europe, and builds its neſt in marſhes. 30. The palumbarius, with black wax edged with yellow, yellow legs, a brown body, and the prime feathers of the tail are marked with pale ſtreaks, and the eye-brows are white. It is the gooſe-hawk of Ray, is an inhabitant of Europe, and an enemy to domeſtic fowls. 31. The niſus, with green wax, yellow legs, and a white belly undulated with grey; the tail is marked with blackiſh belts. It is the ſparrow-hawk of Ray, and a native of Europe. It is peculiarly fond of pigeons, ſparrows, and larks. 32. The minutus, with brown wax, yellow legs, and the body is white underneath. It is the leaſt hawk of Briſſonius, being about the ſize of a thruſh, and is found at Melita.

FALCONER, one who tames, manages, and looks after falcons, or other hawks. See the next article.

FALCONRY, the art of training all manner of hawks, but more eſpecially the larger ſort, to the exerciſe of hawking. See HAWKING.

When a falcon is taken, ſhe muſt be ſeeled in ſuch a manner, that as the ſeeling ſlackens, ſhe may ſee what proviſion lies before her; but care ought to be taken, not to ſeel her too hard. A falcon or hawk newly taken, ſhould have all new furniture, as new jeſſes of good leather, mailled leaſhes with buttons at the end, and new bewets. There ſhould alſo be provided a ſmall round ſtick, to ſtroke the hawk; becauſe the oftener this is done, the ſooner and better will ſhe be manned. She muſt alſo have two good bells, that ſhe may be found when ſhe ſcattereth. Her hood ſhould be well faſhioned, raiſed and emboſſed againſt her eyes, deep, and yet ſtrait enough beneath, that it may faſten about her head without hurting her; and her beak and talons muſt be a little copied, but not ſo near as to make them bleed.

FALKIRK, a town of Scotland: W. long. 3° 48′, N. lat. 56° 20′.

FALL, the deſcent of a heavy body towards the center of the earth; it is alſo the name of a meaſure of length uſed in Scotland, containing ſix ells.

FALLACY, a deception, fraud, or falſe appearance.

The Epicureans deny that there is any ſuch thing as a fallacy of the ſenſes: for, according to them, all our ſenſations and perceptions, both of ſenſe and phantaſy, are true: whence they make ſenſe the primary criterion of truth.

FALLING SICKNESS. See MEDICINE.

FALLOPIAN TUBES. See ANATOMY, p. 275.

FALLOW, a pale red colour, like that of brick half burnt: ſuch is that of a fallow-deer.

FALLOW-FIELD, or FALLOW GROUND, land laid up, or that has lain untilled for a conſiderable time.

FALLOWING *of land*, a particular method of improving land. See AGRICULTURE.

FALMOUTH, a port-town of Cornwall, in England, ſituated in W. long. 5° 30′, N. lat. 50° 15′, on a fine bay of the Engliſh channel, the entrance whereof is guarded by two forts.

FALSE, in general, ſomething contrary to truth, or not what it ought to be; thus we ſay, a falſe witneſs, falſe action, falſe weights, falſe claim, *&c.*

FALSHOOD, in philoſophy, is the repreſenting a thing otherwiſe than it is.

Crimen falſi, in the civil law, is fraudulent ſubornation or concealment with deſign to darken or hide the truth, and make things appear otherwiſe than they are. The crimen falſi is committed, 1. By words, as when a witneſs ſwears falſely. 2. By writing, as when a man antedates a contract, or the like. 3. By deed, as when he ſells by falſe weights and meaſures.

FALX, in anatomy. See ANATOMY, p. 284.

FAN, a machine uſed to raiſe wind and cool the air by agitating it. The cuſtom which now prevails of wearing fans, was borrowed from the Eaſt, where they are almoſt indiſpenſably neceſſary for keeping off the ſun and the flies. Fans are made of a thin ſkin or piece of paper, taffaty, or other light ſtuff, cut ſemicircularly, and mounted on ſeveral little ſticks of wood, ivory, tortoſe-ſhell, or the like. The paper, *&c.* is uſually painted, and in mounting is plaited in ſuch a manner, as that the plaits may be alternately inward and outward.

FAN is alſo an inſtrument uſed in winnowing corn.

Fans for corn pay on importation, 1 s. $3\frac{40}{100}$d. and draws back on exportation, 1 s. $1\frac{50}{100}$d. India fans pay for every 100 l. groſs value at the ſale 26 l. 14 s $2\frac{52\frac{5}{8}}{100}$d.

The draw-back on exportation is 25 l. 2 s. $11\frac{51\frac{3}{8}}{100}$d.

FANATICS, wild, enthusiastic, visionary persons, who pretend to revelation and inspiration.

FANCY, or IMAGINATION. See IMAGINATION.

FANIONS, in the military art, small flags carried along with the baggage.

FANO, a bishop's see and port-town of Italy, situated on the gulph of Venice, in 14° E. long. and 44° N. lat.

FAR, in horsemanship, an appellation given to any part of a horse's right side: thus the far foot, far shoulder, *&c.* is the same with the right foot, right shoulder, *&c.*

FARCE, was originally a droll or petty shew exhibited by mountebanks and their buffoons in the open streets, to gather the people together. At present it is of more dignity: it is removed from the street to the theatre, and instead of being performed by merry-andrews to amuse the rabble, is acted by comedians, and become the entertainment of a polite audience. Poets have reformed the wildness of the primitive farces, and brought them to the taste and manner of comedy. The difference between the two on our stage is, that comedy keeps to nature and probability, and therefore is confined to certain laws prescribed by ancient critics; whereas farce disallows of all laws, or rather sets them aside on occasion. Its end is purely to make merry; and it sticks at nothing which may contribute thereto, however wild and extravagant. Hence the dialogue is usually low, the persons of inferior rank, the fable or action trivial or ridiculous, and nature and truth every where heightened and exaggerated to afford the more palpable ridicule.

FARCIN, FARCY, or FASHIONS, in farriery, a creeping ulcer, and the most loathsome, stinking, and filthy disease that a horse can be affected with.

For the cure, first bleed the horse well; then take oil of bay and euphorbium mixed together, and anoint the knots with it; or bathe the place with the stale of an ox or cow, and the herb called lion's foot, all boiled together. Some apply tallow and horse-dung, burn the knots with a hot iron, or wash the sore with salt, vinegar, alum, verdigrease, green copperas, and gun-powder, boiled in chamber-lee. Others again anoint the sores with a salve made of a penny-worth of tar, two penny worth of white mercury, and two handfuls of pigeon's dung.

FARDING-DEAL, the fourth part of an acre of land. See ACRE.

FARE, most commonly signifies the money paid for a voyage, or passage by water; but, in London, it is what persons pay for being conveyed from one part of the town to another in a coach or chair.

FAREHAM, a market town of Hampshire, ten miles east of Southampton.

FAREWELL CAPE, the most southerly promontory of Greenland, in 50° W. long. and 60° N. lat.

FARINA FOECUNDANS, among botanists, the supposed impregnating meal or dust on the apices or antheræ of flowers. See BOTANY, Sect. III.

FARINGTON, a market town of Berkshire, twenty-five miles north-west of Reading.

FARM, or FERM, signifies the chief messuage in a village; or any large messuage, whereto belongs land, meadow, pasture, wood, common, *&c.* and which has been used to let for term of life or years, under a certain yearly rent payable by the tenant for the same.

FARNHAM, a market-town in the county of Surry, ten miles west of Guilford, remarkable for its large plantations of hops.

FARO, a sea-port town of Portugal, in the province of Algarva: W. long. 9°, N. lat. 36° 50′.

FARREATION, in antiquity. See CONFARREATION.

FARRIER, one whose emoloyment is to shoe horses, and cure them when diseased or lame.

F A R R I E R Y.

FARRIERY, the art of curing the diseases of horses. The practice of this useful art has been hitherto almost entirely confined to a set of men who are totally ignorant of anatomy, and the general principles of medicine. It is not therefore surprising, that their prescriptions should be equally absurd as the reasons they give for administering them. It cannot indeed be expected that farriers, who are almost universally illiterate men, should make any real progress in their profession. They prescribe draughts, they rowel, cauterise, *&c.* without being able to give any other reason for their practice, but because their fathers did so before them. How can such men deduce the cause of a disease from its symptoms, or form a rational method of cure, when they are equally ignorant of the causes of diseases and the operation of medicines?

The miserable state of this useful art, especially in this country, has determined us to select, from the best authors, such a system of practice as seemed to be formed on rational principles; this, we hope, will be a sufficient apology for being so full upon this article.

General Directions with regard to the Management of Horses.

IT ought to be laid down as a general rule, to give horses as few medicines as possible; and by no means to comply with the ridiculous custom of some, who are frequently bleeding, purging, and giving balls, though their horses be in perfect health, and have no indication that requires such treatment.

Proper management in their feeding, exercise, and dressing, will alone cure many disorders, and prevent most;

moſt; for the ſimplicity of a horſe's diet, which chiefly conſiſts of grain and herbage, when good in kind, and diſpenſed with judgment, ſecures him from thoſe complicated diſorders, which are the general effects of intemperance in the human body.

In France, Germany, and Denmark, horſes are ſeldom purged; there they depend much on alteratives; the uſe of the liver of antimony, we have from the French, which is in general a good medicine for that purpoſe, and may, in many caſes, be ſubſtituted in the room of purging.

As hay is ſo material an article in a horſe's diet, great care ſhould be taken to procure the beſt: when it is not extraordinary, the duſt ſhould be well ſhook out before it is put in the rack; for ſuch hay is very apt to breed vermin.

Beans afford the ſtrongeſt nouriſhment of all grain, but are fitteſt for laborious horſes; except on particular occaſions. In ſome ſeaſons they breed a kind of vermin called the red bugs, which is thought to be dangerous; the beſt method in ſuch a caſe, is to procure them well dried and ſplit.

Bran ſcalded is a kind of panada to a ſick horſe; but nothing is worſe than a too frequent uſe of it, either dry or ſcalded; for it relaxes and weakens the bowels too much. The bots in young horſes may be owing to too much muſty bran and chaff, given with other foul feed to make them up for ſale: particular care therefore ſhould be taken that the bran be always ſweet and new.

Oats, well ripened, make a more hearty and durable diet than barley, and are much better ſuited to the conſtitutions of Britiſh horſes. A proper quantity of cut ſtraw and hay mixed with them, is ſometimes very uſeful to horſes troubled with bots, indigeſtion, *&c.*

Horſes who eat their litter, ſhould particularly have cut ſtraw and powdered chalk given them with their feed; as it is a ſign of a depraved ſtomach, which wants correcting.

The ſalt-marſhes are good paſture for horſes who have been ſurfeited, and indeed for many other diſorders; they purge more by dung and urine than any other paſture, and make afterwards a firmer fleſh: their water is for the moſt part brackiſh, and of courſe, as well as the the graſs, ſaturated with ſalts from the ſea-water.

A ſummer's graſs is often neceſſary; more particularly to horſes glutted with food, and which uſe little execiſe; but a month or two's running is proper for moſt: thoſe eſpecially who have been worked hard, and have ſtiff limbs, ſwelled legs, or wind-galls. Horſes whoſe feet have been impaired by quitters, bad ſhoeing, or any other accidents, are alſo beſt repaired at graſs. Thoſe lameneſſes particularly require turning out to graſs, where the muſcles or tendons are contracted or ſhrunk; for by the continual gentle excercife in the field, with the aſſiſtance of a pattin-ſhoe on the oppoſite foot, the ſhortened limb is kept on the ſtretch, the waſted parts are reſtored to their uſual dimenſions, and the limb again recovers its uſual tone and ſtrength.

The fields which lie near great towns, and are much dunged, are not proper paſture for horſes; but on obſervation appear very injurious to them, if they feed thereon all the ſummer.

Horſes may be kept abroad all the year, where they have a proper ſtable or ſhed, to ſhelter them from the weather, and hay at all times to come to. So treated, they are ſeldom ſick, their limbs are always clean and dry; and, with the allowance of corn, will hunt, and do more buſineſs than horſes kept conſtantly within doors.

If horſes, when taken from graſs, ſhould grow hot and coſtive, mix bran and chopt hay with their corn; and give them ſometimes a feed of ſcalded bran for a fortnight, or longer: let their exerciſe and diet be moderate for ſome time, and increaſe both by degrees.

When horſes are ſoiled in the ſtable, care ſhould be taken that the herbage is young, tender, and full of ſap; whether it be green barley, tares, clover, or any thing elſe the ſeaſon produces, and that it be cut freſh once every day at leaſt, if not oftener.

When horſes loſe their fleſh much in ſoiling, they ſhould in time be taken to a more ſolid diet; for it is not in ſoiling as in grazing; where, though a horſe loſes his fleſh at firſt, yet, after the graſs has purged him, he ſoon grows fat.

Young horſes who have not done growing, muſt be indulged more in their feeding, than thoſe come to their maturity; but if their exerciſe is ſo little, as to make it neceſſary to abridge their allowance of hay, a little freſh ſtraw ſhould conſtantly be put in their racks, to prevent their nibbling the manger, and turning cribbiters; they ſhould alſo ſometimes be ſtrapped back in order to cure them of this habit.

It is obvious to every one, what care ſhould be taken of a horſe after violent exerciſe, that he cools not too faſt, and drinks no cold water, *&c.* for which reaſon we ſhall wave particular directions.

Moſt horſes fed for ſale, have the interſtices of their muſcles ſo filled with fat, that their true ſhapes are hardly known. For which reaſon, a horſe juſt come out of the dealer's hands, ſhould at firſt be gently uſed. He ought to loſe blood, and have his diet lowered, though not too much: walking exerciſe is moſt proper at firſt, two hours in a day; in a week or fortnight two hours at a time, twice a-day; after this uſage for a month, bleed him again, and give him two or three times a-week ſcalded bran, which will prepare him for purging phyſic, that may now be given ſafely, and repeated at the uſual intervals.

When a horſe comes out of a dealer's hands, his cloathing muſt be abated by degrees, and care taken to put him in a moderately warm ſtable; otherwiſe the ſudden tranſition would be attended with the worſt conſequences.

Some General Directions in regard to Bleeding, Purging, *&c.*

Horſes who ſtand much in ſtable, and are full fed, require bleeding now and then, eſpecially when their eyes look heavy, dull, red, and inflamed; as alſo, when they feel hotter than uſual, and mangle their hay.

Young horſes ſhould be bled when they are ſhedding their teeth, as it takes off thoſe feveriſh heats they are then ſubject to. But the caſes that chiefly require bleeding, are colds, fevers of moſt kinds, falls, bruiſes, hurts of the eyes, ſtrains, and all inflammatory diſorders, *&c.*

It is right to bleed a horſe, when he begins to grow fleſhy

fleshy at grass, or at any other time when he looks heavy: and it is generally proper to bleed before purging.

Let your horse always be bled by measure, that you may know what quantity you take away: two or three quarts is always enough at one time; when you repeat it, allow for the disorder, and the horse's constitution.

Let the blood, when cold, be carefully examined, both as to colour and consistence, whether black, florid, sizey, &c.

Purging is often necessary in gross full horses, in some disorders of the stomach, liver, &c. but should be directed with caution. Before a purge is given to any horse, it is necessary some preparation should be made for it, in order to render the operation more safe and efficacious; thus a horse that is full of flesh should first be bled, and at the same time have his diet lowered for a week, especially those that have been pampered for sale; several mashes of scalded bran should also previously be given, in order to open the bowels, and unload them of any indurated excrement; which sometimes proves an obstacle to the working of the physic, by creating great sickness and griping.

Let it be remembered, that a horse is purged with difficulty; that the physic generally lies twenty-four hours in the guts before it works; and, that the tract of bowels it has to pass through, is above thirty yards; and lying horizontally, consequently resinous and other improper drugs may, and often do, by their violent irritations, occasion excessive gripings and cold sweats, shave off the very mucus or lining of the guts, and bring on inflammations, which often terminate in mortifications, and death.

It is remarkable too, that the stomach and guts of a horse are but thin, compared to some other animals of the same bulk, and therefore must be more liable to inflammation and irritation.

Horses kept much in the stable, who have not the proper benefit of air, and exercise, in proportion to their food, should in spring have a mild purge or two, after a previous preparation by bleeding, lowering their diet, and scalded mashes.

Horses that fall off in their stomach, whether it proceeds from too full feeding, or ingendering crudities and indigested matter, should have a mild purge or two.

Horses of a hot temperament, will not bear the common aloetic purges; their physic therefore should be mild and cooling.

Purging is always found very beneficial in stubborn dry coughs: but mild mercurials joined with them, make them yet more efficacious.

Horses of a watery constitution, who are subject to swelled legs, that run a sharp briny ichor, cannot have the causes removed any way so effectually as by purging.

The first purge you give to a horse should be mild, in order to know his constitution.

It is a mistaken notion, that if a proper prepared purge does not work to expectation, the horse will be injured by it; for though it does not pass by stool, its operation may be more efficacious, as an alterative to purify the blood, and it may pass by urine, or other secretions.

Purging medicines are very successfully given in small quantities, mixed with others; and act then as alteratives.

If mercurial physic is given, care should be taken that it be well prepared; and warmer cloathing, and greater circumspection is then required.

Purges should be given early in the morning upon an empty stomach: about three or four hours after the horse has taken it, he should have a feed of scalded bran; and a lock or two of hay may then be put into his rack. The same day give him two more mashes; but should he refuse warm meat, he may be allowed raw bran.

All his water should be milk warm, and have a handful of bran squeezed in it; but if he refuses to drink white water, give it him without bran.

Early the next morning, give him another mash; but if he refuses to eat it, give him as much warm water as he will drink: let him be properly cloathed, and rode gently about. This should be done two or three times a-day, unless he purges violently, once or twice will then be sufficient: at night give him a feed of oats mixed with bran.

During the working, a horse should drink plentifully; but, if he will not drink warm water, he must be indulged with cold, rather than not drink at all.

We shall here insert some general forms of purges,

Take succotrine aloes ten drams, jallap and salt of tartar each two drams, grated ginger one dram, oil of cloves thirty drops; make them into a ball with syrup of buckthorn.

Or,

Take aloes and cream of tartar each one ounce, jallap two drams, cloves powdered one dram, syrup of buckthorn a sufficient quantity.

Or,

The following, which has an established character among sportsmen.

Take aloes, from ten drams to an ounce and an half, myrrh and ginger powdered each half an ounce, saffron and oil of annifeed each half a dram.

Mr Gibson recommends the following,

Take succotrine aloes ten drams, myrrh finely powdered half an ounce, saffron and fresh jallap in powder of each a dram, make them into a stiff ball with syrup of roses, then add a small spoonful of rectified oil of amber.

The succotrine aloes should always be preferred to the Barbadoes or plantation aloes; though the latter may be given to robust strong horses, but even then should always be prepared with the salt, or cream of tartar; which by opening its parts, prevents its adhesion to the coats of the stomach, and bowels; from whence horrid gripings, and even death itself has often ensued. This caution is well worth remarking, as many a horse hath fallen a sacrifice to the neglect of it.

Half an ounce of Castile soap, to a horse of a gross constitution, may be added to any of the above; and the proportions may be increased for strong horses.

When mercurial physic is intended, give two drams of calomel over night, mixed up with half an ounce of a diapente and a little honey, and the purging ball the next morning. The

The following, when it can be afforded, is a very gentle and effectual purge, particularly for fine delicate horses; and if prepared with the Indian rhubarb, will not be expensive.

TAKE of the finest succotrine aloes one ounce, rhubarb powdered half an ounce or six drams, ginger grated one dram; make into a ball with syrup of roses.

The following purging drink may be given with the utmost safety; it may be quickened, or made stronger, by adding an ounce more senna, or two drams of jalap.

TAKE senna two ounces, infuse it in a pint of boiling water two hours, with three drams of salt of tartar; pour off, and dissolve in it four ounces of Glauber's salts, and two or three of cream of tartar.

This last physic is cooling, easy, and quick in its operation; and greatly preferable in all inflammatory cases to any other purge, as it passes into the blood, and operates also by urine.

When horses lose their apetites after purging, it is necessary to give them a warm stomach-drink, made of an infusion of chamomile flowers, anniseeds and saffron: or the cordial ball may be given for that purpose.

Should the purging continue too long, give an ounce of dioscordium in an English pint of Port wine, and repeat it once in twelve hours, if the purging continues. Plenty of gum arabic water should also be given; and in case of violent gripes, fat broth glysters, or tripe liquor, should be often thrown up, with an hundred drops of laudanum in each.

The arabic solution may be thus prepared.

TAKE of gum arabic and tragacanth of each four ounces, juniper-berries and carraway-seeds of each an ounce, cloves bruised half an ounce; simmer gently in a gallon of water, till the gums are dissolved: give a quart at a time in half a pail of water; but if he will not take it freely this way, give it him often in a horn.

When a purge does not work, but makes the horse swell, and refuse his food and water, which is sometimes the effect of bad drugs, or catching cold, warm diuretics are the only remedy; of which the following are recommended.

TAKE a pint of white wine, nitre one ounce; mix with it a dram of camphire, dissolved in a little rectified spirit of wine; then add two drams of oil of juniper, and the same quantity of unrectified oil of amber, and four ounces of honey, or syrup of marshmallows.

When a horse swells much with physic, do not suffer him to be rode about till he has some vent; but rather lead him gently in hand, till some evacuation is obtained.

As it is observed, that horses more willingly take sweet and palatable things, than those that are bitter and of an ill taste; care should be taken, that the latter are given in balls; and that their drinks are always contrived to be as little nauseous as possible, and sweetened either with honey or liquorice. Those that are prepared with gross powders, are by no means so agreeable to a horse, as those made by infusion; as the former often clam the mouth, irritate the membranes about the palate and throat, and frequently occasion the cough they are intended to prevent.

Balls should be of an oval shape, and not exceed the size of a pullet's egg; when the dose is larger, it should be divided into two; and they should be dipt in oil, to make them slip down the easier.

As we have given some general forms of purges, we shall observe the same rule in regard to glysters, with some few cautions and remarks.

Let it be observed then, that, before the administring emollient clysters in costive disorders, a small hand, well oiled, should be passed up the horse's fundament, in order to bring away any hardened dung, which otherwise would be an obstacle to the glyster's passage.

A bag and pipe of a proper form, is to be preferred to a syringe, which throws up the glyster with so much force, that it often surprises a horse, and makes him reject it as fast as it goes in; whereas the liquor, when pressed gently from the bag, gives him no surprize or uneasiness, but passes easily up into the bowels, where it will sometimes remain a long time, and be extremely useful, by cooling and relaxing them; and will sometimes incorporate so with the dung, as not easily to be distinguished from the other contents of the guts. These emollient glysters are extremely serviceable in most fevers, and greatly preferable to purging ones; which in general are too pungent, and stimulate too much, especially if aloes are a part of the composition.

Nutritive glysters are very necessary, and often save a horse from starving, when his jaws are so locked up by convulsions that nothing can be conveyed by the mouth.

They should not exceed a quart or three pints at a time, but be often repeated: nor should they be too fat; but made of sheeps heads, trotters, or any other meat-broths, milk pottage, rice-milk strained, and many other such nourishing things. For an emollient glyster, take the following.

TAKE marshmallows and chamomile flowers each a large handful, bay-berries and sweet fennel-seeds bruised each an ounce; boil in a gallon of water to three quarts, pour off into a pan, and dissolve in it half a pound of treacle, and a pint of lint-seed oil, or any common oil.

To make it more laxative, add four ounces of lenitive electuary, or the same quantity of cream of tartar, or common purging salts.

Purging Glyster.

TAKE two or three handful of marshmallows, senna one ounce, bitter apple half an ounce, bay berries and anniseed bruised each an ounce, salt of tartar half an ounce; boil a quarter of an hour in three quarts of water; pour off, and add four ounces of syrup of buckthorn, and half a pint of oil.

This glyster will purge a horse pretty briskly; and may be given succesfully, when an immediate discharge is wanting; especially in some fevers with inflamed lungs, or other disorders, which require speedy relief

But it is necessary to caution against a solution of course aloes for this purpose, as it has been found to gripe horses violently, and excite feverish, and sometimes convulsive

convulſive ſymtoms; and indeed all pungent and ſtimulating medicines, as the ſtronger purgatives generally are, ſhould be given in this form with great caution.

But the generality of emollient glyſters, may be prepared with much leſs trouble: as two quarts of water-gruel, with a half a pound of treacle, a pint of oil, and a handful of common ſalt, will as effectually anſwer every purpoſe. The following is a reſtringent glyſter.

Take pomegranate-bark or oak-bark two ounces, red roſe-leaves freſh or dry a handful, balauſtines an ounce; boil in two quarts of water, till one is near conſumed; pour off and diſſolve in it four ounces of diaſcordium; to which may be added a pint of Port wine.

This will anſwer in all common caſes, where reſtringents are neceſſary, but ſhould never be given in larger quantities; for the longer glyſters of this kind lie in the bowels, the more efficacious they are.

Of Colds.

By taking cold, we mean that the pores and outlets of the ſkin (which in a natural healthy ſtate of body are continually breathing out a fine fluid, like the ſtream ariſing from hot water, or ſmoke from fire) are ſo far ſhut up, that theſe ſtreams, or perſpirable matter, not having a free paſſage through them, are hindered from going off in the uſual manner; the conſequence of which is, their recoiling on the blood, vitiating its quality, overfilling the veſſels, and affecting the head, glands or kernels of the neck and throat, the lungs, and other principal parts.

To enumerate the various cauſes of colds would be endleſs; the moſt uſual are, riding horſes till they are hot, and ſuffering them to ſtand in that condition where the air is cold and piercing; removing a horſe from a hot ſtable to a cold one, and too ſuddenly changing his cloathing; hence it is, that horſes often catch ſuch ſevere colds, after they come out of dealers hands; and by not being carefully rubbed down, when they come in hot, off journeys.

The ſigns of a horſe's catching cold, are a cough, heavineſs and dullneſs, which affect him more or leſs in proportion to the ſeverity of it: the eyes are ſometimes moiſt and watery, the kernels about the ears and under the jaws ſwell, the noſe gleets, and he rattles in his breathing; and when the cold is violent, the horſe will be feveriſh, his flanks work, and he will both loath his hot meat and refuſe his water. When theſe laſt ſymptoms are attended with a ſlimy mouth, ears, and feet cold, and a great inward ſoreneſs, there is danger of a bad fever.

But when the horſe coughs ſtrong, ſnorts after it, is but little off his ſtomach, pricks up his ears, and moves briſkly in his ſtall, dungs and ſtales freely, his ſkin feels kindly, and his coat does not ſtare, he is in no danger, and there will be no occaſion for medicines of any kind; but you ſhould bleed him about two quarts, keep him warm, and give him feeds of ſcalded ban, with as much warm water as he will drink, in order to dilute his blood.

If the diſorder ſhould increaſe, the horſe feel hot, and refuſe his meat, bleed him, if ſtrong, two quarts more; and if you are not ſatisfied, without giving medicines, avoid, as you would poiſon, a farrier's drench; (which is generally compoſed of ſome hot, mauſeous powders, given in a quantity of ale; which too often encreaſes the fever, by overheating the blood, and palls the horſe's ſtomach by its loathſomneſs:) and inſtead of it, infuſe two ounces of anniſeeds, with a dram of ſaffron, in a pint and a half of boiling water; pour off the clear, and diſſolve in it four ounces of honey; to which may be added four ſpoonfuls of ſallad oil: this drink may be given every night; or one of the following balls, provided there is no fever; in which caſe, it always will be more eligible to give two or three ounces of nitre or ſalt prunella every day in his feeds, or water, till it is removed; but ſhould the horſe be inclined to coſtiveneſs, remember that his body ſhould be kept open by emollient glyſters, or cream of tartar diſſolved in his water, to the quantity of three or four ounces a-day.

Pectoral Horſe-ball.

Take of the freſh powders of anniſeed, elicampane, carraway, liquorice, turmerick, and flour of brimſtone, each three ounces; juice of liquorice four ounces, diſſolved in a ſufficient quantity of mountain; ſaffron powdered half an ounce, ſallad oil and honey half a pound, oil of anniſeed one ounce: mix together with wheat-flour enough to make them into a paſte.

Or, the following from Dr Bracken.

Take anniſeed, carraway ſeed, and greater cardamoms, finely powdered, of each one ounce, flour of brimſtone two ounces, turmerick in fine powder one ounce and a half, ſaffron two grams, Spaniſh juice diſſolved in water two ounces, oil of anniſeed half an ounce, liquorice powder one ounce and a half, wheat-flower a ſufficient quantity to make into a ſtiff paſte, by beating all the ingredients well in a mortar.

Theſe balls conſiſt of warm opening ingredients; and, given in ſmall quantities, about the ſize of a pullet's egg, will encourage a free perſpiration; but in caſe of a fever, ſhould be cautiouſly continued. They are much more efficacious, and in all caſes ſuperior to the farrier's drenches, if diſſolved in a pint of warm ale.

This ſimple method, with good nurſing and hot maſhes, warm water and cloathing, eſpecially about the head and throat, which promotes the running at the noſtrils, will anſwer the moſt ſudden colds; and when the horſe feeds heartily, and ſnorts after coughing, moderate exerciſe every day will haſten his recovery.

To a horſe loaded with fleſh, a rowel may ſometimes be neceſſary, as may alſo a gentle purge or two, to ſome, when the diſtemper is gone off.

Of Fevers *in general.*

The ſymptoms of a fever are great reſtleſſneſs, the horſe ranging from one end of his rack to the other; his flanks beat; his eyes are red and inflamed; his tongue parched and dry; his breath is hot, and ſmells ſtrong; he

he loſes his appetite, and nibbles his hay, but does not chew it, and is frequently ſmelling to the ground; the whole body is hotter than ordinary, (though not parched, as in ſome inflammatory diſorders;) he dungs often, little at a time, uſually hard, and in ſmall bits, he ſometimes ſtales with difficulty, and his urine is high-coloured; his flanks beat; and he ſeems to thirſt, but drinks little at a time, and often; his pulſe beats full and hard, to fifty ſtrokes and upwards in a minute.

The firſt intention of cure is bleeding, to the quantity of two or three quarts, if the horſe is ſtrong and in good condition; then give him a pint of the following drink, four times a-day; or an ounce of nitre, mixed up into a ball with honey, may be given thrice a-day, inſtead of the drink, and waſhed down with three or four horns of any ſmall liquor.

Take of baum, ſage and chamomile flowers, each a handful, liquorice root ſliced half an ounce, ſalt prunel or nitre three ounces; infuſe in two quarts of boiling water; when cold, ſtrain off, and ſqueeze into it the juice of two or three lemons, and ſweeten with honey.

As the chief ingredient to be depended on in this drink is the nitre; it may perhaps be as well given in water alone; but as a horſe's ſtomach is ſoon palled, and he requires palatable medicines, the other ingredients may in that reſpect have their uſe. Soleyſel for this purpoſe adviſes two ounces of ſalt of tartar, and one of ſal armoniac to be diſſolved in two quarts of water, and mixed with a pail of common water, adding a handful of bran or barley-flour to qualify the unpleaſant taſte: this may be given every day, and is a uſeful medicine.

His diet ſhould be ſcalded bran, given in ſmall quantities; which, if he refuſes, let him have dry bran ſprinkled with water: put a handful of picked hay into the rack, which a horſe will often eat, when he will touch nothing elſe; his water need not be much warmed, but ſhould be given often, and in ſmall quantities: his cloathing ſhould be moderate; too much heat and weight on a horſe being improper in a fever; which ſcarce ever goes off in critical ſweats (as thoſe in the human body terminate) but by ſtrong perſpiration.

If in a day or two he begins to eat his bran, and pick a little hay; this method with good nurſing will anſwer: but if he refuſes to feed, more blood ſhould be taken away, and the drinks continued; to which may be added two or three drams of ſaffron, avoiding at this time all hotter medicines: the following glyſter ſhould be given, which may be repeated every day, eſpecially if his dung is knotty or dry.

Take two handfuls of marſhmallows, and one of chamomile flowers; fennel ſeed an hounce; boil in three quarts of water to two; ſtrain off, and add four ounces of treacle, and a pint of linſeed oil, or any common oil.

Two quarts of water-gruel, fat broth, or pot-liquor, with the treacle and oil, will anſwer this purpoſe; to which may be added a handful of ſalt. Theſe ſort of glyſters are properer than thoſe with purging ingredients.

The following opening drink is very effectual in theſe fevers, and may be given every other day, when the glyſters ſhould be omitted; but the nitre-balls or drink may be continued, except on thoſe days theſe are taken.

Take of cream of tartar and Glauber's ſalts, each four ounces; diſſolve in barley water, or any other liquor: an ounce or two of lenitive electuary may be added, or a dram or two of powder of jallap, to quicken the operation in ſome horſes.

Four ounces of Glauber's ſalts, or cream of tartar, with the ſame quantity of lenitive electuary, may be given for the ſame purpoſe, if the former ſhould not open the body ſufficiently.

In four or five days the horſe generally begins to pick his hay, and has a ſeeming reliſh to food; though his flanks will heave pretty much for a fortnight: yet the temper of his body and return of appetite ſhew, that nothing more is requiſite to complete his recovery, than walking him abroad in the air, and allowing plenty of clean litter to reſt him in the ſtable.

This method of treating a fever is ſimple, according to the laws of nature; and is confirmed by long experience, to be infinitely preferable to the hot method.

The intention here is to leſſen the quantity of blood; promote the ſecretion of urine and perpiration, and cool and dilute the fluids in general.

There is another ſort of fever that horſes are ſubject to, of a more complicate and irregular nature than the former; which if not properly treated, often proves fatal.

The ſigns are a ſlow fever with languiſhing, and great depreſſions; the horſe is ſometimes inwardly hot, and outwardly cold; at other times hot all over, but not to any extreme; his eyes look moiſt and languid; he has a continual moiſture in his mouth, which is the reaſon he ſeldom cares to drink, and when he does it is but little at a time. He feeds but little, and leaves off as ſoon as he has eat a mouthful or two; he moves his jaws in a feeble, looſe manner, with an unpleaſant grating of his teeth; his body is commonly open; his dung ſoft and moiſt, but ſeldom greaſy; his ſtaling is often irregular, ſometimes little, at other times profuſe, ſeldom high-coloured, but rather pale, with little or no ſediment

When a horſe's appetite declines daily, till he refuſes all meat, it is a bad ſign. When the fever doth not diminiſh, or keep at a ſtand, but increaſes, the caſe is then dangerous. But when it ſenſibly abates, and his mouth grows drier, the grating of his teeth ceaſes, his appetite mends, and he takes to lay down (which perhaps he has not done for a fortnight) theſe are promiſing ſigns. A horſe in theſe fevers always runs at the noſe, but not the kindly white diſcharge, as in the breaking of a cold, but of a reddiſh or greeniſh duſky colour, and of a conſiſtence like glue, and ſticks like turpentine to the hair on the inſide of the noſtrils: If this turns to a gleet of clear thin water, the horſe's hide keeps open, and he mends in his appetite; theſe are certain ſigns of recovery.

The various and irregular ſymptoms that attend this ſlow fever, require great ſkill to direct the cure, and more knowledge of the ſymptoms of horſes diſeaſes, than the generality of gentlemen are acquainted with. The experienced

perienced farrier ſhould therefore be conſulted and attended to, in regard to the ſymptoms; but very ſeldom as to the application of the remedy, which is generally above their comprehenſion; though it may be readily ſelected, by duly attending to the obſervations here inculcated.

Firſt then, a moderate quantity of blood, not exceeding three pints, may be taken away, and repeated in proportion to his ſtrength, fullneſs, inward ſoreneſs, cough, or any tendency to inflammation. After this, the fever-drink, (p. 457. col. 1. parag. 3.) may be given, with the addition of an ounce of ſnake-root, and three drams of ſaffron and camphor diſſolved firſt in a little ſpirit of wine; the quantity of the nitre may be leſſened, and theſe increaſed, as the ſymptoms indicate.

The diet ſhould be regular; no oats given, but ſcalded, or raw bran ſprinkled; the beſt flavoured hay ſhould be given by handfuls, and often by hand, as the horſe ſometimes cannot lift up his head to the rack.

As drinking is ſo abſolutely neceſſary to dilute the blood, if the horſe refuſes to drink freely of warm water or gruel, he muſt be indulged with having the chill only taken off, by ſtanding in the ſtable; nor will any inconvenience enſue, but oftener an advantage; for the nauſeous warmth of water, forced on horſes for a time, palls their ſtomachs, and takes away their appetites, which the cold water generally reſtores.

Should the fever after this treatment increaſe, the horſe feed little, ſtale often, his urine being thin and pale, and his dung ſometimes looſe, and at other times hard: ſhould the moiſture in his mouth continue, his ſkin being ſometimes dry, and at others moiſt, with his coat looking ſtarting, and ſurfeited: upon theſe irregular ſymptoms, which denote great danger, give the following balls, or drink; for in theſe caſes there is no time to be loſt.

Take of contrayerva-root, myrrh, and ſnake-root powdered, each two drams, ſaffron one dram, mithridate or Venice treacle half an ounce; make into a ball with honey, which ſhould be given twice or thrice a-day, with two or three horns of an infuſion of ſnake-root, ſweetened with honey; to a pint and a half of which may be added half a pint of treacle water or vinegar, which latter is a medicine of excellent uſe in all kinds of inflammatory and putrid diſorders, either external or internal.

Should theſe balls not prove ſucceſsful, add to each a dram of camphor, and where it can be afforded, to a horſe of value, the ſame quantity of caſtor. Or the following drink may be ſubſtituted in their ſtead for ſome days.

Take of contrayerva and ſnake-root of each two ounces, liquorice-root ſliced one ounce, ſaffron two drams; infuſe in two quarts of boiling water cloſe covered for two hours; ſtrain off, and add half a pint of diſtilled vinegar, four ounces of ſpirit of wine, wherein half an ounce of camphor is diſſolved, and two ounces of mithridate or Venice treacle; give a pint of this drink every four, ſix, or eight hours.

Should the horſe be coſtive, recourſe muſt be had to clyſters, or the opening drink: ſhould he purge, take care not to ſuppreſs it, if moderate; but if, by continuance, the horſe grows feeble, add diaſcordium to his drinks, inſtead of the mithridate; if it increaſes, give more potent remedies.

Let it be remembered, that camphor is a very powerful and effectual medicine in theſe kinds of putrid fevers; being both active and attenuating, and particularly calculated to promote the ſecretions of urine and perſpiration.

Regard ſhould alſo be had to his ſtaling; which, if in too great quantities, ſo as manifeſtly to depreſs his ſpirits, ſhould be controuled by proper reſtringents, or by preparing his drinks with lime-water. If, on the contrary, it happens that he is too remiſs this way, and ſtales ſo little as to occaſion a fullneſs, and ſwelling of the body and legs, recourſe may be had to the following drink:

Take of ſalt prunella, or nitre, one ounce; juniper-berries, and Venice turpentine, of each half an ounce; make into a ball with oil of amber.

Give him two or three of theſe balls, at proper intervals, with a decoction of marſh-mallows, ſweetened with honey.

But if, notwithſtanding the method we have laid down, a greeniſh or reddiſh gleet is diſcharged from his noſtrils, with a frequent ſneezing; if he continues to loſe his fleſh, and becomes hide bound; if he altogether forſakes his meat, and daily grows weaker; if he ſwells about the joints, and his eyes look fixed and dead; if the kernels under his jaws ſwell, and feel looſe; if his tail is raiſed and quivers; if his breath ſmells ſtrong, and a purging enſues with a diſcharge of fætid dark-coloured matter, his caſe may then be looked on as deſperate, and all future attempts to ſave him will be fruitleſs.

The ſigns of a horſe's recovery are known by his hide keeping open, and his ſkin feeling kindly; his ears and feet will be of a moderate warmth, and his eyes briſk and lively; his noſe grows clean and dry; his apetite mends, he lays down well, and both ſtales and dungs regularly.

Be careful not to overfeed him on his recovery; let his diet be light, feeds ſmall, and increaſed by degrees as he gets ſtrength; for by overfeeding, horſes have frequent relapſes, or great ſurfeits, which are always difficult of cure.

If this fever ſhould be brought to intermit, or prove of the intermitting kind, immediately after the fit is over, give an ounce of Jeſuit's bark, and repeat it every ſix hours, till the horſe has taken four or ſix ounces; ſhould eruptions or ſwellings appear, they ought to be encouraged, for they are good ſymptoms at the decline of a fever, denote a termination of the diſtemper, and that no further medicines are wanted.

The true reaſons perhaps why ſo many horſes miſcarry in fevers, are, that their maſters, or doctors, will not wait with patience, and let nature have fair play: that they generally neglect bleeding ſufficiently at firſt; and are conſtantly forcing down ſugar ſops, or other food in a horn, as if a horſe muſt be ſtarved in a few days, if he did not eat: then they ply him twice or thrice a-day with hot medicines and ſpirituous drinks, which (excepting a very few caſes) muſt be extremely pernicious to a horſe, whoſe diet is naturally ſimple, and whoſe ſtomach and blood, unaccuſtomed to ſuch heating medicines, muſt be greatly injured, and without doubt are often inflamed by ſuch treatment.

Dilute

Dilute the blood with plenty of water, or white drink; let his diet be warm bran mafhes, and his hay fprinkled. Should the fever rife, which will be known by the fymptoms above defcribed, give him an ounce of nitre thrice a-day in his water, or made up in a ball with honey. Let his body be kept cool and open, with the opening drink, given twice or thrice a-week; or an ounce of falt of tartar may be given every day, diffolved in his water, for that purpofe, omitting then the nitre. After a week's treatment in this manner, the cordial ball may be given once or twice a-day, with an infufion of liquorice-root fweetened with honey; to which may be added, when the phlegm is tough, or cough dry and hufky, a quarter of a pint of linfeed or fallad oil, and the fame quantity of oxymel fquills.

The following cooling purge is very proper to give at the decline of the diftemper, and may be repeated three or four times.

Take two ounces of fenna; annifeed and fennel bruifed, each half an ounce; falt of tartar three drams; let them infufe two hours in a pint of boiling water; ftrain off, and diffolve in it three ounces of Glauber's falt, and two of cream of tartar; give for a dofe in the morning.

This purge generally works before night very gently; and in fevers, and all inflammatory diforders, is infinitely preferable to any other phyfic.

Before we clofe this chapter on fevers, it may be no improper hint to the curious, to take notice that a horfe's pulfe fhould more particularly be attended to than is cuftomary, as a proper eftimate may thereby be made both of the degree and violence of the fever prefent, by obferving the rapidity of the blood's motion, and the force that the heart and arteries labour with to propel it round. The higheft calculation that has been made of the quicknefs of the pulfe in a healthy horfe, is, that it beats about forty ftrokes in a minute; fo that in proportion to the increafe above this number, the fever is rifing, and if farther increafed to above fifty, the fever is very high.

How often the pulfe beats in a minute may eafily be difcovered by meafuring the time with a ftop-watch, or minute fand-glafs, while your hand is laid on the horfe's near fide, or your fingers on any artery; thofe which run up on each fide the neck, are generally to be feen beating as well as felt a little above the cheft; and one withinfide each leg may be traced with the finger.

A due attention to the pulfe is fo important an article, in order to form a proper judgment in fevers, that it would appear amazing it has fo much been neglected, if one did not recollect, that the generality of farriers are fo egregioufly ignorant, that they have no manner of conception of the blood's circulation, nor in general have they ability enough to diftinguifh the difference between an artery and a vein.—With fuch pretty guardians do we intruft the healths and lives of the moft valuable of animals!

Of a Pleurisy, *and* Inflammation *of the* Lungs, *&c.*

These diforders have fcarce been mentioned by any writer in farriery before Mr Gibfon; who, by frequently examining the carcafes of dead horfes, has found them fubject to the different kinds of inflammations here defcribed.

In order to diftinguifh thefe diforders from others, we fhall defcribe the fymptoms in Mr Gibfon's own words.

"A pleurify then, which is an inflamation of the pleura; and a peripneumony, which is an inflammation of the lungs; have fymptoms very much alike; with this difference only, that in a pleurify a horfe fhews great uneafinefs, and fhifts about from place to place; the fever, which at firft is moderate, rifes fuddenly very high; in the beginning he often ftrives to lie down, but ftarts up again immediately, and frequently turns his head towards the affected fide, which has caufed many to miftake a pleuritic diforder for the gripes, this fign being common to both, though with this difference: in the gripes a horfe frequently lies down and rolls, and when they are violent he will alfo have convulfive twitches, his eyes being turned up, and his limbs ftretched out as if he were dying; his ears and feet are fometimes occafionally hot, and fometimes as cold as ice; he falls into profufe fweats, and then into cold damps; ftrives often to ftale and dung, but with great pain and difficulty; which fymptoms generally continue, till he has fome relief: but in a pleurify, a horfe's ears and feet are always burning hot, his mouth parched and dry, his pulfe hard and quick: even fometimes when he is nigh dying, his fever is continued and increafing; and though in the beginning he makes many motions to lie down, yet afterwards he reins back as far as his collar will permit, and makes not the leaft offer to change his pofture, but ftands panting with fhort ftops, and a difpofition to cough, till he has relief, or drops down.

In an inflammation of the lungs, feveral of the fymptoms are the fame; only in the beginning he is lefs active, and never offers to lie down during the whole time of his ficknefs; his fever is ftrong, breathing difficult, and attended with a fhort cough: and whereas in a pluerify a horfe's mouth is generally parched and dry; in an inflammation of the lungs, when a horfe's mouth is open, a ropy flime will run out in abundance; he gleets alfo at the nofe a reddifh or yellowifh water, which fticks like glue to the infide of his noftrils.

In a pleurify, a horfe heaves and works violently at his flanks, with great reftleffnefs, and for the moft part his belly is tucked up; but in an inflammation of the lungs, he always fhews fullnefs, and the working of his flanks is regular, except after drinking and fhifting his pofture; and his ears and feet are for the moft part cold, and often in damp fweets.

The cure of both thefe diforders is the fame. In the beginning a ftrong horfe may lofe three quarts of blood, the next day two quarts more; and if fymptoms do not abate, the bleedings muft be repeated, a quart at a time; for it is fpeedy, large, and quick-repeated bleedings that are in thefe cafes chiefly to be depended on. But if a horfe has had any previous weaknefs, or is old, you muft bleed him in lefs quantities, and oftener. Mr Gibfon recommends rowels on each fide the breaft, and one on the belly; and a bliftering ointment to be rubbed all over his brifket upon the foremoft ribs.

The

The diet and medicines ſhould be both cooling, attenuating, relaxing, and diluting; and the horſe ſhould have warm maſhes, and plenty of water or gruel. The following balls may be given thrice a-day.

Take of ſpermaceti and nitre, of each one ounce; oil of anniſeed, thirty drops; honey enough to make a ball.

A pint of barley-water, in which figs and liquorice-root have been boiled, ſhould be given after each ball; to which the juice of lemons may be added; and if the lungs are greatly oppreſſed with a dry ſhort cough, two or three horns full of the decoction may be given three or four times a-day, with four ſpoonfuls of honey and linſeed oil. A ſtrong decoction of the rattle-ſnake-root is alſo much recommended in pleuritic diſorders, and may be given to the quantity of two quarts a-day, ſweetened with honey. It remarkably attenuates the blood, and diſperſes the inflammation, and in ſome parts is deemed a ſpecific for this complaint.

An emollient glyſter ſhould be injected once a-day, to which may be added two ounces of nitre or cream of tartar.

In two or three days he will probably run at the noſe, and begin to feed; but ſhould he not, and continue hot and ſhort-breathed, you muſt bleed him again, and give the following glyſter.

Take ſenna and marſhmallows, of each two ounces; fennel and bay-berries, each one ounce; boil in five pints of clear water, to two quarts; pour off the clear, and add four ounces of purging ſalts, two or three of ſyrup of buckthorn, and half a pint of linſeed, or any common oil.

If by theſe means he grows cooler, and his pain moderates, repeat the glyſter the next day, unleſs it worked too much; then intermit a day; and when he comes to eat ſcalded bran and picked hay, leave off the balls, and continue only the decoction, with now and then a glyſter.

But let it be obſerved, that a horſe ſeldom gets the better of theſe diſorders, unleſs he has relief in a few days; for if the inflammation is not checked in that time, it uſually terminates in a gangrene, or collection of matter, which, for want of expectoration, ſoon ſuffocates him.

But as pleuritic diſorders are apt to leave a taint on the lungs, great care ſhould be taken of the horſe's exerciſe and feeding, which ſhould be light and open for two or three weeks.

There is alſo an external pleuriſy, or inflammation of the muſcles between the ribs, which, when not properly treated, proves the foundation of that diſorder called the *cheſt-founder*; for if the inflammation is not diſperſed in time, and the viſcid blood and juices ſo attenuated by internal medicines, that a free circulation is obtained; ſuch a ſtiffneſs and inactivity will remain on theſe parts, as will not eaſily be removed, and which is generally known by the name of cheſt-founder.

The ſigns of this inflammation, or external pleuriſy, are a ſtiffneſs of the body, ſhoulders, and fore-legs; attended ſometimes with a ſhort dry cough, and a ſhrinking when handled in thoſe parts.

Bleeding, ſoft pectorals, attenuants, and gentle purges are the internal remedies; and externally, the parts affected may be bathed with equal parts of ſpirit of ſal armoniac, and ointment of marſhmallows, or oil of chamomile.

Theſe outward inflammations frequently fall into the inſide of the fore-leg, and ſometimes near the ſhoulder; forming abſceſſes, which terminate the diſorder.

The membrane which ſeparates the lungs, and more particularly the diaphragm or midriff, is often alſo inflamed; which is ſcarce to be diſtinguiſhed from the pleuriſy, only in this, that when the midriff is greatly inflamed, the horſe will ſometimes be jaw-ſet, and his mouth ſo much cloſed that nothing can be got in; but the method of cure is the ſame.

Of a Cough, *and* Asthma.

The conſequence often of the preceding diſorders injudiciouſly treated, are ſettled habitual coughs; which frequently degenerate into aſthmas, and broken-wind.

Nothing has more perplexed practitioners than the cure of ſettled coughs; the cauſe of which, perhaps, has been their want of attention to the different ſymptoms which diſtinguiſh one cough from another; for without ſtrict obſervance thereof, it is impoſſible to find out the true method of cure.

Thus, if a horſe's cough is of long ſtanding, attended with loſs of appetite, waſting of fleſh, and weakneſs, it denotes a conſumption; and that the lungs are full of knotty, hard ſubſtances, called tubercles, which have often been diſcovered on diſſection.

The following ſigns denote when the cough proceeds from phlegm, and ſlimy matter, that ſtop up the veſſels of the lungs.

The horſe's flanks have a ſudden quick motion; he breathes thick, but not with his noſtrils open, like a horſe in a fever, or that is broken-winded; his cough is ſometimes dry and huſky, ſometimes moiſt, before which he wheezes, rattles in the throat, and ſometimes throws out of his noſe and mouth great gobs of white phlegm, eſpecially after drinking, or when he begins or ends his exerciſe, which diſcharge commonly gives great relief. Some ſuch horſes wheeze and rattle to ſuch a degree, and are ſo thick-winded, that they can ſcarce move on, till they have been out ſome time in the air; though then they will perform beyond expectation.

The above aſthmatic caſe proves often very obſtinate; but, if it happens to a young horſe, and the cough is not of long ſtanding, it is greatly relieved, if not totally cured, by the following method.

If the horſe is full of fleſh, bleed him plentifully; if low in fleſh, more ſparingly; which may occaſionally be repeated, on very great oppreſſions and difficulty of breathing, in proportionate quantities.

As mercurial medicines are found remarkably uſeful in theſe caſes, give a mercurial ball (with two drams of calomel) over night, and a common purge next morning: or the following, which is recommended by Mr Gibſon.

Take gum-galbanum, ammoniacum, and aſſa fœtida, of

of each two drams, fine aloes one ounce, ſaffron one dram, oil of anniſeeds two drams, oil of amber one dram; with honey enough to form into a ball.

They may be repeated at proper intervals, with the uſual cautions. In the intermediate days, and for ſome time after, one of the following balls may be given every morning.

Take cinnabar of antimony, finely levigated, ſix ounces; gum ammoniacum, galbanum, and aſſa fætida, of each two ounces; garlick four ounces; ſaffron half an ounce: make into a paſte for balls, with a proper quantity of honey.

Take of the pectoral or cordial ball one pound, balſam of Peru half an ounce, balſam of ſulphur anniſated one ounce, flowers of Benjamin half an ounce, honey as much as is ſufficient to form them into a paſte; give the ſize of a pigeon's egg every morning.

Exerciſe in a free open air is very ſerviceable, and the diet ſhould be moderate.

The following are the ſymptoms of a dry cough, or aſthma.

The horſe afflicted with this cough eats heartily, hunts and goes through his buſineſs with alacrity, appears well coated, and has all the ſigns of perfect health; yet he coughs at particular times almoſt inceſſantly, without throwing up any thing, except that the violence of the cough will cauſe a little clear water to diſtill from his noſe. Though this cough is not periodical, yet ſome of theſe horſes cough moſt in a morning, after drinking.

This may properly be ſtyled a nervous aſthma in a horſe; as probably it chiefly affects the nerves in the membranous parts of the lungs and midriff; and is a caſe very doubtful at leaſt, if not incurable; but when the horſe is young, the following method may be ſucceſsful.

Take away firſt a moderate quantity of blood; then give him two drams of calomel, mixed up with an ounce of diapente, for two nights; and the next morning a purging ball. Keep him well cloathed and littered, and feed him with ſcalded bran and warm water.

Once in eight or ten days this purge may be repeated, with one mercurial ball only, given over night.

The following balls may then be taken, one every day, about the ſize of a pullet's egg, the horſe faſting two hours afterwards; and ſhould be continued two months, or longer, to be of real ſervice.

Take native cinnabar, or cinnabar of antimony, half a pound; gum guaiacum four ounces; myrrh, and gum armoniac, of each two ounces; Venice ſoap half a pound: the cinnabar muſt be finely levigated, as before obſerved, and the whole mixed up with honey, or oxymel ſquills.

The following alſo will be found a uſeful remedy in obſtinate dry coughs.

Take gum ammoniacum, ſquills, and Venice ſoap, of each four ounces, balſam of ſulphur with anniſeeds one ounce; beat up into a maſs, and give as the former.

Before we cloſe this ſection, it may be neceſſary to obſerve here, that ſome young horſes are ſubject to coughs on cutting their teeth; their eyes alſo are affected from the ſame cauſe. In theſe caſes, always bleed; and if the cough is obſtinate, repeat it, and give warm maſhes; which, in general, are alone ſufficient to remove this complaint.

Of a Broken-wind.

This diſorder hitherto ſeems to have been little underſtood; but Mr Gibſon is inclined to think, that the ſource of it is frequently owing to injudicious or haſty feeding young horſes for ſale; by which means the growth of the lungs, and all the contents within the cheſt, are ſo increaſed, and in a few years ſo preternaturally enlarged, that the cavity of the cheſt is not capacious enough for them to expand themſelves in, and perform their functions.

A narrow contracted cheſt with large lungs may ſometimes naturally be the cauſe of this diſorder: and it has been obſerved, that horſes riſing eight years old are as liable to this diſtemper, as, at a certain period of life, men fall into aſthmas, conſumptions, and other chronic diſeaſes.

The reaſon why this diſorder becomes more apparent at this age, may be, that a horſe comes to his full ſtrength and maturity at this time: at ſix he commonly finiſhes his growth in height; after that time he lets down his belly, and ſpreads, and all his parts are grown to their full extent; ſo that the preſſure on the lungs and midriff is now more increaſed.

But how little weight ſoever theſe reaſons may have, repeated diſſections have given ocular proofs of a preternatural largeneſs, not only of the lungs of broken-winded horſes, but of their heart and its bag, and of the membrane which divides the cheſt; as well as of a remarkable thinneſs in the diaphragm, or midriff.

This diſproportion has been obſerved to be ſo great, that the heart and lungs have been almoſt of twice their natural ſize, perfectly ſound, and without any ulceration whatever; or any defect in the wind-pipe, or its glands.

Hence it appears, that this enormous ſize of the lungs, and the ſpace they occupy, by hindering the free action of the midriff, is the chief cauſe of this diſorder; and as the ſubſtance of the lungs was found more fleſhy than uſual, they of courſe muſt loſe a great deal of their ſpring and tone.

Whoever conſiders a broken-wind in this light, muſt own that it may be reckoned among the incurable diſtempers of horſes; and that all the boaſted pretenſions to cure are vain and frivolous, ſince the utmoſt ſkill can amount to no more than now and then palliating the ſymptoms, and mitigating their violence.

We ſhall therefore only lay down ſuch methods as may probably prevent this diſorder, when purſued in time. But if they ſhould not ſucceed, we ſhall offer ſome remedies and rules to mitigate its force, and to make a horſe as uſeful as poſſible under this malady.

It is uſual, before a broken wind appears, for a horſe to have a dry obſtinate cough, without any viſible ſickneſs or loſs of appetite; but, on the contrary, a diſpoſition to foul feeding, eating the litter, and drinking much water.

In,

In order then to prevent, as much as poffible, this diforder, bleed him, and give him the mercurial phyfic above prefcribed, which fhould be repeated two or three times.

The following balls are then to be taken for fome time, which have been found extremely efficacious in removing obftinate coughs.

TAKE aurum mofaicum, finely powdered, eight ounces; myrrh and elicampane, powdered, each four ounces; annifeeds and bay-berries, each an ounce; faffron, half an ounce; make into balls with oxymel fquills.

The aurum mofaicum is made of equal parts of quickfilver, tin, fal armoniac, and fulphur. We give this medicine as ftrongly recommended by Mr Gibfon; but how far the aurum mofaicum may contribute to its efficacy, may perhaps juftly be difputed: as a fubftitute in its room, therefore, for this purpofe, we recommend the fame quantity of powdered fquills, or gum ammoniacum, or equal parts of each.

Broken-winded horfes fhould eat fparingly of hay, which as well as their corn may be wetted with chamber lye, or fair water; as this will make them lefs craving after water.

The volatile falts in the urine may make it preferable to water, and may be the reafon why garlick is found fo efficacious in thefe cafes; two or three cloves given at a time in a feed, or three ounces of garlick bruifed, and boiled in a quart of milk and water, and given every other morning for a fortnight, having been found very ferviceable; for by warming and ftimulating the folids, and diffolving the tenacious juices, which choak up the veffels of the lungs, thefe complaints are greatly relieved.

Careful feeding, and moderate exercife has greatly relieved broken-winded horfes.

Horfes fent to grafs in order to be cured of an obftinate cough, have often returned completely broken-winded, where the pafture has been rich and fucculent, fo that they have had their bellies conftantly full. As the ill confequence therefore is obvious, where you have not the conveniency of turning out your horfe for a conftancy, you may foil him for a month or two with young green barley, tares, or any other young herbage.

To purfive thick-winded horfes, Barbadoes and common tar have often been given with fuccefs, to the quantity of two fpoonfuls mixed with the yelk of an egg, diffolved in warm ale, and given fafting two or three times a week, efpecially thofe days you hunt or travel.

But in order to make all thefe forts of horfes of any real fervice to you, the grand point is to have a particular regard to their diet, obferving a juft œconomy both in that and their exercife; giving but a moderate quantity of hay, corn, or water, at a time, and moiftening the former, to prevent their requiring too much of the latter, and never exercifing them but with moderation, as has before been obferved. The following alterative ball may be given once a-fortnight or three weeks; and as it operates very gently, and requires no confinement but thofe days it is given (when warm meat and water are neceffary), it may be continued for two or three months.

TAKE fuccotrine aloes fix drams; myrrh, galbanum, and ammoniacum, of each two drams; bay-berries half an ounce: make into a ball with a fpoonful of oil of amber, and a fufficient quantity of fyrup of buckthorn.

Of a CONSUMPTION.

WHEN a confumption proceeds from a defect in a horfe's lungs, or any principal bowel; the eyes look dull; the ears and feet are moftly hot; he coughs fharply by fits; fneezes much, and frequently groans with it; his flanks have a quick motion; he gleets often at the nofe, and fometimes throws out a yellowifh curdled matter; and he has little appetite to hay, but will eat corn, after which he generally grows hot.

As to the cure, one of the principal things is bleeding in fmall quantities (a pint, or pint and half, from fome horfes is fufficient) which fhould be repeated as often as the breath is more than ordinarily oppreffed. Pectorals may be given to palliate prefent fymptoms; but as diffections have difcovered both the glands of the lungs and mefentery to be fwelled, and often indurated, the whole ftrefs lies on mercurial purges, and the following ponderous alteratives, given intermediately.

TAKE native cinnabar, or cinnabar of antimony, one pound, powdered very fine, and add the fame quantity of gum guaiacum and nitre; give the horfe an ounce of this powder twice a-day, wetting his feeds.

The fpring grafs is often extremely ferviceable, but the falt marfhes are to be preferred, and to be more depended on than medicines; for great alterations are thereby made in the blood and juices, and no fmall benefit arifes from open air and proper exercife.

Of an APOPLEXY *or* STAGGERS, CONVULSIVE DISORDERS, LETHARGY, EPILEPSY, *and* PALSY.

FARRIERS generally include all diftempers of the head under two denominations, *viz. ftaggers* and *convulfions*; wherein they always fuppofe the head primarily affected. But in treating thefe diforders, we will diftinguifh between thofe that are peculiar to the head, as having their fource originally thence; and thofe that are only concomitants of fome other difeafe.

In an apoplexy a horfe drops down fuddenly, without other fenfe or motion than a working at his flanks.

The previous fymptoms are, drowfinefs; watery eyes, fomewhat full and inflamed; a difpofition to reel, feeblenefs, a bad appetite; the head almoft conftantly hanging, or refting on the manger; fometimes with little or no fever, and fcarce any alteration in the dung or urine: the horfe is fometimes difpofed to rear up, and apt to fall back when handled about the head; which is often the cafe with young horfes, to which it does not prove fuddenly mortal; but with proper help they may fometimes recover. If the apoplexy proceeds from wounds, or blows on the head, or matter on the brain; befides the above fymptoms, the horfe will be frantick by fits, efpecially after his feeds, fo as to ftart and fly at every thing. Thefe cafes feldom admit of a perfect recovery; and when horfes fall down fuddenly, and work violently at their flanks, without any ability to rife after a plentiful bleeding, they feldom recover.

All that can be done is to empty the veſſels as ſpeedily as poſſible, by ſtriking the veins in ſeveral parts at once, bleeding to four or five quarts, and to raiſe up the horſe's head and ſhoulders, ſupporting them with plenty of ſtraw. If he ſurvives the fit, cut ſeveral rowels; give him night and morning glyſters prepared with a ſtrong decoction of ſenna and ſalt, or the purging glyſter mentioned in the directions; blow once a-day up his noſtrils a dram of powder of aſarabacca, which will promote a great diſcharge; afterwards two or three aloetic purges ſhould be given; and to ſecure him from a relaple, by attenuating and thinning his blood, give him an ounce of equal parts of antimony and crocus metallorum for a month; or, which is preferable, the ſame quantity of cinnabar of antimony and gum guaiacum.

If the fit proceeds only from fulneſs of blood, high feeding, and want of ſufficient exerciſe, or a ſizy blood (which is often the caſe with young horſes, who though they reel, ſtagger, and ſometimes ſuddenly fall down, yet are eaſily cured by the above method), an opening diet with ſcalded bran and barley will be neceſſary for ſome time; and the bleeding may be repeated in ſmall quantities.

As to the other diſorders of the head, ſuch as lethargy or ſleeping evil, epilepſy or falling-ſickneſs, vertigo, frenzy, and madneſs, convulſions, and paralytical diſorders, as they are moſt of them to be treated as the apoplexy and epilepſy, by bleeding and evacuations with the alteratives there directed, we ſhall wave treating of them ſeparately, but mention ſome particular rules to diſtinguiſh them, according to the plan we laid down, and then offer ſome general remedies for the ſeveral purpoſes.

In an epilepſy, or falling ſickneſs, the horſe reels and ſtaggers, his eyes are fixed in his head, he has no ſenſe of what he is doing, he ſtales and dungs inſenſibly, he runs round and falls ſuddenly; ſometimes he is immoveable, with his legs ſtretched out as if he was dead, except only a quick motion of his heart and lungs, which cauſes a violent working of his flanks; ſometimes he has involuntary motions, and ſhaking of his limbs, ſo ſtrong, that he has not only beat and ſpurned his litter, but the pavement with it; and with theſe alternate ſymptoms a horſe continued more than three hours, and then he has as ſurpriſingly recovered; at the going off of the fit, he generally foams at the mouth, the foam being white and dry, like what comes from a healthful horſe when he champs on the bit.

But in all kinds of gripes, whether they proceed from diſorders in the guts, or retention of urine, a horſe is often up and down, rolls and tumbles about; and when he goes to lie down, generaly makes ſeveral motions with great ſeeming carefulneſs, which ſhews he has a ſenſe of his pain; and if he lays ſtretched out for any time, it is generally but for a ſhort ſpace.

Epilepſies and convulſions may ariſe from blows on the head, too violent exerciſe, and hard ſtraining; and from a fulneſs of blood, or impoveriſhed blood, and ſurfeits; which are ſome of the cauſes that denote the original diſorder.

In lethargic diſorders, the horſe generally reſts his head with his mouth in the manger, and his pole often reclined to one ſide; he will ſhew an inclination to eat, but generally falls aſleep with his food in his mouth, and he frequently ſwallows it whole, without chewing: emollient glyſters are extremely neceſſary in this caſe, with the nervous balls recommended for the ſtaggers and convulſions; ſtrong purges are not requiſite, nor muſt you bleed in too large quantities, unleſs the horſe be young and luſty. In old horſes, rowels and large evacuations are improper; but volatiles of all kinds are of uſe, when they can be afforded: the alterative purge (p 554. col. 2. par. 2 from the bottom) may be given, and repeated on his amendment.

This diſtemper is to be cured by theſe means, if the horſe is not old and paſt his vigour. It is a good ſign if he has a tolerable appetite, and drinks freely without ſlabbering, and if he lies down, and riſes up carefully, though it be but ſeldom.

But if a lethargic horſe does not lie down; if he is altogether ſtupid and careleſs, and takes no notice of any thing that comes near him; if he dungs and ſtales ſeldom, and even while he ſleeps and dozes, it is a bad ſign: if he runs at the noſe thick white matter, it may relieve him; but if a viſcid gleet, that ſticks to his noſtrils like glue, turn to a profuſe running of ropy, reddiſh and greeniſh matter, it is an infallible ſign of a great decay of nature, and that it will prove deadly.

Young horſes from four to ſix years, are very ſubject to convulſions, from bots in the ſpring; and the large coach breed, more than the ſaddle They are ſeized without any previous notice; and if bots and worms are diſcovered in their dung, the cauſe ſeems to be out of doubt; more eſpecially if they have lately come out of a dealer's hands.

When this convulſion proceeds from a diſtemperature of the midriff, or any of the principal bowels, it is to be diſtinguiſhed from bots and vermin by previous ſymptoms; the horſe falls off his ſtomach, and grows gradually weak, feeble, and diſpirited in his work, and turns ſhort-breathed with the leaſt exerciſe.

The lively deſcription of that univerſal cramp or convulſion, called by ſome the ſtag-evil, which ſeizes all the muſcles of the body at once, and locks up the jaws, ſo that it is impoſſible almoſt to force them open, we ſhall give in Mr Gibſon's own words, who ſays: As ſoon as the horſe is ſeized, his head is raiſed with his noſe towards the rack, his ears pricked up, and his tail cocked, looking with eagerneſs as an hungry horſe when hay is put down to him, or like a high-ſpirited horſe when he is put upon his mettle; inſomuch, that thoſe who are ſtrangers to ſuch things, when they ſee a horſe ſtand in this manner, will ſcarce believe any thing of conſequence ails him; but they are ſoon convinced, when they ſee other ſymptoms come on apace, and that his neck grows ſtiff, cramped, and almoſt immoveable; and if a horſe in this condition lives a few days, ſeveral knots will ariſe on the tendinous parts thereof, and all the muſcles both before and behind will be ſo much pulled and cramped, and ſo ſtretched, that he locks as if he was nailed to the pavement, with his legs ſtiff, wide, and ſtradling; his ſkin is drawn ſo tight on all parts of the body, that it is almoſt impoſſible to move it; and if trial be made to make him walk,

walk, he is ready to fall at every ſtep, unleſs he be carefully ſupported; his eyes are ſo fixed with the inaction of the muſcles, as give him a deadneſs in his looks; he ſnorts and ſneezes often, pants continually with ſhortneſs of breath; and this ſymptom increaſes continually till he drops down dead; which generally happens in a few days, unleſs ſome ſudden and very effectual turn can be given to the diſtemper.

In all theſe caſes the horſe ſhould firſt be bled plentifully, unleſs he is low in fleſh, old, or lately come off any hard continued duty, then you muſt be more ſparing of his blood; afterwards give the following ball.

TAKE aſſa fœtida half an ounce, Ruſſia caſtor powdered two drams, valerian root powdered one ounce; make into a ball with honey and oil of amber.

This ball may be given twice a-day at firſt; and then once, waſhed down with a decoction of miſletoe or valerian ſweetened with liquorice or honey: an ounce of aſſa fœtida may be tied up in a piece of ſtrong coarſe linen rag, and put behind his grinders to champ on.

The laxative purges and emollient glyſters ſhould be given intermediately to keep the body open; but when the former balls have been taken a week or ten days, the following may be given once a-day with the valerian decoction.

TAKE cinnabar of antimony ſix drams, aſſa fœtida half an ounce, ariſtolochia myrrh and bay-berries of each two drams; make into a ball with treacle and oil of amber.

This is the moſt effectual method of treating theſe diſorders; but when they are ſuſpected to ariſe from bots, and worms, which is generally the caſe, mercurial medicines moſt lead the way, thus:

TAKE mercurius dulcis and philonium of each half an ounce; make into a ball with conſerve of roſes, and give the horſe immediately; half the quantity may be repeated in four or five days.

The following infuſion ſhould then be given, to the quantity of three or four horns, three or four times a-day, till the ſymptoms abate; when the above nervous balls may be continued till they are removed.

TAKE penny-royal and rue of each two large handfuls, chamomile flowers one handful, aſſa fœtida and caſtor of each half an ounce, ſaffron and liquorice-root ſliced of each two drams; infuſe in two quarts of boiling water; pour off from the ingredients as wanted.

If the caſtor is omitted, add an ounce of aſſa fœtida.

The following ointment may be rubbed into the cheeks, temples, neck, ſhoulders, ſpines of the back and loins, and where-ever there is the greateſt contractions and ſtiffneſs.

TAKE nerve and marſhmallow ointment of each four ounces, oil of amber two ounces, with a ſufficient quantity of camphorate ſpirit of wine; make a liniment.

When the jaws are ſo locked up that medicines cannot be given by the mouth, it is more eligible to give them by way of glyſter; for forcing open the jaws by violence often puts a horſe into ſuch agonies, that the ſymptoms are thereby increaſed.

In this caſe alſo he muſt be ſupported by nouriſhing glyſters, made of milk-pottage, broths, &c. which muſt be given to the quantity of three or four quarts a-day; glyſters of this kind will be retained, and abſorbed into the blood; and there have been inſtanced of horſes thus ſupported for three weeks together, who muſt otherwiſe have periſhed.

Mr Gibſon mentions ſome extraordinary inſtances of ſucceſs in caſes of this ſort by theſe methods, and repeated frictions, which are extremely ſerviceable in all convulſive diſorders, and often prevent their being jaw-ſet; they ſhould be applied with unwearied diligence every two or three hours, where ever any ſtiffneſs or contractions in the muſcles appear; for a horſe in this condition never lies down till they are in ſome meaſure removed.

The uſe of rowels in theſe caſes is generally unſucceſsful, the ſkin being ſo tenſe and tight, that they ſeldom digeſt kindly, and ſometimes mortify; ſo that if they are applied, they ſhould be put under the jaws, and in the breaſt.

The red-hot iron ſo frequently run through the foretop and mane, near the occipital bone, for this purpoſe, has often been found to have deſtroyed the cervical ligament.

In paralytic diſorders, where the uſe of a limb or limbs is taken away, the internals above recommended ſhould be given, in order to warm, invigorate, and attenuate the blood; and the following ſtimulating embrocation ſhould be rubbed into the parts affected.

TAKE oil of turpentine four ounces, nerve ointment and oil of bays of each two ounces, camphor rubbed fine one ounce, rectified oil of amber three ounces, tincture of cantharides one ounce.

With this liniment the parts affected ſhould be well bathed for a conſiderable time, to make it penetrate; and when the hind parts chiefly are lame, the back and loins ſhould be well rubbed with the ſame. To the nervous medicines above recommended, may be added ſnake-root, contrayerva, muſtard-ſeed, horſe-raddiſh root ſteeped in ſtrong beer, or wine where it can be afforded. Take the following for an example, which may be given to the quantity of three pints a-day alone, or two horns full may be taken after the nervous balls.

TAKE ſnake-root, contrayerva, and valerian, of each half an ounce; muſtard-ſeed and horſe-raddiſh root ſcraped, of each two ounces; long pepper two drams: infuſe in three pints of ſtrong wine.

When the horſe is recovering from any of the above diſorders, the following alterative purge may be repeated two or three times, as it operates very gently.

TAKE ſuccotrine aloes one ounce, myrrh half an ounce, aſſa fœtida and gum ammoniacum of each two drams, ſaffron one dram; make into a ball with any ſyrup.

Where a retention of dung is the cauſe of this diſorder, the great gut ſhould firſt be raked thoroughly with a ſmall hand, after which plenty of emollient oily glyſters ſhould be thrown up, and the opening drink given, till the bowels are thoroughly emptied of their impriſoned dung. Their diet ſhould for ſome days be opening, and conſiſt

consist chiefly of scalded bran, with flower of brimstone, scalded barley, *&c.*

Of the STRANGLES, *and* VIVES.

THE strangles is a distemper to which colts and young horses are very subject; and begins with a swelling between the jaw-bones, which sometimes extends to the muscles of the tongue; and is attended with so great heat, pain, and inflammation, that sometimes, till matter is formed, the horse swallows with the utmost difficulty.

The symptoms are extraordinary heat and feverishness, with a painful cough, and a great inclination to drink without being able; some horses losing their appetite entirely, others eating but little, by reason of the pain which chewing and swallowing occasions: when the swelling begins on the inside of the jaw-bones, it is much longer en coming to matter than when more to the middle; when it arises among the glands, and divides into several tumours, the cure is generally tedious, as it breaks in different places; and when it forms upwards on the wind-pipe and gullet, there is sometimes danger of suffocation, unless the swelling soon breaks. But the most dangerous kind is, when, besides the above symptoms, the horse runs at the nose; this is by some called the *bastard strangles.*

As this disorder seems to be critical, the most approved method is to assist nature in bringing the swellings to maturity, by keeping them constantly moist with ointment of marshmallows, and covering the head and neck with a warm hood. But as all swellings in glandular parts suppurate slowly, the following poultice may be applied hot twice a-day.

TAKE leaves of marshmallows ten handfuls, white-lily root half a pound, linseed and fenugreek-seed bruised of each four ounces; boil them in two quarts of water till the whole is pulpy, and add four ounces of ointment of marshmallows, and a sufficient quantity of hogs-lard, to prevent its growing stiff and dry.

In five or six days, by these means, the matter is generally formed, and makes its way through the skin; and if the discharge is made freely and with ease, the opening need not be inlarged; but should be dressed with the following ointment spread on tow, still continuing the poultice over it to promote the digestion, and prevent any remaining hardness.

TAKE rosin and Burgundy pitch of each a pound and a half, honey and common turpentine each eight ounces, yellow wax four ounces, hogs-lard one pound, verdigrease finely powdered one ounce; melt the ingredients together, but do not put in the verdigrease, till removed from the fire; and it should be stirred in by degrees, till the whole is grown stiff and cool.

If the fever and inflammation run high, and the swelling be so situated as to endanger suffocation, a moderate quantity of blood must be taken away, and the remainder diluted with plenty of water-gruel, or warm water, mashes, *&c.*

The running at the nose which often attends the strangles is dangerous, especially if it continues after they have ripened and broke, as the horse will be greatly weakened thereby. To prevent this waste and decay, give him every day for some time an ounce of Jesuit's bark; or a strong decoction of guaiacum shavings, which hath been found extremely beneficial in restraining these glandular discharges when too liberal, and in drying up ulcers of all kinds in horses.

If a hardness remains after the sores are healed up, they may be anointed with the mercurial ointment; and when the horse has recovered his strength, purging will be necessary.

The vives or ives differ from the strangles only in this; that the swellings of the kernels, under the ears of the horse, (which are the parts at first chiefly affected), seldom gather, or come to matter, but by degrees perspire off and disperse by warm cloathing, anointing with the marshmallow ointment, and a moderate bleeding or two. But should the inflammation continue notwithstanding these means, a suppuration must be promoted by the methods above recommended in the strangles.

When these swellings appear in an old or full-aged horse, they are signs of great malignity, and often of an inward decay, as well as forerunners of the glanders.

The mercurial ointment above-mentioned, may be prepared thus:

TAKE of crude mercury or quicksilver one ounce, Venice turpentine half an ounce; rub together in a mortar till the globules of the quicksilver are no longer visible; then add two ounces of hogs-lard.

Of the Diseases of the EYES.

IN order to make the disorders of the eyes well understood, we shall consider them as arising from different causes; external injuries affecting the globe of the eye; and from internal causes affecting the humours within the globe. We shall consider also the eye as naturally weak from a bad conformation, which possibly may often be hereditary.

In all recent disorders of the eye from external injuries, such as blows, bites, *&c.* attended with a swelling of the lid, and a running from the eye, you must first sponge the part often with cold spring-water and vinegar; and if much swelled, bleed immediately, and apply over it a poultice made of the pulps of roasted or boiled apples, cleared from their seeds and husks; or of conserve of roses and vinegar, with a little bole, and the white of an egg. When the swelling is abated, either of the following washes will complete the cure.

TAKE white vitriol half an ounce, sugar of lead two drams; dissolve in a pint of spring-water; to which may occasionally be added, when the rheum is very great, and inflammation removed, half an ounce of tutty, or compound powder cerufs.

Let the eye and eyelid be bathed three or four times a-day with a clean sponge dipped in this wash; or it may be applied with a feather, leaving a few drops on the eye. When the veins under the eye have been turgid, opening them with a launcet has often been found successful.

Mr Gibſon, from his own experience, recommends the following, with which alone he has ſucceeded in moſt common caſes.

TAKE two drams of roſe-buds, infuſe them in half a pint of boiling water; when cold, pour off the infuſion, and add to it twenty grains of ſugar of lead.

This is to be uſed as the former; but the quantity of ſugar of lead may occaſionally be increaſed.

Sometimes from the violence of the inflammation, ſucceeding blows, and external injuries, the coats of the eye ſhall loſe their tranſparency, thicken, and turn white, or pearl-colour; in the latter caſe, the horſe has ſome glimmering of light; in the former, he is blind while the eye continues in this ſtate.

If the horſe be fleſhy and of a groſs conſtitution, bleeding may be repeated, and a rowel will be neceſſary: let his diet be ſcalded bran or barley; avoiding for ſome days oats, beans, or any thing hard to chew.

The cooling opening drink, (p. 547. col. 1. par. 1.) ſhould be given every other day, which will anſwer better than aloetic purges.

If the eye-lids continue ſwelled and moiſt, and the under ſide of the eye inflamed, an ounce of honey may be added to four ounces of the above waters; or the part may be well bathed with an ounce of honey of roſes, and half a dram of ſugar of lead, diſſolved in three ounces of ſpring-water: to which may be added, when the eye is very watery, a ſpoonful or two of red wine, which will help to thicken the matter and dry it up.

If a film or thick ſlough ſhould remain, it may be taken off, by blowing into the eye equal parts of white vitriol and ſugar-candy finely powdered.

Glaſs finely powdered, mixed up with honey and a little freſh butter, is much recommended by Dr Bracken for this purpoſe; as alſo the following ointment.

TAKE ointment of tutty one ounce, honey of roſes two drams, white vitriol burnt one ſcruple; this, with a feather, may be ſmeared over the eye twice a-day.

Let it be remembered, that it has long been obſerved in practice, that the eye in its firſt ſtate of inflammation is ſo very tender, that the eye-waters prepared with tutty and other powders aggravate the diſorder; conſequently, during this ſtate, the tinctures of vegetables and ſolutions of ſalts are greatly preferable.

Wounds of the eye may be dreſſed with honey of roſes alone, or with a little ſugar of lead mixed with it, adding thereto, after a few days, an eighth part of tincture of myrrh; all the preceding directions in regard to inflammation being attended to, eſpecially bleeding, rowels, and gentle cooling phyſic.

When the humours of the eye are thickened, and the diſorder is within the globe, ſharp external applications are not only uſeleſs, but extremely detrimental, by the irritation they occaſion, and conſequently ſhould be avoided.

In all caſes of this ſort, whether moon-eyes, which are only cataracts forming, or in confirmed ones attended with a weeping; general evacuations, with internal alteratives, can only take place.

Theſe generally make their appearance, when a horſe is turned five, coming ſix; at which time one eye becomes clouded, the eye lids being ſwelled, and very often ſhut up; and a thin water generally runs from the diſeaſed eye down the cheek, ſo ſharp as ſometimes to excoriate the ſkin; the veins of the temple, under the eye, and along the noſe, are turgid and full: though ſometimes it happens that the eye runs but little.

This diſorder comes and goes till the cataract is ripe; then all pain and running diſappears, and the horſe becomes totally blind, which is generally in about two years. During this time ſome horſes have more frequent returns than others; which continue in ſome a week or more, in others three or four; returning once in two or three months, and they are ſeldom ſo long as five without a relapſe.

There is another kind of moon-blindneſs, which is alſo the forerunner of cataracts, where no humour or weeping attends. The eye is never ſhut up or cloſed here, but will now and then look thick and troubled, at which time the horſe ſees nothing diſtinctly: when the eyes appear ſunk and periſhing, the cataracts are longer coming to maturity; and it is not unuſual in this caſe for one eye to eſcape.

Theſe caſes generally end in blindneſs of one, if not of both eyes; the moſt promiſing ſigns of recovery are when the attacks come more ſeldom, and their continuance grows ſhorter, and that they leave the cornea clear and tranſparent, and the globe plump and full.

The attempts to cure cataracts have hitherto been only palliative and mitigating the ſymptoms; yet early care has ſometimes been ſucceſsful. To this end the horſe ſhould be rowel'd and bled at proper intervals; except where the eyes appear ſunk and periſhing, where it is often pernicious. During the violence of the ſymptoms, obſerve the cooling treatment above recommended, giving him two ounces of nitre every day mixed into a ball with honey, and bathe the parts above the eye with verjuice, or vinegar, wherein roſe-leaves are infuſed; to four ounces of which, half a dram of ſugar of lead may be added. The ſwelling on the lid may afterwards be bathed with a ſponge dipt in equal parts of lime and Hungary water, mixed together: the cooling phyſic, (p. 545 col. 1. par. 4.) ſhould be given every fourth day, till the eye becomes clear, and recovers its uſual brightneſs. The following alſo is very proper phyſic for this purpoſe.

TAKE lenitive electuary and cream of tartar of each four ounces, Glauber's ſalts three ounces, ſyrup of buckthorn two ounces.

When the weeping is by theſe means removed, the alterative powders (See the ſection, *Of* ALTERATIVE MEDICINES) ſhould be given every day, till two or three pounds are taken, and after an interval of three months, the ſame courſe ſhould be repeated. This method has often been attended with good ſucceſs, where the eyes have been full, and no way periſhed; in that caſe, bathe or foment them with the following, twice a-day.

TAKE crude ſal armoniac two drams, diſſolve in a pint of lime-water, and add to it four ounces of brandy, or Hungary water.

This will act as a ſtimulus, and may help to thin and rarify

rarify the gummy juices, and bring new fupplies of nourifhment to the perifhing eyes.

This courfe not fucceeding, in order more powerfully to open the veffels of the chryftalline humour, (which in thefe cafes is always found opake, and, when the cataract is confirmed, entirely lofes its tranfparency,) and hinder as much as poffible the forming of obftructions, mercurials are chiefly to be depended on: thus give every other day, for three or four mornings, two drams of calomel, mixed up with conferve of rofes; and then purge off with the common ball.

During this courfe, particular care fhould be taken of the horfe: after repeating this, the alterative powders before-mentioned fhould be given for fome weeks or months, if you expect any benefit from them; or they may be beat up into a ball with live millepedes, and an ounce and a half given every day: if thefe fhould not fucceed, and the horfe is a valuable one, the turbith courfe recommended in the fection on alteratives, feems to be the moft promifing method left. But to horses that are not fo, an ounce of antimony, ground into an impalpable powder, may be given every day in one of his feeds for three months or longer; or a ftrong decoction of guaiacum fhavings may be given for fome time, to which crude antimony may be given in the following manner.

Take guaiacum fhavings one pound, crude antimony tied in a rag the fame quantity; boil in two gallons of forge-water to one, and give a quart a-day, either alone, or mixed with his water.

The haws is a fwelling and fponginefs that grows in the inner corner of the eye, fo large fometimes as to cover a part of the eye. The operation here is eafily performed by cutting part of it away; but the farriers are apt to cut away too much; the wound may be dreffed with honey of rofes; and if a fungus or fpongy flefh arifes, it fhould be fprinkled with burnt alum, or touched with blue vitriol.

Of the Glanders.

The caufe and feat of the glanders has till lately been fo imperfectly handled, and fo little underftood by the writers of this diftemper, that it is no wonder it fhould be ranked among the incurables: but a new light having been thrown on this whole affair by the ftudy of M. La Foffe, the king of France's farrier, who has been at the pains to trace out, and difcover, by diffections, the fource and caufe of this diforder; we hope the method he has propofed, with fome further experiments and improvements, will foon bring to a certainty of cure (in moft cafes at leaft) a diftemper fo dangerous to our horfes, and that hitherto has eluded the force of art.

M. de la Foffe has diftinguifhed feven different kinds of glanders, four of which are incurable.

The firft proceeds from ulcerated lungs, the purulent matter of which comes up the trachea, and is difcharged through the noftrils, like a whitifh liquor, fometimes appearing in lumps and grumes: in this diforder, though the matter is difcharged from the noftrils, yet the malady is folely in the lungs.

The fecond is a wafting humour, which ufually feizes horfes at the decline of a difeafe, caufed by too hard labour; this defluxion alfo proceeds from the lungs.

The third is a malignant difcharge, which attends the ftrangles fometimes, and falls upon the lungs, which runs off by the noftrils.

The fourth is, when an acrimonious humour in the farcy feizes thefe parts, where it foon makes terrible havock.

The fifth kind we fhall defcribe by and by, as arifing from taking cold.

The fixth kind is a difcharge from the ftrangles, which fometimes vents itfelf at the noftrils.

Thefe are the various diforders which have been obferved fometimes to throw matter out from the noftrils; let us now defcribe the real glanders.

The matter, then, difcharged from the noftrils of a glandered horfe, is either white, yellow, or greenifh, fometimes ftreaked, or tinged with blood: when the difeafe is of long ftanding, and the bones are fouled, the matter turns blackifh, and becomes very fœtid; and is always attended with a fwelling of the kernels or glands under the jaws; in every other refpect the horfe is generally healthy and found, till the diftemper has been of fome continuance.

It is always a bad fign, when the matter fticks to the infide of the noftrils, like glue or ftiff pafte; when the infide of the nofe is raw, and looks of a livid or lead colour; when the matter becomes bloody, and ftinks, and when it looks of an afh-colour. But when only a limpid fluid is firft difcharged, and afterwards a whitifh matter, the gland under the jaw not increafing, and the diforder of no long continuance, we may expect a fpeedy cure; for in this cafe, which arifes from taking cold, after a horfe has been overheated, the pituitary membrane is but flightly inflamed, the lymph in the fmall veffels condenfed, and the glands overloaded, but not yet ulcerated.

From thefe fymptoms, and fome obfervations made both by Bracken and Gibfon, it is plain they were not abfolute ftrangers to the feat of this diforder, though they neglected pufhing their inquiries to the fountain-head, and confequently were at a lofs to know how to apply the remedy to the parts affected.

But our author, after examining by diffection the carcafes of glandered horfes, and making a ftrict fcrutiny into the ftate of the vifcera, affifted for that purpofe by ingenious and expert anatomifts, for ten years together, affirms this difeafe to be altogether local; and that the true feat of it is in the pituitary membrane which lines the partition along the infide of the nofe, the maxillary finufes or cavities of the cheek-bones on each fide the nofe, and the frontal finufes or cavities above the orbits of the eyes; that the vifcera, as liver, lungs, *&c.* of glandered horfes are in general exceeding found; and confequently that the feat of this diforder is not in thofe parts, as has been afferted by moft authors; nor indeed is it probable it fhould: for how could fuch horfes preferve their appetite, their good appearance, fleek and fhining coats? in a word, all the figns of health for many years together (which many glandered horfes are known to enjoy) with fuch diftempered bowels.

But on nicely examining the heads of fuch horfes, he found the cavities above-mentioned more or lefs filled with a vifcous flimy matter, the membrane which lines both them and the noftrils inflamed, thickened, and corroded with

with fordid ulcers, which in some cases had eat into the bones.

He observes, that when glandered horses discharge matter from both nostrils, both sides of the membrane and cavities were affected; but when they ran at one nostril only, that side only was found distempered.

It is a curious remark of our author, that the sublingual glands, or the kernels situated under the jaw-bone, which are always swelled in this distemper, do not discharge their lymph into the mouth, as in man, but into the nostrils; and that he constantly found their obstruction agreed with the discharge; if one gland only was affected, then the horse discharged from one nostril only; but if both were, then the discharge was from both.

The seat of this disorder thus discovered, our author with great ingenuity has paved the way for cure, by trepanning these cavities, and taking out a piece of bone, by which means the parts affected may be washed with a proper injection, and in fine the ulcers deterged, healed, and dried up.

But as from the observations since made by this gentleman, there are different species of the glanders, so the cure of the milder kinds may first be attempted by injections and fumigations: thus after taking cold, should a horse for fifteen or twenty days discharge a limpid fluid or whitish matter from one or both nostrils, the glands under the jaw rather growing harder than diminishing, we may expect it will degenerate into a true glanders. To prevent which, after first bleeding, and treating him as we have directed for a cold, let an emollient injection, prepared with a decoction of linseed, marshmallows, elder, chamomile flowers, and honey of roses, or such like, be thrown up as far as possible with a strong syringe, and repeated three times a-day: should the running not lessen or be removed in a fortnight by the use of this injection, a restringent one may now be prepared with tincture of roses, lime-water, *&c.* and the nostrils fumigated with the powders of frankincense, mastich, amber, and cinnabar, burnt on an iron heated for that purpose; the fume of which may easily be conveyed through a tube into the nostrils.

This method has been found successful when used in time; but the methods of cure depend on the stubbornness of the disorder; and when inveterate, recourse must be had to the operation above described.

Of the Cholic *or* Gripes, *and* Pains *in the* Bowels, *from sudden accidents.*

There seems to be no distemper so little understood by the common farrier, as the cholic or gripes in horses, one general remedy or method serving them in all cases; but as this disorder may be produced by very different causes, the method of cure must also vary, otherwise the intended remedy, injudiciously applied, will not only aggravate the complaint, but make it fatal. We shall divide this disorder into three different species: the flatulent or windy, the bilious or inflammatory, and the dry gripes; each of which we shall distinguish by their different symptoms, and then point out the proper remedies.

The flatulent or windy cholic is thus known. The horse is often lying down, and as suddenly rising again with a spring; he strikes his belly with his hinder feet, stamps with his fore-feet, and refuses his meat; when the gripes are violent, he will have convulsive twitches, his eyes be turned up, and his limbs stretched out as if dying, his ears and feet being alternately very hot and cold; he falls into profuse sweats, and then into cold damps; strives often to stale, and turns his head frequently to his flanks; he then falls down, rolls about, and often turns on his back; this last symptom proceeds from a stoppage of urine, that almost always attends this sort of cholic, which may be increased by a load of dung pressing on the neck of the bladder.

These are the general symptoms of cholic and gripes from wind, drinking cold water when hot, and when the perspirable matter is retained, or thrown on the bowels by catching cold; in all which cases they are violently distended. Cribbing horses are more particularly subject to this complaint, by reason they are constantly sucking in great quantities of air.

The first intention is to empty the strait gut with a small hand dipt in oil, which frequently makes way for the confined wind to discharge itself; and by easing the neck of the bladder, the suppression of urine is taken off, and the horse stales and gets ease.

The following ball and glyster seldom fail of giving relief in these cases.

Take Strasburgh or Venice turpentine, and juniper-berries pounded, of each half an ounce; sal-prunella, or salt-petre, an ounce; oil of juniper, one dram; salt of tartar, two drams; make into a ball with any syrup; it may be given whole, and washed down with a decoction of juniper-berries, or a horn or two of ale.

If the horse does not break wind, or stale plentifully, he will find no relief; therefore in an hour or two give him another ball, and add to it a dram of salt of amber; which may be repeated a third time, if found necessary. During the fit the horse may be walked and trotted gently, but should by no means be harassed beyond his ability, or dragged about till he is jaded.

The following glyster may be given, between the balls, or alone, and repeated occasionally.

Take chamomile flowers two handfuls; anise, coriander, and fennel seeds, of each an ounce; long pepper half an ounce; boil in three quarts of water to two; and add Daffy's elixir, or gin, half a pint; oil of amber half an ounce, and oil of chamomile eight ounces.

The signs of a horse's recovery, are his lying quiet, without starting, or tumbling, and his gathering up his legs, and ceasing to lash out; and if he continues an hour in this quiet posture, you may conclude all danger over.

The next species of cholic we shall describe, is the bilious or inflammatory; which besides most of the preceding symptoms, is attended with a fever, great heat, panting, and dryness of the mouth; the horse also generally throws out a little loose dung, with a hot scalding water, which when it appears blackish, or of a redish colour, and fœtid smell, denotes an approaching mortification.

In this case the horse should immediately be bled to the quantity of three quarts; and it should be repeated, if the symptoms do not abate in a few hours. The emollient

lient glyster, with two ounces of nitre dissolved in it, should be thrown up twice a-day, to cool the inflamed bowels; plenty of gum-arabic water should be taken, and a pint of the following drink given every two or three hours, till several loose stools are procured; and then it should be given only night and morning till the disorder is removed.

Take senna three ounces, salt of tartar half an ounce; infuse in a quart of boiling water an hour or two; then strain off, and add two ounces of lenitive electuary, and four of Glauber's salts.

If this disorder is not removed by these means, but the inflammation and fever increase, attended with a discharge of the flesh-coloured water above described, the event will most probably be fatal: and the chief thing to be depended on now, must be a strong decoction of Jesuits bark, given to the quantity of a pint every three hours, with a gill of red port-wine.

A quart of the same may be used for a glyster, with two ounces of Venice turpentine, dissolved with the yolks of two eggs, an ounce of diascordium, and a pint of red wine, and given twice a-day: if the horse recovers, give two or three mild rhubarb purges.

The last we shall describe is the dry gripes, or the cholic, which arises often from costiveness; it is discovered by the horse's frequent and fruitless motion to dung, the blackness and hardness of the dung, the frequent and quick motion of his tail, the high colour of his urine, and his great restlessness and uneasiness.

In this case the strait gut should be examined and emptied with a small hand oiled properly for that purpose; the emollient oily glyster, (p. 545. col. 2. par. 7.) should be thrown up twice a day; and the above purging drink given, till the bowels are unloaded, and the symptoms removed.

The diet for a horse in the gripes, should be scalded bran, warm water gruel, or white water, made by dissolving four ounces of gum-arabic in a quart of water, and mixing it with his other water.

From this history and division of gripes and cholics, with their different treatment, it appears how absolutely necessary it is they should be well understood, in order to be managed skilfully: it is plain too, that violent hot medicines should in every species of this disorder be guarded against, and given with great caution and discretion, even in the first kind of flatulent cholic, where indeed they can only be wanted; yet too often, when prepared by the farriers with oil of turpentine, geneva, pepper, and brine, *&c.* they even increase that disorder, by stimulating the neck of the bladder, too forcibly heating the blood, and inflaming the bowels, till a mortification is brought on them. These are, in general, the constant appearances of horses that die of this disorder, whose bowels being examined for that purpose, have been found inflamed, full of red and livid spots, sometimes quite black, crisped with extreme heat, and rotten.

Of the Lax *and* Scouring, *with other Disorders of the* Stomach *and* Bowels.

It is sometimes a nice matter to form a proper judgment when to controul or encourage a looseness, but these general rules may be a direction: If a healthy full horse, on taking cold, or upon hard riding, overfeeding, eating unwholesome food, or with a slight fever, should have a moderate purging, by no means think of stopping it; but rather encourage it with an open diet, and plenty of warm gruel: but if it continues long, with gripings, the mucus of the bowels coming away, and the horse losing his appetite and flesh, it is then high time to give him proper medicines; if he voids great quantities of slime and greasy matter, give him the following drench, and repeat it every other day for three times.

Take lenitive electuary and cream of tartar of each four ounces, yellow rosin finely powdered one ounce, and four ounces of sweet oil; mix with a pint of water gruel.

The following alterative ball alone has been found successful for this purpose, when given twice a-week, with scalded bran and warm gruel.

Take succotrine aloes half an ounce, diapente one ounce; make into a ball with the juice of Spanish liquorice dissolved in water, and a spoonful of oil of amber.

To this may be added two drams of myrrh, and a dram of saffron, and (where it can be afforded) half an ounce of rhubarb.

When the purging is attended with a fever, rhubarb should first be given to the quantity of half an ounce, with an ounce and half of lenitive electuary; at night after the working, give half an ounce or more of diascordium in a pint of red wine mulled with cinnamon, and repeat it every day, and the rhubarb ball once in two or three.

But if the distemper increases, the horse's flanks and belly look full and distended, and he appears griped and in pain, let this glyster be given, and the quantity of diascordium increased an ounce in his night-drink.

Take chamomile flowers one handful, red roses half a handful, pomegranate and balaustines of each an ounce; boil in two quarts of water to one; strain off, and dissolve in it two or three ounces of diascordium, and one of mithridate; to which may be added a pint of port wine: repeat it once a-day.

If the flux continues violent, give an ounce of rock-alum, with an ounce and a half of bole, twice a-day; or, dissolve double this quantity with two ounce of diascordium, and the cordial ball, in two quarts of hartshorn drink; to which may be added a pint of port; and give the horse, three or four times a-day, a pint of this drink. For this purpose also a strong decoction of oak-bark may be given, with either of the above remedies, and to the same quantity; even by itself, it will be found on trial no inconsiderable remedy.

When the discharge is attended with an acrid mucus or slime, the griping and pains are very severe, the common lining of the bowels being washed away; in this case the following glyster should frequently be injected warm.

Take of tripe liquor or thin starch two quarts, oil of olives half a pint, the yelk of six eggs well broke, and two or three ounces of course sugar.

Some horses having naturally weak stomachs and bowels,

bowels, throw out their aliment undigefted; their dung is habitually foft, and of a pale colour; they feed poorly, and get no flefh: to remedy this complaint, give the following purge two or three times; and then the infufion to the quantity of a pint every morning.

Take fuccotrine aloes fix drams, rhubarb powdered three drams, myrrh and faffron each a dram; make into a ball with fyrup of ginger.

Infufion.—Take zedoary, gentian, winters bark, and orange-peel, of each two ounces; pomegranate-bark and balauftine, of each an ounce; chamomile-flowers and centaury, each a handful; cinnamon and cloves, each an ounce: infufe in a gallon of port or ftrong beer.

The bloody flux is a diftemper horfes are not very fubject to; however, as it fometimes does occcur, whenever blood is difcharged, attended with gripings, and great pain in the bowels, if the flux is not fpeedily reftrained, the horfe probably may be foon loft: we recommend therefore the following glyfter and drink for that purpofe.

Take oak-bark four ounces, tormentil-root two ounces, burnt hartfhorn three ounces; boil in three quarts of forge-water to two; ftrain off, and add two ounces of diafcordium, four ounces of ftarch, and half a dram of opium.

A glyfter may alfo be prepared with the fame quantity of fat broth, ftarch and opium, in order to plaifter over the coats of the bowels, and abate their violent irritations. Alfo,

Take foft chalk two ounces, mithridate or diafcordium one ounce, powder of Indian-root half a dram, liquid laudanum fifty or fixty drops; diffolve in a pint of hartfhorn drink, and add to it four ounces of cinnamon-water or red wine: give it twice a-day.

Gum arabic diffolved in hartfhorn drink, or in common water, fhould be the horfe's ufual drink.

When horfes are apt to be coftive, from whatever caufe it arifes, gentle openers fhould be given; fuch as cream of tartar, Glauber's falts, and lenitive electuary; four ounces of any two of thefe diffolved in warm ale, whey, or water, given every other morning for two or three times, will anfwer this purpofe; efpecially if affifted by an oily emollient glyfter, prepared with a handful of falt. Scalded bran or barely, with an ounce of fenugreek and linfeed, occafionally given, will prevent this complaint: but where it is conftitutional, and proceeds from the power and force of digeftion in the ftomach and guts, as fometimes happens, and the horfe is otherwife in perfect health, no inconvenience will arife from it; and it is obferved that fuch horfes are able to endure great fatigue and labour.

Of Worms *and* Bots.

Authors have defcribed three different forts of worms that affect horfes, *viz. Bots*, which young horfes are often troubled with in the fpring; the *Rotundi*, or thofe refembling earth-worms; and the *Afcarides*, or thofe about the fize of the largeft fewing needle, with flat heads.

The bots which breed in the ftomachs of horfes, and are fometimes the caufe of convulfions, appear to be very large maggots, compofed of circular rings, with little fharp prickly feet along the fides of their bellies (like the feet of hog-lice), which by their fharpnefs (like the points of the fineft needles) feem to be of ufe to faften them to the part where they breed and draw their nourifhment, and to prevent their being loofened from fuch adhefion before they come to maturity. The eggs from whence thefe bots are produced, are difperfed into clufters all round the lower orifice of the ftomach, and are laid under the inner coat or thin membrane of the ftomach; fo that when the animals come to form and life, they burft through this inner coat with their breech and tail ftraight outwards, and their trunks fo fixed into the mufcular or flefhy coat of the ftomach, that it fometimes requires a good pull to difengage them; from the blood of this laft coat they draw their nourifhment, which they fuck like fo many leeches, every one ulcerating and purfing up the part where it fixes like a honey comb; and they often make fuch quick havock, as to deftroy the horfe.

The fymptoms of worms are various. The bots that many horfes are troubled with in the beginning of the fummer, are always feen fticking on the ftrait gut, and are often thruft out with the dung, with a yellowifh coloured matter like melted fulphur; they are noways dangerous there, but are apt to make a horfe reftlefs and uneafy, and rub his breech againft the pofts. The feafon of their coming is ufually in the months of May and June, after which they are feldom to be feen, and rarely continue in any one horfe above a fortnight or three weeks. Thofe that take their lodgment in the ftomach, are extremely dangerous by caufing convulfions; and are feldom difcovered by any previous figns before they come to life, when they throw a horfe into violent agonies. The other kinds are more troublefome than dangerous; but are known by the following figns: The horfe looks lean and jaded, his hair ftares as if he was furfeited, and nothing he eats makes him thrive; he often ftrikes his hind-feet againft his belly, is fometimes griped, but without the violent fymptoms that attend a cholic or ftrangury; for he never rolls and tumbles, but only fhews uneafinefs, and generally lays himfelf down quietly on his belly for a little while, and then gets up and falls a feeding; but the fureft fign is when he voids them with his dung.

For the cure of bots in the ftomach, we have already taken notice that calomel fhould firft be given in large quantities, and repeated at proper intervals, (fee p. 554. col. 1.) Æthiops mineral, or fome of the under-mentioned forms, may be given afterwards.

But bots in the ftrait gut may be cured by giving the horfe a fpoonful of favin, cut very fmall, once or twice a-day in his oats or bran, moiftened; and three or four cloves of garlick may be added to advantage. Give alfo an aloetic purge between whiles; the following ftands recommended.

Take fine fuccotrine aloes, ten drams; frefh jallap, one dram; ariftochia, or birthwort, and myrrh powdered,

powdered, of each two drams; oil of savin and amber, of each one dram; syrup of buckthorn enough to form into a ball.

But as the source of worms in general proceeds from a vitiated appetite and a weak digestion, recourse must first be had to mercurials, and afterwards to such things as are proper to strengthen the stomach, promote digestion, and, by destroying the supposed ova, prevent the regeneration of these animals. Thus, two drams of calomel may be given with half an ounce of diapente, and mixed up with conserve of wormwood, over night; and the next morning the above purge: these may be repeated six or eight days. Or the following mercurial purge may be given, which will be less troublesome, and no less efficacious.

Take crude quicksilver two drams, Venice turpentine half an ounce; rub the quicksilver till no glistening appears; then add an ounce of aloes, a dram of grated ginger, thirty drops of oil of savin, and a sufficient quantity of syrup of buckthorn to make a ball.

One of these balls may be given every six days, with the usual precautions in regard to mercurial physic; and these powders intermediately.

Take powdered tin and Æthiops mineral of each half an ounce: give every night in a mash, or among his corn.

The various preparations of antimony and mercury must be given several weeks together, in order to get entire riddance of these vermin. The Æthiops mineral may be given to the quantity of half an ounce a-day; the the mercurius alkalisatus to two drams a day, incorporated with a bit of cordial ball. The cinnabar powders, as directed in the farcy, are no less effectual: and when worms are bred from high feeding, or unwholesome food; rue, garlick, tansy, savin, box, and many other simples, may be given successfully; being for that purpose mixed with their food; as also cut tobacco, from half an ounce to an ounce a-day.

Of the Yellows, *or* Jaundice.

Horses are frequently subject to this distemper; which is known by a dusky yellowness of the eyes; the inside of the mouth and lips, the tongue and bars of the roof of the mouth, looking also yellow. The horse is dull, and refuses all manner of food; the fever is slow, yet both that and the yellowness increase together. The dung is often hard and dry, of a pale yellow, or light pale green. His urine is commonly of a dark dirty brown colour; and when it has settled some time on the pavement, it looks red like blood. He stales with some pain and difficulty; and if the distemper is not checked soon, grows delirous and frantic. The off-side of the belly is sometimes hard and distended; and in old horses, when the liver has been long diseased, the cure is not practicable, and ends fatally with a wasting diarrhæa: but when the distemper is recent, and in young horses, there is no fear of a recovery, if the following directions are observed.

First of all bleed plentifully; and give the laxative glyster (p. 547. col. 1. par. 2. from the bottom) as horses are apt to be very costive in this distemper; and the next day give him this purge.

Take of Indian rhubarb powdered one ounce and a half, saffron two drams, succotrine aloes six drams, syrup of buckthorn a sufficient quantity.

If the rhubarb should be found too expensive, omit it, and add the same quantity of cream of tartar, and half an ounce of Castile soap, with four drams more of aloes. This may be repeated two or three times, giving intermediately the following balls and drink.

Take of Æthiop's mineral half an ounce, millepedes the same quantity, Castile soap one ounce; make into a ball, and give one every day, and wash it down with a pint of this decoction.

Take madder-root and turmerick of each four ounces, burdock root sliced half a pound, Monk's rhubarb four ounces, liquorice sliced two ounces; boil in a gallon of forge-water to three quarts; strain off, and sweeten with honey.

Balls of Castile soap and turmerick may be given also for this purpose, to the quantity of three or four ounces a day, and will in most recent cases succeed.

By these means the distemper generally abates in a week, which may be discovered by an alteration in the horse's eyes and mouth; but the medicines must be continued till the yellowness is intirely removed. Should the distemper prove obstinate, and not submit to this treatment, you must try more potent remedies, *viz.* mercurial physic, repeated two or three times at proper intervals; and then the following balls.

Take salt of tartar two ounces, cinnabar of antimony four ounces, live millepedes and filings of steel of each three ounces, saffron half an ounce, Castile or Venice soap half a pound: make into balls, the size of a pullet's egg, with honey; and give one, night and morning, with a pint of the above drink.

It will be proper, on his recovery, to give two or three mild purges; and if a fat full horse, to put in a rowel.

Of the Disorders of the Kidneys *and* Bladder.

The signs of the kidneys being hurt or affected are, a weakness of the back and loins, difficulty of staling, faintness, loss of appetite, and deadness in the eyes; the urine is thick, foul, and sometimes bloody, especially after a violent strain. A horse diseased in his kidneys can seldom *back*, that is, move strait backwards without pain, which is visible as often as he is put to the trial: the same thing is observable indeed in horses, whose backs have been wrung and wrenched; but with this difference, that in the latter there is seldom any defect or alteration in the urine, except that it is higher coloured.

Bleeding is the prime remedy, and that plentifully, in order to prevent inflammation; and the more so, if a fever attends a difficulty in staling, for then we may suspect the kidneys already inflamed. A rowel in the belly has been found useful; and the following balls may be given twice or thrice a-day, with a pint of marshmallow decoction, in which half an ounce of gum arabic is dissolved, with an ounce of honey.

Take lucatellus-balsam one ounce, spermaceti six drams,

drams; ſal prunella half an ounce; mix into a ball with honey: if the urine is bloody, add half an ounce of Japan earth.

Should the fever continue, bleed largely, give emollient glyſters, and the cooling opening drink, (p. 547. col. 1. par. 3.) till it abates.

If the urine paſſes with difficulty and pain, notwithſtanding theſe means, give this ball, and repeat it twice or thrice a-day till the horſe ſtales freer and without pain, his urine become of a right conſiſtence, and free from any purulent ſettlement.

Take balſam of copivi or Straſburgh turpentine, and Venice ſoap, of each one ounce, nitre ſix drams, myrrh powdered two drams; make into a ball with honey, and waſh it down with the marſhmallow decoction.

As a ſuppreſſion of urine ariſes ſometimes from an inflammation of the kidney; ſo at others, from a paralytic diſorder, diſabling them in their office of ſeparating the urine from the blood: in this latter caſe, the bladder is uſually empty, ſo that a horſe will make no motion to ſtale; and if he continues a few days in this condition, his body will ſwell to a great degree, breaking out in blotches all over, and death will ſoon cloſe the ſcene.

If it ariſes from inflammation, bleed largely, and treat the horſe as above recommended; but if not, give ſtimulating glyſters, and ſtrong diuretics, ſuch as the following balls, once in four hours: for if a horſe ſtales not in thirty hours, his danger muſt be great.

Take juniper-berries powdered one ounce, ſal prunella ſix drams, ætherial oil of turpentine half an ounce, camphor one dram, oil of juniper two drams; make into a ball with honey, and give after it three or four horns of the marſhmallow decoction and honey.

Or,

Take ſquills powdered two or three drams, nitre half an ounce or ſix drams; make into a ball with honey.

If the complaint is not removed by theſe means, rub the horſe's reins well with two parts of oil of turpentine, and one of oil of amber; and apply a poultice of garlick, horſe raddiſh, muſtard-ſeed, camphor, and green ſoap, ſpread on thick cloth, over them. Give the horſe alſo two drams of calomel over night, and a moderate purge the next morning. Theſe perhaps are the chief and beſt remedies that can be given in this generally fatal diſorder.

When the ſtrangury in a horſe does not ariſe from wind, or dung preſſing on the neck of the bladder (as was obſerved in the Section on Cholicks) the cauſe is from inflammation, or too long a retention of the urine. Such horſes make frequent motions to ſtale, ſtand wide and ſtraddling, are full, and have their flanks diſtended. In this caſe bleed largely; give the following drink, and repeat it every two hours, for two or three times, till the horſe is relieved.

Take Venice turpentine, broke with the yolk of an egg, one ounce, nitre or ſal prunella ſix drams, half a pint of ſweet oil, and a pint of white wine.

If this drink ſhould not have the deſired effect, the diuretic ball above mentioned may be given in the ſame manner, omitting the myrrh.

Give the horſe plenty of the marſhmallow decoction, in a quart of which diſſolve an ounce of nitre and gum arabic, and two of honey.

Horſes ſubject to a *diabetes*, or profuſe ſtaling, if old, or of a weak conſtitution, are ſeldom cured; they ſoon loſe their fleſh and appetite, grow feeble, their coat ſtaring, and they die rotten. Of a young horſe there are more hopes; but he muſt not be indulged with too much water, or moiſt food. Give him the following:

Take jeſuit's bark four ounces, biſtort and tormentil-root of each two ounces; boil in two gallons of lime-water to the conſumption of half, and give a pint three times a-day.

As this diſorder generally proceeds from too violent exerciſe, over-ſtraining, *&c.* repeated bleedings in ſmall quantities are abſolutely neceſſary, till the mouths of the veſſels cloſe up.

Of Molten-grease.

By molten-greaſe is meant a fat or oily diſcharge with the dung, and ariſes from a colliquation, or melting down of the fat of a horſe's body by violent exerciſe in very hot weather. It is always attended with a fever, heat, reſtleſſneſs, ſtarting and tremblings, great inward ſickneſs, ſhortneſs of breath, and ſometimes with the ſymptoms of a pleuriſy. His dung will be extremely greaſy, and he will fall into a ſcouring; his blood will have a thick ſkin or fat over it when cold, of a white or yellow hue, but chiefly the latter; the congealed part or ſediment is commonly a mixture of ſize and greaſe, which makes it ſo extremely ſlippery, that it will not adhere to the fingers, and the ſmall portion of ſerum feels alſo ſlippery and clammy. The horſe ſoon loſes his fleſh and fat, which probably is diſſolved and abſorbed into blood; and thoſe that ſurvive this ſhock, commonly grow hidebound for a time, their legs ſwelling both before and behind, and continue in this ſtate till the blood and juices are rectified; and if this is not done effectually, the farcy, or ſome obſtinate ſurfeit, generally follows, very difficult to remove.

In the firſt place bleed plentifully, and repeat it for two or three days ſucceſſively in ſmaller quantities; two or three rowels ſhould alſo be immediately put in, and the cooling emollient glyſters (p. 547. col. 1. par. 2. from the bottom) daily thrown up to abate the fever, and drain off the greaſy matter from the inteſtines. By the mouth give plenty of warm water or gruel, with cream of tartar or nitre, to dilute and attenuate the blood, which in this caſe is greatly diſpoſed to run into grumes, and endanger a total ſtagnation.

When the fever is quite gone off, and the horſe has recovered his appetite, gentle aloetic purges ſhould be given once a-week, for a month or ſix weeks, in order to bring down the ſwelled legs. To this end give the following, which, reapeated for ſome time, will entirely remove this diſorder.

Take of ſuccotrine aloes ſix drams, of gum guaiacum powdered

powdered half an ounce, of diaphoretic antimony and powder of myrrh of each two drams; make into a ball with ſyrup of buckthorn.

Theſe will ſeldom take a horſe from his buſineſs above two or three days in a week; neither will he loſe his fleſh or appetite with them, but on the contrary mend in both; which cannot be obtained by any other method of purging, and gives this greatly the preference in many caſes.

Of Surfeits, Mange, *and* Hide-bound.

Surfeits ariſe from various cauſes; but are commonly the effects of ſome diſeaſes not attended to, or that have been ill cured.

A horſe is ſaid to be ſurfeited, when his coat ſtares, and looks ruſty and dirty, though proper means has not been wanting to keep him clean. The ſkin is full of ſcales and dander, that lies thick and meally among the hair, and is conſtantly ſupplied with a freſh ſucceſſion of the ſame, for want of due tranſpiration. Some horſes have hurdles of various ſizes like peas or tares; ſome have dry fixed ſcabs all over their limbs and bodies; others a moiſture, attended with heat and inflammation; the humours being ſo ſharp, and violently itching, that the horſes rub ſo inceſſantly, as to make themſelves raw. Some have no eruptions at all, but an unwholeſome look, and are dull, ſluggiſh and lazy; ſome appear only lean and hide-bound: others have flying pains and lameneſs, reſembling a rheumatiſm; ſo that in the ſurfeits of horſes, we have almoſt all the different ſpecies of the ſcurvy and other chronical diſtempers.

The following method is uſually attended with ſucceſs in the dry ſpecies. Firſt take away about three or four pounds of blood, and then give the following mild purge, which will work as an alterative, and ſhould be repeated once a-week, or ten days, for ſome time.

Take ſuccotrine aloes ſix drams or one ounce, gum guaiacum half an ounce, diaphoretic antimony and powder of myrrh of each two drams; make into a ball with ſyrup of buckthorn.

In the intermediate days, an ounce of the following powder ſhould be given, morning and evening, in his feeds.

Take native cinnabar, or cinnabar of antimony, finely powdered, half a pound; crude antimony, in fine powder, four ounces; gum guaiacum, alſo in powder, four ounces: make into ſixteen doſes for eight days.

This medicine muſt be repeated till the horſe coats well, and all the ſymptoms of ſurfeit diſappear.

The wet furfeit, which is no more than a moiſt running ſcurvy, appears on different parts of the body of a horſe, attended ſometimes with great heat and inflammation; the neck oftentimes ſwells ſo in one night's time, that great quantities of a hot briny humour iſſues forth, which, if not allayed, will be apt to collect on the poll or withers, and produce the poll-evil or fiſtula. This diſeaſe alſo frequently attacks the limbs, where it proves obſtinate and hard to cure: and in ſome horſes ſhews itſelf ſpring and fall.

In this caſe bleed plentifully, avoid externally all repellers, and give cooling phyſic twice a-week; as, four ounces of lenitive electuary, with the ſame quantity of cream of tartar; or the latter, with four ounces of Glauber's ſalts, quicked, if thought proper, with two or three drams of powder of jallap, diſſolved in water-gruel, and given in a morning faſting.

After three or four of theſe purges. two ounces of nitre made into a ball with honey may be given every morning for a fortnight; and if attended with ſucceſs, repeated for a fortnight longer.

The powders above-mentioned may be alſo given with the horſe's corn; or a ſtrong decoction of guaiacum ſhavings or logwood may be given alone to the quantity of two quarts a-day. Theſe, and indeed all alterative medicines, muſt be continued for a long time, where the diſorder proves obſtinate.

The diet ſhould be cool and opening, as ſcalded bran or barley; and if the horſe is hide-bound, an ounce of fenugreek-ſeeds ſhould be given in his feeds for a month or longer; and, as this diſorder often proceeds from worms, give the mercurial phyſic too, and afterwards the cinnabar powders, as above directed; but as in general, it is not an original diſeaſe, but a ſymptom only of many, in the cure regard muſt be had to the firſt cauſe: thus, as it is an attendant on ſurfeits, fevers, worms, *&c.* the removal of this complaint muſt be variouſly effected.

In a mangy horſe the ſkin is generally tawny, thick, and full of wrinkles, eſpecially about the mane, the loins and tail; and the little hair that remains in thoſe parts ſtands almoſt always ſtrait out or briſtly: the ears are commonly naked and without hair, the eye and eyebrows the ſame; and when it affects the limbs, it gives them the ſame aſpect; yet the ſkin is not raw, nor peels off, as in the hot inflamed ſurfeit.

Where this diſtemper is caught by infection, if taken in time it is very eaſily cured: and we would recommend a ſulphur ointment as moſt effectual for that purpoſe, rubbed in every day. To purify and cleanſe the blood, give antimony and ſulphur for ſome weeks after. There are a great variety of external remedies for this purpoſe, ſuch as train-oil and gun-powder, tobacco ſteeped in chamber-lye, *&c.* Solleyſell recommends the following.

Take burnt alum and borax in fine powder of each two ounces, white vitriol and verdegreaſe powdered of each four ounces; put them into a clean pot, with two pounds of honey, ſtirring till they are incorporated; when cold, add two ounces of ſtrong aqua-fortis.

But when this diſorder is contracted by low feeding, and poverty of blood, the diet muſt be mended, and the horſe properly indulged with hay and corn. The following ointments are effectually uſed for this diſorder, rubbed into the parts affected every day.

Take powdered brimſtone, train-oil, and tar, of each equal quantities; to which may be added ginger, or white hellebore.

Or,

Take ſulphur vivum half a pound, crude ſal armoniac one ounce, hogs lard or oil a ſufficient quantity to form into an ointment.

Theſe

Theſe are both very powerful remedies for this diſorder, and can ſcarce fail of ſucceſs.

Of the Farcin *or* Farcy.

The true farcy is properly a diſtemper of the blood-veſſels, which generally follows the tract of the veins, and, when inveterate, thickens their coats and integuments, ſo that they become like ſo many chords. We ſhall not deſcribe the different ſorts of farcies, ſeeing they are only degrees of one and the ſame diſtemper; but proceed to paint the diſtemper by its ſymptoms, which are pretty manifeſt to the eye.

At firſt, one or more ſmall ſwellings, or round buds like grapes or berries, ſpring out over the veins, and are often exquiſitely painful to the touch; in the beginning they are hard, but ſoon turn into ſoft bliſters, which when broke diſcharge an oily or bloody ichor, and turn into very foul and ill-diſpoſed ulcers. In ſome horſes it appears on the head only; in ſome on the external jugular; in others on the plate vein, and runs downwards on the inſide of the fore-arm towards the knee, and very often upwards towards the briſket: in ſome the farcy ſhews itſelf on the hind-parts, about the paſterns, and along the large veins on the inſide of the thigh, riſing upwards into the groin, and towards the ſheath; and ſometimes the farcy makes its appearance on the flanks, and ſpreads by degrees towards the lower belly, where it often becomes very troubleſome.

When the farcy appears on the head only, it is eaſily cured; eſpecially when it is ſeated in the cheeks and forehead, the blood-veſſels being here ſmall: but it is more difficult when it affects the lips, the noſtrils, the eyes, the kernels under the jaws, and other ſoft and looſe parts, eſpecially if the neck-vein becomes chorded. When it begins on the outſide of the ſhoulder or hips, the cure is ſeldom difficult: but when the farcy ariſes on the plate-vein, and that vein ſwells much, and turns corded, and the glands or kernels under the arm-pit are affected, it is hard to cure; but more ſo when the crural veins within ſide of the thigh are corded, and beſet with buds, which affects the kernels of the groin and the cavernous body of the yard. When the farcy begins on the paſterns or lower limbs, it often becomes very uncertain, unleſs a timely ſtop is put to it; for the ſwelling in thoſe dependant parts grows ſo exceſſively large in ſome conſtitutions, and the limbs ſo much disfigured thereby with foul ſores and callous ulcerations, that ſuch a horſe is ſeldom fit for any thing afterwards but the meaneſt drudgery: but it is always a promiſing ſign, wherever the farcy happens to be ſituate, if it ſpreads no further. It is uſual to affect only one ſide at a time; but when it paſſes over to the other, it ſhews great malignancy: when it ariſes on the ſpines, it is then for the moſt part dangerous, and is always more ſo to horſes that are fat and full of blood, than to thoſe that are in a more moderate caſe. When the farcy is epidemical, as ſometimes happens, it riſes on ſeveral parts of the body at once, forms naſty foul ulcers, and makes a profuſe running of greeniſh bloody matter from both noſtrils; and ſoon ends in a miſerable rot.

When the farcy makes its firſt appearance on the head, it riſes on the cheeks and temples, and looks like a net-work, or ſmall creeping twigs full of berries. Sometimes it inflames the eye, and ſometimes little bliſters or buds run along the ſide of the noſe. It ariſes often on the outſide of the ſhoulder, running along the ſmall veins with heat and inflammation; and ſometimes a few ſmall buds appear near the withers, and on the outſide of the hip. In all theſe appearances, the diſeaſe being ſuperficial, and affecting only the ſmaller veſſels, is eaſily conquered by the following method, when taken in time; for the ſimpleſt farcy, if neglected, may degenerate into the worſt ſort.

This diſtemper, then, being of an inflammatory nature, and in a particular manner affecting the blood veſſels, muſt neceſſarily require large bleeding, particularly where the horſe happens to be fat and full of blood. This always checks the beginning of a farcy, but is of ſmall ſervice afterwards; and if a horſe is low in fleſh, the loſs of too much blood ſometimes proves injurious. After bleeding, let the horſe have four ounces of cream of tartar and lenitive electuary; which may be given every other day for a week, to cool the blood, and open the body; and then give nitre three ounces a-day for three weeks or a month, and anoint the buds and ſwellings with the following ointment twice a-day.

Take ointment of elder four ounces, oil of turpentine two ounces, ſugar of lead half an ounce, white vitriol powdered two drams; mix together in a gally-pot.

The buds ſometimes by this method are diſperſed, leaving only little bald ſpots, which the hair ſoon covers again. When they break and run, if the matter be thick and well digeſted, they will ſoon be well: but in order to confirm the cure, and to diſperſe ſome little lumps which often remain for ſome time on the ſkin without hair, give the liver of antimony for a month; two ounces a-day for a fortnight, and then one ounce a-day for the other fortnight: by following this method, a farcy which affects only the ſmall veſſels, may be ſtopped in a week or ten days, and ſoon after totally eradicated.

When the farcin affects the larger blood-veſſels, the cure is more difficult; but let it always be attempted early: therefore on the plate, thigh, or neck veins appearing chorded, bleed immediately on the oppoſite ſide, and apply the following to the chorded vein.

Take oil of turpentine in a pint bottle ſix ounces, oil of vitriol three ounces; drop the oil of vitriol into the oil of turpentine by little at a time, otherwiſe the bottle will burſt; when it has done ſmoaking, drop in more oil of vitriol, and ſo on till all is mixed.

This mixture is one of the beſt univerſals in a beginning farcy; but where it is ſeated in looſe fleſhy parts, as flanks or belly, equal parts of the oil of vitriol and turpentine are neceſſary.

Rub the parts firſt with a woollen cloth; and then apply ſome of the mixture over the buds, and where-ever there is any ſwelling, twice a-day. Give the cooling phyſic every other day, and then three ounces of nitre every day for ſome time.

When the farcy begins on the flanks, or towards the lower belly, it often takes its riſe from a ſingle puncture of

of a sharp spur. The pain and smarting is one sure sign to distinguish the farcy from common accidents; the staring of the hair, which stands up like a tuft all round the buds or blisters, and the matter that issues from the buds, which is always purulent and of a clammy greasy consistence, are other certain signs. After bathing with the mixture above mentioned till the ulcers are smooth and healing, should the swelling not subside, to prevent the spreading of the buds, and to disperse them, bathe with either of these mixtures as far as the centre of the belly; and at the same time give a course of antimonials, as will presently be prescribed.

Take spirits of wine four ounces, oil of vitriol and turpentine, of each two ounces, white-wine vinegar, or verjuice, six ounces.

Or the following:

Take spirits of wine rectified four ounces, camphor half an ounce, vinegar or verjuice six ounces, white vitriol, dissolved in four ounces of spring water, one ounce; mix together.

In the lower limbs the farcy lies sometimes concealed for a great while, and makes so slow a progress, that it is often mistaken for grease, or for a blow or kick, and goes by the general appellation of a humour settled there. In order to distinguish the one from the other, we shall observe that a kick, or bruise, is generally attended with a sudden swelling, or a contused wound, which for the most part digests easily: the grease is also a smooth swelling that breaks out above the bending of the pasterns backwards; but the farcy begins on the pastern joint usually with one bud, and runs upwards like a knotty crab-tree.

Very simple means have sometimes stopped it, before it has begun to spread; a poultice with bran and verjuice bound round the part, and renewed once a-day, will often alone succeed; and if proud flesh should arise, touch it with oil of vitriol, or aqua fortis, an hour before you apply the poultice; for when the distemper is local, as we suppose it here, it is to be conquered by outward applications.

When the distemper grows inveterate, and resists the above method, and the vessels continue chorded, Gibson recommends the following mixture.

Take linseed oil half a pint; oil of turpentine and salt-petre, of each three ounces; tincture of euphorbium and hellebore, of each two drams; the soldiers ointment two ounces; or oil of bays, or oil of origanum, half an ounce; double aqua fortis half an ounce: after the ebullition is over, add two ounces of Barbadoes tar.

Rub this into the chorded veins, and where-ever there is a swelling, once in two or three days; but if the orifices are choaked up with proud flesh, or the skin so much thickened over the ulcers as to confine the matter, in either case it is necessary to make an open passage with a small hot iron, and destroy the proud flesh, after which it may be kept down by touching with oil of vitiol, aqua fortis, or butter of antimony. A salve may also be prepared with quicksilver and aqua fortis, rubbing any quantity of the former with enough of the latter, to the consistence of a liniment; smear the ulcers with this whenever they appear foul, and you will find it preferable to most other eating medicines.

Our farriers, after opening the buds, put in usually a small quantity of corrosive sublimate or arsenic, which they call coring out the farcy; this may answer where the buds are few, and not situated near large blood-vessels, joints, or tendons: others use Roman vitriol, or sublimate and vitriol, in equal quantities: but let it be remembered, that many a horse has been poisoned by these medicines ignorantly used, and in too large quantities.

The following balls are proper in every state of the farcy; and when the distemper has been in its infancy, before the skin was much defaced, has often cured it in a week or two, by giving them only once or twice a-day: but in an old farcy they should be given for two or three months together.

Take of native cinnabar, or cinnabar of antimony, eight ounces; long bithwort and gum guaiacum powdered, of each four ounces: make into a paste with honey, and form into balls of the size of a large walnut, and roll them into liquorice powder.

The tediousness of this course has encouraged the giving of mercurials; and indeed where they are directed with skill, they must be attended with success: the stronger preparations, as the red and white precipitates, and turbith, being combined with sharp saline parts, may be hazardous and injurious; but the latter given in small quantities have been found very successful in such kind of inveterate disorders. Mr Gibson says, he has given it to a dram at a doze, where the limbs have been greatly swelled; that in forty-eight hours the sores were all dried up, and the limbs reduced; but that it made the horse so violently sick for several days, and scoured him to such a degree, that it could not be repeated.

One would have thought that the success attending this medicine so suddenly, might have encouraged Gibson to have made further trials in smaller quantities; which had he done, it is more than probable he would not have been disappointed: for the grand secret in giving mercurials as alteratives, is the introducing them into the blood, without operating on the stomach and bowels; and to do this effectually, they must be given in small quantities, and so bridled as to controul their force on the first passages; taken in this manner, they will mix gradually with the blood and juices, and operate both effectually and safely.

Dr Bracken recommends the knots and chords to be rubbed with the mercurial ointment before they break, in order to disperse them; and after breaking, to dress the sores with equal parts of Venice turpentine and quicksilver: if by these means the mouth should become sore, treat as above.—This method seems to be effectual with proper care.

The following is also recommended by the same gentleman:

Take butter of antimony and bezoar mineral, of each one ounce; beat up with half a pound of cordial ball, and give the bigness of a walnut, or three quarters of an ounce, every day for two or three weeks, fasting two or three hours after it.

We ſhall here take notice of what is called the water-farcy, which has no reſemblance to a true farcy, either in its cauſe, ſymptoms, or effects, but has only obtained this name through cuſtom and ignorance.

This water farcy then is of two kinds; one the product of a feveriſh diſpoſition, terminating on the ſkin, as often happens in epidemical colds; the other is dropſical, where the water is not confined to the belly and limbs, but ſhews itſelf in ſeveral parts of the body by ſoft ſwellings yielding to the preſſure of the finger. This laſt kind uſually proceeds from foul feeding, or from the latter graſs and fog, that often comes up in great plenty with continued cold rains, and breeds a ſluggiſh viſcid blood. In the former caſe, we have ſeen the limbs and whole body enormouſly ſwelled, and very hard, the belly and ſheath greatly diſtended; which were as ſurpriſingly reduced in four and twenty hours, by ſlight ſcarifications within ſide the leg and thigh, with a ſharp penknife, and three or four ſtrokes on the ſkin of the belly on each ſide the ſheath; from theſe ſcarifications there was a conſtant and ſurpriſing large dripping of water, which ſoon relieved the horſe; when a few purges compleated his recovery.

In the other ſpecies of dropſy the curative intentions are to diſcharge the water, recover the craſis or ſtrength of the blood, and brace up the relaxed fibres throughout the whole body. To this end, purge once a-week or ten days; and give intermediately either of the following.

Take black hellebore freſh gathered, two pounds; waſh, bruiſe, and boil in ſix quarts of water, to four; and then ſtrain out the liquor, and put two quarts of white-wine on the remaining hellebore, and let it infuſe warm forty-eight hours; then ſtrain off, mix both together, and give the horſe a pint night and morning.

Take nitre two ounces, ſquills powdered three drams or half an ounce, camphor one dram, honey enough to form into a ball, to be given once a-day alone, or waſhed down with a horn or two of the above drink.

Before we cloſe this ſection, it is proper to lay down the ſymptoms of an incurable farcy, that the owners of ſuch horſes may ſave themſelves unneceſſary expence and trouble in their endeavours to obtain a cure.

When a farcy, by improper applications, or by neglect, has ſpread and increaſed, or after long continuance reſiſted the medicines above recommended; if freſh buds are continually ſprouting forth, while the old ones remain foul and ill conditioned; if they riſe on the ſpines of the back and loins; if the horſe grows hide-bound, and runs at the noſe; if abſceſſes are formed in the fleſhy parts between the interſtices of the large muſcles; if his eyes look dead and lifeleſs; if he forſakes his food, and ſcours often, and his excrements appear thin and of a blackiſh colour; if the plate or thigh vein continues large and chorded after firing, and other proper applications: theſe ſymptoms denote the diſtemper to have penetrated internally, and that it will degenerate into an incurable conſumption: it is moſt probable alſo, that the whole maſs of fluids are tainted, and become irremediable by art.

Of Alterative Medicines.

By alteratives, or altering medicines, are to be underſtood ſuch as, having no immediate ſenſible operation, gradually gain upon the conſtitution, by changing the humours or juices from a ſtate of diſtemperature to health. This intention in ſome caſes may perhaps be effected by correcting the acrimony of the juices, and accelerating the blood's motion; and in others by attenuating, or breaking its particles, and dividing thoſe coheſions which obſtruct the capillaries or finer veſſels; and ſo promote the due ſecretions of the various fluids. It is certain, that many have but an indifferent opinion of a medicine that does not operate externally, and gratify their ſenſes with a quantity of imagined humours ejected from the body: but let ſuch people remember, that there are good humours as well as bad, which are thrown off together; that no evacuating medicine has a power of ſelecting, or ſeparating the bad from the good; and conſequently that they are thrown out only in a proportionate quantity. Theſe few hints may be ſufficient to convince the judicious reader of the great advantages ariſing from alteratives, and the preference due to them in moſt caſes over purgatives; unleſs it could be proved, as already mentioned, that the latter could cull out and ſeparate from the blood the bad humours ſolely, leaving the good behind; but this ſelective power has long been juſtly exploded as ridiculous and uncertain, ſince it is plain, that all kinds of purging medicines differ only in degree of ſtrength, and operate no otherwiſe upon different humours than as they ſtimulate more or leſs.

We ſhall therefore take this opportunity of recommending ſome alterative medicines, which are not ſo generally known as they ought to be; and that too on the ſureſt grounds, a proper experience of their good effects in repeated trials. The firſt then is nitre or purified ſalt-petre, which has long been in great eſteem, and perhaps is more to be depended on in all inflammatory fevers than any other medicine whatever: but beſides this extenſive power of allaying inflammatory diſorders, it is now offered as a remedy, taken in proper quantities, as an alterative for ſurfeits, molten-greaſe, hide-bound, greaſe-heels, *&c.* And as it has been known to ſucceed even in the cure of the farcy, what other diſtempers in horſes, ariſing from vitiated fluids, may it not be tried on, with a ſtrong probability of ſucceſs? This great advantage will ariſe from the uſe of this medicine over moſt others, that, as its operation is chiefly by urine, it requires no confinement or cloathing; but the horſe may be worked moderately throughout the whole courſe. This medicine has been found equally efficacious (by many trials made in one of our hoſpitals) in correcting the acrimony of the juices, and diſpoſing the moſt obſtinate and inveterate ſores to heal up; and hence probably it came recommended as an alterative to our horſes.

The quantity of nitre given at a time ſhould be from two to three ounces a-day; let it be finely powdered, and then mix with it by little at a time as much honey as will

will form it into a ball; give it every morning fasting for a month; or it may be given at first for a fortnight only, intermitting a fortnight, and then repeat it. If it be observed that the horse shews an uneasiness at the stomach after taking it, a horn or two of any liquor should be given after it, or it may be dissolved at first in his water, or mixed with his corn; though the ball, where it agrees, is the easiest method of giving.

When horses take drinks with great reluctance, powders must be given in their feeds; thus crude antimony, or liver of antimony finely powdered, may be given to the quantity of half an ounce, night and morning; but in all surfeits, gum guaiacum mixed with antimony is found more efficacious. Thus,

TAKE of crude antimony finely powdered, or, where it can be afforded, cinnabar of antimony, and gum guaiacum, of each a pound: mix together with an oily pestle to prevent the gum's caking: divide the whole into thirty-two dozes, *viz.* an ounce each doze; let one be given every day in the evening feed.

Or,

TAKE of cinnabar of antimony, gum guaiacum, and Castile or Venice soap, of each half a pound, salt of tartar four ounces; beat them up into a mass, and give an ounce every day. To these may be added very advantageously, an ounce and an half of camphor.

Æthiops mineral given to the quantity of half an ounce a-day, is a very good sweetener and corrector of the blood and juices; but it has been observed, after having been taken a week or ten days, to make some horses slabber, and unable to chew their hay and oats; and the same symptoms have arose, where only two drams of crude mercury has been given, and continued about the same space of time.

Diet Drinks.—1. A decoction of logwood, prepared like that of guaiacum, is also succesfsully given in surfeits.

2. Lime-water, prepared with shavings of sassapharas and liquorice, is a good diet-drink, to sweeten and correct a horse's blood; and may be given with the nitre balls for that purpose.

3. Tar-water also, as has before been hinted, may in many cases be well worth trial: but let it be remembered, that all medicines of this kind should be continued a considerable time in obstinate cases.

Of ROWELLING.

THERE seems to be no remedy so much made use of, and so little understood by farriers in general, as rowels; for which reason we shall endeavour to set the whole affair in a clearer light, than hitherto it has appeared in.

We shall begin then by describing rowelling, which is an artificial vent made between the skin and flesh, in order to unload and empty the vessels in general, and thereby relieve particular parts, when too much oppressed by a fulness or redundancy.

The general and absurd reasoning of farriers on the effects and use of rowelling, in some measure makes this section the more necessary, as it is too notorious how impertinently they talk on this subject: for in short, with them, a rowel is to draw off all the bad and corrupt humours from the blood by a sort of magic.

It is necessary to observe, that the matter generally discharged by a rowel, is nothing more than an ouzing from the extremities of the vessels divided in the making of it; in fact then, it is blood, which loses its colour, by being shed out of the vessels, the warmth of the part, and its confinement.

If this is granted, it will evidently appear, that the good effects ensuing this operation, must be owing to a gradual depletion or emptying of the vessels in general; by which means the surcharge or load on a particular part, is taken off and removed, and impurities or bad juices (generally called humours) run off with the good in proportion to their quantity in the blood.

Thus, to lean hide-bound horses, and those of a dry hot constitution, the discharge, by depriving the constitution of so much blood and fluids, is daily exhausting the strength of the animal; and may be productive of bad consequences, by defrauding the constitution of a necessary fluid.

But in disorders from fulness, attended with acrimony, or sharpness of the juices, and with defluxions on the eyes, lungs, or any part of consequence; the gradual discharge, brought on by these means, will contribute to lessen the fulness on the parts affected, and give the vessels an opportunity of recovering their tone, while evacuating and alterative medicines are doing their office.

It may be necessary, however, to observe, that there is a wonderful communication between the vessels of the cellular membrane under the skin, which remarkably appears, by inflating those of sheep, calves, *&c.* by the butchers; hence probably it is that some disorders of this integument, are so apparently relieved by issues, or rowels, without our having any recourse to that general depletion of the vessels, we have just observed, to account for it; and hence also may be deduced their utility, sometimes in draining off any extravasated fluids, which may lodge between the interstices of the muscles, after violent strains of the shoulder; also in discharging such vitious or sharp fluids as are thrown on the membranes, and occasion those flying pains and lamenesses, which we find are often removed by this local remedy.

Of STRAINS *in* VARIOUS PARTS.

IT is necessary to observe, that in all strains, the muscular or tendinous fibres are overstretched; and sometimes ruptured, or broke. To form therefore a true idea of these disorders, let us first consider every muscle and tendon as composed of springy elastic fibres, which have a proper power of their own to contract and extend themselves; or, to make their action more familiar, let us compare them to a piece of catgut, that we may the better judge with what propriety oily medicines are directed for their cure. Thus then, if by a violent extension of this catgut, you had so overstretched it as to destroy its springiness or elasticity, and was inclined to recover its lost tone; would you for that purpose think of soaking it in oil? And is not the method of treating strains, or overstretched

ftretched mufcles and tendons, full as prepofterous, when you bathe or foak them in oily medicines, at a time that they want reftringents to brace them up? Yet cuftom has fo eftablifhed this practice, and fallacious experience feemingly fo confirmed it, that it would be a difficult tafk to convince the illiterate and prejudiced of the abfurdity, who, by atributting effects to wrong caufes, are led into this error, and the oils ufurp the reputation that is due only to reft and quiet: they feem, however, to be aware of the ill confequences, by their adding the hot oils, as fpike, turpentine, and origanum; which, though they in fome meafure guard againft the too fuppling quality of the other oils, yet the treatment is ftill too relaxing to be of real fervice.

And indeed, in all *violent* ftrains of either tendons or mufcles, whatever opinion we may entertain of bathing and anointing with favourite noftrums, which often fucceed in flight cafes, where perhaps bandage alone would have done; yet it is the latter, with proper refting the relaxed fibres, till they have thoroughly recovered their tone, that are the chief things to be depended on; and frequently fome months are neceffary for effecting the cure.

All violent ftrains of the ligaments, which connect the bones together, efpecially thofe of the thigh, require time, and turning out to grafs, to a perfect recovery. External applications can avail but little here, the parts affected lying too deep, and fo furrounded with mufcles that medicine cannot penetrate to them. The fooner, in thefe cafes, a horfe is turned out to grafs, the better; as the gentle motion in the field will prevent the ligaments and joint oil from thickening, and of courfe the joint itfelf from growing ftiff.

When a horfe's fhoulder is overftrained, he does not put out that leg as the other; but to prevent pain, fets the found foot hardily on the ground to fave the other; even though he be turned fhort on the lame fide, which motion tries him the moft of any. When trotted in hand, inftead of putting his leg forward in a right line, he forms a circle with the lame leg; and when he ftands in the ftable, that leg is advanced before the other.

In order to cure this lamenefs, firft bleed him, and let the whole fhoulder be well bathed three times a day with hot verjuice or vinegar, in which may be diffolved a piece of foap; but if the lamenefs continues without fwelling, or inflammation, after refting two or three days, let the mufcles be well rubbed for a confiderable time, to make them penetrate, with good opodeldoch, or either of the following mixtures:

Take camphorated fpirit of wine, two ounces; oil of turpentine, one ounce; this proportion will prevent the hair coming off.

Or,

Take the beft vinegar, half a pint; fpirit of vitriol, and camphorated fpirit of wine, of each two ounces.

When the fhoulder is very much fwelled, it fhould be fomented with woollen cloths (large enough to cover the whole) wrung out of hot verjuice and fpirit of wine; or a fomentation prepared with a ftrong decoction of wormwood, bay-leaves, and rofemary, to a quart of which may be added half a pint of fpirit of wine.

A rowel in the point of the fhoulder in this cafe often does great fervice; efpecially if the ftrain has been very violent, and the fwelling very large: but as to boring up the fhoulder with a hot iron, and afterwards inflating it, is both a cruel and abfurd treatment; and the pegging up the found foot, or fetting on a patten-fhoe, to bring the lame fhoulder on a ftretch, is a moft prepofterous practice, and directly calculated to render a horfe incurably lame; for it can only be neceffary in cafes the very oppofite to this, where the mufcles have been long contracted, and we want to ftretch them out.

Where poultices can be applied, they are at firft undoubtedly very effectual, after bathing with hot vinegar or verjuice, and are to be preferred greatly to cold charges, which, by drying fo foon on the part, keep it ftiff and uneafy: let them be prepared with oat-meal, rye flour, or bran boiled up in vinegar, ftrong beer or red-wine lees, with lard enough to prevent their growing ftiff; and when by thefe means the inflammation and fwelling is brought down, bathe the part twice a-day with either of the above mixtures, opodeldoch, or camphorated fpirit of wine; and roll the part three or four inches, both above and below, with a ftrong linen roller, of about two fingers width; which contributes not a little to the recovery, by bracing up the relaxed tendon; and perhaps is more to be depended on than the applications themfelves.

In ftrains of the *coffin joint*, that have not been difcovered in time, there will grow fuch a ftiffnefs in the joint, that the horfe will only touch the ground with his toe; and the joint cannot be played with the hand; the only method here is repeated bliftering, and then firing fuperficially.

Strains of the *back finews* are very common, and are eafily difcovered by the fwelling, which extends fometimes from the back-fide of the knee down to the heel, but for the moft part the horfe fets that leg before the other. The tendon fhould be well bathed three or four times a-day with hot vinegar; and if much fwelled, apply the poultices above recommended; and when the fwelling is down, bathe with the mixtures above, or with camphorated fpirit of wine and oil of amber, in which is diffolved as much camphor as the fpirits will take up, and roll up the tendon with a proper bandage, or laced ftocking; which laft, properly fitted to the limb, might be wore to great advantage, not only in thefe fort of injuries, but in moft others, where there is a difpofition to the greafe, or other fwellings of the limbs, from weak and relaxed fibres. Curriers fhavings wetted with vinegar have been found ufeful for this purpofe; as has alfo tar and fpirit of wine: but where the tendons have fuffered by repeated injuries of this kind, the cafe will demand bliftering, firing, and proper reft.

Strains of the *knees* and *pafterns* arife frequently from kicks or blows; if they are much fwelled, apply firft the poultices; and when the fwelling is abated, bathe with the above, or the following.

Take vinegar, one pint; camphorated fpirits of wine, four ounces; white vitriol, diffolved in a little water, two drams.

Or,

Take the white of three or four eggs, beat them into a froth with a fpoon; to which add an ounce of rock

rock allum, finely powdered; ſpirit of turpentine, and wine, of each half an ounce; mix them well together.

As great weakneſs remains in the paſterns after violent ſtrains, the beſt method is to turn the horſe out to graſs till he is perfectly recovered; when this cannot be complied with, the general way is to bliſter and fire.

When a horſe is lame in the *ſtifle*, he generally treads on his toe, and cannot ſet the heel to the ground. Treat him at firſt with the vinegar and cooling reſtringents; but if a large ſwelling, with puffineſs, enſues, foment it well with the diſcutient fomentation till it diſperſes; and then bathe the part with any of the above medicines.

A lameneſs in the *whirl-bone* and hip, is diſcovered by the horſe's dragging his leg after him, and dropping backward on his heel when he trots. If the muſcles of the hip are only injured, this kind of lameneſs is cured eaſily; but when the ligaments of the joint are affected, the cure is often very difficult, tedious, and uncertain. In either caſe, at firſt bathe the parts well with the cooling medicines, four or five times a-day; in the muſcular ſtrain, this method alone may ſucceed; but in the ligamentous, it is reſt and time only can reſtore the injured parts to their proper tone.

Strains in the *hock* are to be treated by ſoaking the parts with coolers and repellers; but when the ligaments are hurt, and they are attended with great weakneſs and pain, uſe the fomentation. If a hardneſs ſhould remain on the outſide, it may be removed by repeated bliſtering; if within, it may be out of the power of any external applications to remove; however, the joint ſhould be fired gently with ſmall razes or lines pretty cloſe together, and then covered with a mercurial plaiſter. To the diſcutient fomentation above mentioned may be added crude ſal armoniac, with a handful of wood-aſhes boiled in it.

The bliſtering ointment for the above purpoſes may be found in the Section of Bone-ſpavin; but the ſublimate ſhould be omitted.

The *firing*, uſed for the ſtrengthening relaxed ſinews or tendons, ſhould act only on the ſkin, which, by contracting and hardening it all round the ſinews, compreſſes them more firmly like a bandage. The bow-men of old ſubmitted to this operation, in order to give ſtrength to the muſcles and tendons of their arms. A proper degree of ſkill is very requiſite to perform it effectually on a horſe; for a due medium ſhould be obſerved, and the inſtrument neither ſo ſlightly applied, as to ſcarify the ſkin only ſuperficially, nor ſo deep as to wound or cauterize the ſinew or its ſheath. The lines ſhould be drawn pretty cloſe together, on each ſide of the joint or ſinew, following the courſe of the hair; no croſs lines ſhould be made, as they but disfigure the horſe afterwards, without any real uſe. The firing inſtrument, or knife, ought to be a little rounded on the edge, gradually thickening to the back, that it may retain the heat for ſome time, but ſhould not be applied till the flaming redneſs is partly gone off. The cauterized parts may be bathed with ſpirit of wine at firſt, and anointed afterwards with bees-wax and oil, which alone is ſufficient to complete the cure.

Of Tumours *and* Imposthumes.

Tumours, or ſwellings, ariſe either from external injuries, or internal cauſes.

Swellings, cauſed by external accidents, as blows and bruiſes, ſhould at firſt be treated with reſtringents; thus, let the part be bathed frequently with hot vinegar or verjuice, and, where it will admit of bandage, let a flannel wetted with the ſame be rolled on: if by this method the ſwelling does not ſubſide, apply, eſpecially on the legs, a poultice with red-wine lees, ſtrong-beer grounds, and oatmeal, or with vinegar, oil, and oatmeal; either of theſe may be continued twice a-day, after bathing, till the ſwelling abates; when, in order to diſperſe it entirely, the vinegar ſhould be changed for camphorated ſpirit of wine, to four ounces of which may be added one of ſpirit of ſal armoniac; or it may be bathed with a mixture of two ounces of crude ſal armoniac boiled in a quart of chamber-lye, twice a day, and rags dipped in the ſame may be rolled on.

Fomentation made by boiling worm-wood, bay-leaves, and roſemary, and adding a proper quantity of ſpirits, are often of great ſervice to thin the juices, and fit them for tranſpiration; eſpecially if the injury has affected the joints.

But in bruiſes, where the extravaſated blood will not by theſe means be diſperſed, the ſhorteſt way is to open the ſkin, and let out the grumes.

Critical tumours, or ſwellings, which terminate fevers, ſhould by no means be diſperſed; except when they fall on the paſtern or coffin-joint, ſo as to endanger them: in this caſe the diſcutient fomentation, (p. 568. col. 1. bottom) ſhould be applied three or four times a-day, and a cloth or flannel frequently wrung out of the ſame ſhould be bound on, in order to keep the joint continually breathing.

But if the ſwelling fixes under the jaws, behind the ears, on the poll, withers, or in the groins and ſheath, *&c.* it ſhould be encouraged and forwarded by ripening poultices where-ever they can be applied; oatmeal boiled ſoft in milk, to which a proper quantity of oil and lard is added, may anſwer this purpoſe; or the poultice recommended in the Section of Strangles: theſe muſt be applied twice a-day, till the matter is perceived to fluctuate under the fingers, when it ought to be let out; for which purpoſe, let the tumour be opened with a knife or ſtrong lancet, the whole length of the ſwelling, if it can be done ſafely; for nothing contributes ſo much to a kind healing, as the matter's having a free diſcharge, and the openings being big enough to dreſs to the bottom.

Pledgets of tow, ſpread with black or yellow baſilicon (or the wound ointment) and dipped in the ſame, melted down with a fifth part of oil of turpentine, ſhould be applied to the bottom of the ſore, and filled up lightly with the ſame, without cramming; it may be thus dreſſed once or twice a-day, if the diſcharge is great, till a proper digeſtion is procured, when it ſhould be changed for pledgets ſpread with the red precipitate ointment, applied in the ſame manner.

Should the fore not digeft kindly, but run a thin water and look pale, foment, as often as you drefs, with the above fomentation; and apply over your dreffing the ftrong-beer poultice, and continue this method till the matter grows thick, and the fore florid.

The following ointments will generally anfwer your expectations in all common cafes, and may be prepared without, as well as with, the verdegreafe.

TAKE Venice turpentine and bees-wax of each a pound, oil of olives one pound and a half, yellow rofin twelve ounces; when melted together, two or three ounces of verdegreafe, finely powdered, may be ftirred in, and kept fo till cold, to prevent its fubfiding.

TAKE of yellow bafilicon, or the above ointment, without verdigreafe, four ounces; red precipitate, finely powdered, half an ounce: mix them together cold with a knife or fpatula.

This laft, applied early, will prevent a fungus, or proud flefh, from fhooting out; for if you drefs too long with the above digeftive, the fungus will rife faft, and give fome trouble to fupprefs it; when it will be neceffary to wafh the fore as often as you drefs, with a folution of blue vitriol in water, or to fprinkle it with burnt alum and precipitate. If thefe fhould not be powerful enough, touch with a cauftic, or wafh with the fublimate water, made by diffolving half an ounce of corrofive fublimate in a pint of lime-water.

But this trouble may in a great meafure be prevented, if the fore is on a part where bandages can be applied with compreffes of linen cloath: for even when thefe excrefcences regerminate, as it were under the knife, and fpring up in fpite of the cauftics above mentioned, they are to be fubdued by moderate compreffion made on the fprouting fibres, by thefe means.

Authors on farriery have given in general very proper receipts to anfwer every intention of this kind by medicines; but as they have not laid down fufficient rules for their application in thofe cafes where they are moft wanted, the following general directions will not be unacceptable; as the difficulty in healing fome kinds of fores arifes frequently from the unfkilful manner of dreffing them.

It may be neceffary then to obferve here, once for all, that the cures of moft fores are affected by the fimpleft methods, and that it is often of much more confequence to know how to drefs a fore, than what to drefs it with; and in this confifts indeed the chief art of this branch of furgery; for the moft eminent in that profeffion have long fince difcovered, that variety of ointments and falves are unneceffary in the cure of moft wounds and fores, and they have accordingly difcarded the greateft part, formerly in repute for that purpofe; repeated obfervations having taught them, that after the digeftion, nature is generally difpofed to heal up the wound faft enough herfelf, and that the furgeon's chief care is to prevent a luxuriancy, commonly called proud flefh; which all ointments, wherein lard or oil enters, are but too prone to encourage, as they keep the fibres too lax and fupple; and which dry lint alone, early applied, as eafily prevents, by its abforbing quality, and light compreffion on the fprouting fibres.

Thus, if a hollow wound or fore is crammed with tents, or the dreffings are applied too hard, the tender fhoots of flefh from the bottom are prevented pufhing up; and the fides of the fore in time from this diftenfion may grow horny, and turn fiftulous; nor has the matter by this method a free difcharge.

On the other hand, if fores of any depth are dreffed fuperficially, the external parts being more difpofed to heal and come together than the internal, they will fall into contact, or heal too foon; and the fore, not filling up properly from the bottom, will break out afrefh.

Hence we may juftly conceive how little ftrefs is to be laid on famous ointments, or family falves, unfkilfully applied; for unlefs this due medium is obferved, or obtained in the dreffing, no hollow fore can heal up properly.

As foon then as a good digeftion is procured (which is known by the thicknefs and whitenefs of the matter difcharged, and the florid red colour at the bottom of the fore) let the dreffings be changed for the precipitate medicine; or the fore may be filled up with dry lint alone, or dipped in lime-water with a little honey and tincture of myrrh, or brandy, about a fifth part of the latter to one of the former; a pledget of lint dipped in this mixture fhould alfo be applied to the bottom of the fore, which fhould be filled up with others to the furface or edges, but not crammed in too hard, as before obferved, nor yet applied too loofely.

By this method, the fore would incarn, or heal up properly, and foft fpongy flefh would be prevented, or fuppreffed in time; whereas when ointments or falves are too long continued, a fungus, or proud flefh, is thereby fo encouraged in its growth, that it requires fome time to deftroy and eat it down again: a proper comprefs of cloth, and a linen roller, is abfolutely neceffary both for this purpofe, and to fecure on the dreffings, where ever they can conveniently be applied.

Of WOUNDS *in General.*

IN all frefh wounds made by cutting inftruments, there is nothing more required than bringing the lips of the wound into contact by future or bandage, provided the part will allow of it; for on wounds of the hips, or other prominent parts, and acrofs fome of the large mufcles, the ftitches are apt to burft on the horfe's lying down and rifing up in the ftall; in fuch cafes the lips fhould not be brought clofe together: one ftitch is fufficient for a wound two inches long; but in large wounds, they fhould be at an inch or more diftance; and if the wound is deep in the mufcles, care fhould be taken to pafs the needles proportionably deep, otherwife the wound will not unite properly from the bottom.

Should the wound bleed much from an artery divided, the firft ftep fhould be to fecure it, by paffing a crooked needle underneath, and tying it up with a waxed thread: if the artery cannot be got at this way, apply a button of lint or tow to the mouth of the bleeding veffel, dipped in a ftrong folution of blue vitriol, ftyptic water, oil of vitriol, or hot oil of turpentine, powdered vitriol, or colcothar, *&c.* and remember always to apply it clofe to the mouth of the bleeding veffels,

veffels, and take care that it is kept there by proper comprefs and bandage, till an efchar is formed; otherwife it will elude your expectations, and frequently alarm you with frefh bleedings.

In a memoir prefented to the Royal Academy of Sciences by M. La Foffe, he gives an account of the fuccefs he had met with in ftopping the bleedings of very confiderable arteries in horfes, by the application of the powder of puff-balls, the arteries cicatrizing by this means only, without any fucceeding hæmorrhage. This Lycoperdon, or puff-ball, was made ufe of for this purpofe in human fubjects, about 160 years ago, by Felix Wurtz, a famous old furgeon in Germany; but he does not feem to have a thought of trufting to it in fuch confiderable arteries as M. La Foffe mentions, *viz.* thofe of the leg and thigh, the bleedings from which divided veffels he ftopt in a few minutes by the ufe of this powder only. The agaric of the oak may alfo be ufed for this purpofe, where it can be retained by a proper bandage.

Thefe applications, as indeed all ftyptics, feem to act by conftringing the extremity of the veffel, or choaking it up, till a grume of blood is formed internally, which plugs up the orifice; and has been found to adhere to it fo, as to conftitute one body with the veffel.

We avoid fetting down any famous receipts for frefh wounds, whether ointments, or Fryar's balfams, being well affured, that in a healthy found conftitution, nature furnifhes the beft balfam, and performs herfelf the cure, which is fo often attributed to the medicine; when it is otherwife, and the blood is deprived of its balfamic ftate, as will appear from the afpect of the wound, and its manner of healing, it muft be rectified by proper internal medicines, before a good foundation for healing can be laid by any external applications whatever.

The lips of the wound then being brought together by the needle or bandage, it needs only to be covered with rags dipped in brandy, or a pledget of tow fpread with the wound ointment, (fee p. 570. col. 1. par. 3.) the directions in the preceding fections being obferved, and the wounded part kept as much as poffible from motion.

Punctured wounds from thorns, or any other accidents, fhould be treated in the fame manner; applying the beer, or bread and milk poultice over the dreffing, till fome figns of digeftion appear; and fomenting the part well every day. This method is alfo very fuccefsfully ufed to thofe fwellings, which often arife on the neck from bleeding, the fores being fprinkled with precipitate, and burnt alum powdered, to fetch out the core, or fungus, which choaks up the orifice. The ufual method is to introduce a piece of vitriol, or fublimate, which often brings on a plentiful difcharge, fetches out the core, and makes a cure; but it is often with the lofs of the vein, and it fometimes leaves a large fwelling and impofthumation.

In gun-fhot wounds, when the ball has not penetrated too deep, it fhould be extracted, if it can be fetched away without difturbance, together with any extraneous bodies that might pafs in with it; the wound fhould be dreffed with the old digeftive of Venice or common turpentine, divided with the yolks of eggs, to which may be added fome honey and tincture of myrrh. The entrance of thefe wounds frequently requires to be enlarged, and a depending orifice fhould always be procured if poffible; and if the wound fhould not digeft kindly, apply the beer poultice, and foment with the difcutient fomentation, p. 569. col. 2. par. 3.

In fcalds, or burns from gun-powder, or any other caufe, when the fkin remains entire, bathe the part well, and keep it foaked with rags dipped in fpirit of wine camphorated: falt bound thick on the part has been found very effectual for this purpofe: and indeed all faline and fpirituous applications excel others, while the fkin is yet unbroke; but when the fkin is feparated, anoint the part, and keep it conftantly fupple with linfeed or fallad oil, and a plaifter fpread with bees-wax and oil; if the fkin is fo fcorched, that floughs muft be digefted out, drefs with the wound-ointment and oil of turpentine, and finifh the cure with any drying ointment. Should the horfe be feverifh from the pain, bleed him, give cooling glyfters, and treat him as we have directed in fimple fevers.

Of ULCERS *in General.*

WE fhall not here enter into a defcription of each particular fpecies of ulcers, but only lay down fome directions for their general treatment; by which means we fhall avoid the ufual proxility of authors on this fubject, and yet give fo general an idea of the nature of ulcers, as we hope will be fufficiently inftructive both of the application and of the proper remedy to each.

It may be neceffary to obferve, that we may often in vain purfue the beft methods of cure by external applications, unlefs we have recourfe to proper internal remedies; for as all ulcers, difficult to heal, proceed from a particular indifpofition of the blood and juices, before the former can be brought into any order, the latter muft be corrected by alteratives and fweetening medicines.

The firft intention in the cure of ulcers is bringing them to digeft, or difcharge a thick matter; which will, in general, be effected by the green ointment, or that with precipitate; but fhould the fore not digeft kindly by thefe means, but difcharge a gleety thin matter, and look pale, you muft then have recourfe to warmer dreffings, fuch as balfam, or oil of turpentine, melted down with your common digeftive, and the ftrong beer poultice over them; it is proper alfo in thefe kind of fores where the circulation is languid, and the natural heat abated, to warm the part, and quicken the motion of the blood, by fomenting it well at the time of dreffing; which method will thicken the matter, and roufe the native heat of the part, and then the former dreffings may be re-applied.

If the lips of the ulcer grow hard or callous, they muft be pared down with a knife, and afterwards rubbed with the cauftic.

Where foft fungous flefh begins to rife, it fhould carefully be fuppreffed in time, otherwife the cure will go on but flowly; if it has already fprouted above the furface, pare it down with a knife, and rub the remainder with a bit of cauftic; and, to prevent its rifing again, fprinkle the fore with equal parts of burnt alum, and red precipitate; or wafh with the fublimate water, and drefs with dry lint even to the furface, and then roll over a comprefs of linen as tight as can be borne; for a proper degree of preffure,

preſſure, with mild applications, will always oblige theſe ſpongy excreſcences to ſubſide, but without bandage the ſtrongeſt will not ſo well ſucceed.

All ſinuſes, or cavities, ſhould be laid open as ſoon as diſcovered, after bandages have been ineffectually tried; but where the cavity penetrates deep into the muſcles, and a counter opening is impracticable or hazardous; where, by a continuance, the integuments of the muſcles are conſtantly dripping and melting down; in theſe caſes injections may be uſed, and will frequently be attended with ſucceſs. A decoction of colcothar boiled in forge-water; or ſolution of lapis medicamentoſus in lime water, with a fifth part of honey and tincture of myrrh, may be firſt tried, injected, three or four ounces twice a-day; or ſome reſin melted down with oil of turpentine, may be uſed for this purpoſe: if theſe ſhould not ſucceed, the following, which is of a ſharp and cauſtic nature, is recommended on Mr Gibſon's experience.

TAKE of Roman vitriol half an ounce; diſſolve in a pint of water, then decant and pour off gently into a large quart-bottle: add half a pint of camphorated ſpirit of wine, the ſame quantity of the beſt vinegar, and two ounces of Ægyptiacum.

This mixture is alſo very ſucceſsfully applied to ulcerated greaſy heels, which it will both cleanſe and dry up.

Theſe ſinuſes, or cavities, frequently degenerate into *fiſtulæ*, that is, grow pipey, having the inſide thickened, and lined, as it were, with a horny callous ſubſtance. In order to their cure, they muſt be laid open, and the hard ſubſtance all cut away; where this is impracticable, ſcarify them well, and truſt to the precipitate medicine made ſtrong, rubbing now and then with cauſtic, butter of antimony, or equal parts of quickſilver and aquafortis.

When a rotten or foul bone is an attendant on an ulcer, the fleſh is generally looſe and flabby, the diſcharge oily, thin, and ſtinking, and the bone diſcovered to be carious, by its feeling rough to the probe paſſed through the fleſh for that purpoſe. In order to a cure, the bone muſt be laid bare, that the rotten part of it be removed; for which purpoſe, deſtroy the looſe fleſh, and dreſs with dry lint; or the doſſils may be preſſed out of tincture of myrrh or euphorbium: the throwing off the ſcale is generally a work of nature, which is effected in more or leſs time, and in proportion to the depth the bone is affected; though burning the foul bone is thought by ſome to haſten its ſeparation.

Where the cure does not properly ſucceed, mercurial phyſic ſhould be given, and repeated at proper intervals: and to correct and mend the blood and juices, the antimonial and alterative powders, with a decoction of guaiacum and lime-waters, are proper for that purpoſe.

Of a BONE-SPAVIN.

WITHOUT entering at all into the cauſe of this diſorder, which is a bony excreſcence, or hard ſwelling, growing on the inſide of the hock of a horſe's leg, we ſhall content ourſelves with deſcribing the different kinds thereof, by their ſymptoms; and then enter on their cure.

A ſpavin, that begins on the lower part of the hock, is not ſo dangerous as that which puts out higher, between the two round proceſſes of the leg-bone; and a ſpavin near the edge is not ſo bad as that which is more inward toward the middle, as it does not ſo much affect the bending of the hock.

A ſpavin, that comes by a kick or blow, is at firſt no true ſpavin, but a bruiſe on the bone, or membrane which covers it; therefore not of that conſequence, as when it proceeds from a natural cauſe: and thoſe that put out on colts, and young horſes, are not ſo bad as thoſe that happen to horſes in their full ſtrength and maturity; but in very old horſes they are generally incurable.

The uſual method of treating this diſorder is by bliſters and firing, without any regard to the ſituation, or cauſe whence it proceeds. Thus, if a fulneſs on the fore-part of the hock comes upon hard riding, or any other violence, which threatens a ſpavin; in that caſe, ſuch coolers and repellers are proper, as are recommended in ſtrains and bruiſes. Thoſe happening to colts and young horſes are generally ſuperficial, and require only the milder applications; for it is better to wear them down by degrees, than to remove them at once by ſevere means.

Various are the preſcriptions for the bliſtering ointment; but the following, on proper experience, ſtands well recommended by Mr Gibſon.

TAKE nerve and marſh-mallow ointment, of each two ounces; quickſilver, one ounce, thoroughly broke with an ounce of Venice turpentine; Spaniſh flies powdered, a dram and a half; ſublimate, one dram; oil of origanum, two drams.

The hair is to be cut as cloſe as poſſible, and then the ointment applied pretty thick over the part; this ſhould be done in the morning, and the horſe kept tied up all day without any litter till night; when he may be untied, in order to lie down; and a pitch or any ſticking plaiſter may be laid over it, and bound on with a broad tape or bandage to keep all cloſe.

After the bliſter has done running, and the ſcabs begin to dry and peel off, it may be applied a ſecond time, in the ſame manner as before; this ſecond application generally taking greater effect than the firſt, and in colts and young horſes makes a perfect cure.

When the ſpavin has been of long ſtanding, it will require to be renewed, perhaps, five or ſix times; but after the ſecond application, a greater diſtance of time muſt be allowed, otherwiſe it might leave a ſcar, or cauſe a baldneſs; to prevent which, once a-fortnight or three weeks is often enough; and it may in this manner be continued ſix or ſeven times, without the leaſt blemiſh, and will generally be attended with ſucceſs.

But the ſpavins that put out on older, or full-aged horſes, are apt to be more obſtinate, as being ſeated more inward; and when they run among the ſinuoſities of the joint, they are for the moſt part incurable, as they then lie out of the reach of applications, and are arrived to a degree of impenetrable hardneſs.

The uſual method in theſe caſes is to fire directly, or to uſe the ſtrongeſt kind of cauſtic bliſters; and ſometimes to fire and lay the bliſter immediately over the part; but this way ſeldom ſucceeds farther than putting a ſtop to

to the growth of the ſpavin, and is apt to leave both a blemiſh and ſtiffneſs behind; beſides the great riſk run (by applications of theſe fiery and cauſtic medicines to the nervous and tendinous parts about the joints) of exciting violent pain and anguiſh, and deſtroying the limb.

The beſt and ſafeſt way therefore, is to make trial of the bliſtering ointment above, and to continue it according to the directions there laid down, for ſome months, if found neceſſary; the horſes in the intervals working moderately: the hardneſs will thus be diſſolved by degrees, and wear away inſenſibly.

Where the ſpavin lies deep, and runs ſo far into the hollow of the joint, that no application can reach it, neither firing nor medicines can avail, for the reaſons abovementioned; though bold ignorant fellows have ſometimes ſucceeded in caſes of this ſort (by men of judgment deemed incurable) by the application of cauſtic ointments with ſublimate, which act very forcibly, enter deep, and make a large diſcharge, and by that means deſtroy a great part of the ſubſtance, and diſſolve away the remainder: Tho', whoever is at all acquainted with the nature of theſe medicines, muſt know how dangerous in general their operation is on theſe occaſions; and that a proper prepared cautery made like a fleam, under the direction of a ſkilful hand, may be applied with leſs danger of injuring either tendons or ligaments. After the ſubſtance of the ſwelling has been properly penetrated by the inſtrument, it muſt be kept running by the precipitate medicine, or mild bliſtering ointment. Where the ſpavin lies not deep in the joint, and the bliſtering method will not ſucceed, the ſwelling may be ſafely fired with a thin iron forced pretty deep into the ſubſtance, and then ſhould be dreſſed, as is above directed.

Of a Curb *and* Ring-bone.

As a ſpavin riſes among the bones on the fore-part of the hock, ſo a curb takes its origin from the junctures of the ſame bones, and riſes on the hind part, forming a pretty large tumour over the back part of the hind-leg, attended with ſtiffneſs, and ſometimes with pain and lameneſs.

A curb proceeds from the ſame cauſes that produce ſpavins; *viz.* hard riding, ſtrains, blows, or kicks. The cure at firſt is generally eaſy enough effected by bliſtering, repeated two or three times, or oftener. If it does not ſubmit to this treatment, but grows exceſſively hard, the quickeſt and ſureſt way is to fire with a thin iron, making a line down the middle from top to bottom, and drawing ſeveral lines in a penniform manner pretty deep; and then to apply a mild bliſtering plaiſter or ointment over it.—This method will entirely remrove it.

There is another ſwelling taken notice of on the outſide of the hock, which is called a *jardon*. This commonly proceeds from blows and kicks of other horſes; but frequently happens to menaged horſes, by ſetting them on their haunches: it is ſeldom attended with much lameneſs, unleſs it has been neglected, or ſome little proceſs of the bone be broke. It ſhould firſt be treated with the coolers and repellers in (p. 574. and 575.); but if any ſwelling continues hard, and inſenſible, the beſt way is to bliſter or fire; but the mild bliſters alone generally ſucceed.

The *ring-bone* is a hard ſwelling on the lower part of the paſtern, which generally reaches half-way round the fore-part thereof, and from its reſemblance to a ring has its denomination. It often ariſes from ſtrains, *&c.* and when behind, from putting young horſes too early upon their haunches; for in that attitude a horſe throws his whole weight as much, if not more, upon his paſterns, than on his hocks.

When it appears diſtinctly round the paſtern, and does not run downwards toward the coronet, ſo as to affect the coffin-joint, it is eaſily cured; but if it takes its origin from ſome ſtrain or defect in the joint originally, or if a calloſity is found under the round ligament that covers that joint, the cure is generally dubious, and ſometimes impracticable; as it is apt to turn to a quittor, and in the end to form an ulcer upon the hoof.

The ring-bones that appear on colts and young horſes, will often inſenſibly wear off of themſelves, without the help of any application; but when the ſubſtance remains, there needs no other remedy beſides bliſtering, unleſs when by long continuance it is grown to an obſtinate hardneſs, and then it may require both bliſtering and firing.

To fire a ring-bone ſucceſsfully, let the operation be performed with a thinner inſtrument than the common one, and let the lines or razes be made not above a quarter of an inch diſtant, croſſing them obliquely, ſomewhat like a chain: apply a mild bliſter over all, and, when quite dried up, the rupture-plaiſter; and then turn the horſe to graſs for ſome time.

Of Splents.

These are hard excreſcences that grow on the ſhank-bone, and are of various ſhapes and ſizes. Some horſes are more ſubject to ſplents than others; but young horſes are moſt liable to theſe infirmities, which often wear off and diſappear of themſelves. Few horſes put out ſplents after they are ſeven or eight years old, unleſs they meet with blows or accidents.

A ſplent that ariſes in the middle of the ſhank bone is no ways dangerous; but thoſe that ariſe on the back part of this bone, when they grow large and preſs againſt the back ſinew, always cauſe lameneſs or ſtiffneſs, by rubbing againſt it: the others, except they are ſituated near the joints, ſeldom occaſion lameneſs.

As to the cure of ſplents, the beſt way is not to meddle with them, unleſs they are ſo large as to disfigure a horſe, or are ſo ſituated as to endanger his going lame.

Splents in their infancy, and on their firſt appearance, ſhould be well bathed with vinegar, or old verjuice; which, by ſtrengthening the fibres, often put a ſtop to their growth: for the membrane covering the bone, and not the bone itſelf, is here thickened: and in ſome conſtitutions purging, and afterwards diuretic drinks, will be a great means to remove the humidity and moiſture about the limbs, which is what often gives riſe to ſuch excreſcences.

Various are the remedies preſcribed for this diſorder; the uſual way is to rub the ſplent with a round ſtick or the handle of a hammer, till it is almoſt raw, and then touch it with oil of origanum. Others lay on a pitch-plaiſter,

plaister, with a little sublimate, or arsenic, to destroy the substance: some use oil of vitriol; some tincture of cantharides: all which methods have at times succeeded; only they are apt to leave a scar with the loss of hair. Those applications that are of a more caustic nature, often do more hurt than good, especially when the splent is grown very hard, as they produce a rottenness, which keeps running several months before the ulcer can be healed, and then leaves an ugly scar.

Mild blisters often repeated, as recommended in the section upon the *Bone-Spavin*, should first be tried as the most eligible method, and will generally succeed, even beyond expectation: but if they fail, and the splent be near the knee or joints, you must fire and blister in the same manner as for the bone-spavin.

Splents on the back part of the shank-bone are difficult to cure, by reason of the back sinews covering them: the best way is to bore the splent in several places with an iron not very hot; and then to fire in the common way, not making the lines too deep, but very close together.

Of the Poll-evil.

The poll-evil is an abscess near the poll of a horse, formed in the sinuses between the poll-bone, and the uppermost vertebræ of the neck.

If it proceeds from blows, bruises, or any external violence, at first bathe the swelling often with hot vinegar; and if the hair be fretted off with an ouzing through the skin, make use of two parts of vinegar, and one of spirit of wine; but if there be an itching, with heat and inflammation, the safest way is to bleed, and apply poultices with bread, milk, and elder-flowers: this method, with the assistance of physick, will frequently disperse the swelling, and prevent this evil.

But when the tumour is critical, and has all the signs of matter, the best method then is to forward it by applying the ripening poultices already taken notice of, till it comes to maturity, and bursts of itself; or if opened with a knife, great care should be taken to avoid the tendinous ligament that runs along the neck under the mane: when matter is on both sides, the opening must be made on each side, and the ligament remain undivided.

If the matter flows in great quantities, resembles melted glue, and is of an oily consistence, it will require a second incision, especially if any cavities are discovered by the finger or probe; these should be opened by the knife, the orifices made depending, and the wound dressed with the common digestive of turpentine, honey, and tincture of myrrh, and, after digestion, with the precipitate ointment; or wash the sore with the following, made hot, and fill up the cavity with tow soaked in it.

Take vinegar or spirit of wine half a pint, white vitriol dissolved in spring-water half an ounce, tincture of myrrh four ounces.

This may be made sharper by adding more vitriol; but if the flesh is very luxuriant, it should first be pared down with a knife before the application; with this wash alone Mr Gibson has cured this disorder without any other formality of dressing, washing with it twice a-day, and laying over the part a quantity of tow soaked in vinegar and the white of eggs beat together.

But the most compendious method of cure, is found by observation to be by *scalding*, as the farriers term it; and is thus prosecuted when the sore is foul, of a bad disposition, and attended with a profusion of matter.

Take corrosive sublimate, verdegrease in fine powder, and Roman vitriol, of each two drams; green copperas half an ounce, honey or Ægyptiacum two ounces, oil of turpentine and train oil of each eight ounces, rectified spirit of wine four ounces; mix together in a bottle.

The manner of scalding is first to clean the abscess well with a piece of sponge dipped in vinegar; then put a sufficient quantity of the mixture into a ladle with a spout, and when it is made scalding hot, pour it into the abscess, and close the lips together with one or more stitches. This is to remain in several days; and if good matter appears, and not in an over great quantity, it will do well without any other dressing, but bathing with spirit of wine; if the matter flows in great abundance, and of a thin consistence, it must be scalded again, and repeated till the matter lessens and thickens.

Of a Fistula, *and* Bruises *on the* Withers; Warbles *on the Back, and* Sit-fasts.

Bruises on the withers frequently imposthumate, and for want of care turn fistulous. They arise often from pinches of the saddle, and should be treated with repellers: for this purpose bathe the tumour well with hot vinegar three or four times a day; if that does not succeed alone, an ounce of oil of vitriol may be put to a quart of vinegar, or half an ounce of white vitriol dissolved in a little water, and added to the same quantity. These are generally very effectual repellers for this purpose in horses, and will frequently prevent imposthumation: when the swelling is attended with heat, smarting, and little hot watery pimples, the following mixture will then be more proper to bathe with.

Take two ounces of crude sal ammoniac, boiled in a quart of lime-water; where that cannot be had, a handful of pearl or wood-ashes may be boiled in common water: pour off the decoction when settled, and mix with it half a pint of spirit of wine: anoint the part afterwards with linseed oil, or elder ointment, to soften and smooth the skin.

But when the swellings are critical, the consequence of a fever settled on this part, you must avoid the repelling method, and assist in bringing the swelling to matter, by means of suppurating poultices: experienced farriers advise, never to open these tumours till they break of themselves; for if they are opened before they are ripe, the whole sore will be spongy, and discharge a bloody ichor, which soon degenerates into a sordid ulcer. But take care to enlarge the openings and pare away the lips, that your dressings may be applied easily; and avoid the ligament which runs along the neck to the withers: if a gathering forms on the opposite side, open it in the same manner, but take care they incline downwards, for the sake of depending orifices, and letting the matter flow off

off eafily. For the method of dreffing, we muft refer to the preceding Section; and if the bones fhould be found foul, they muft be dreffed with tincture of myrrh till they fcale off: if the fungus is very troublefome, and the difcharge oily, yellow and vifcid, pledgets foaked in the following, made hot, have been found very effectual, bathing the fwelling round with fpirit of wine and vinegar.

Take half an ounce of blue vitriol diffolved in a pint of water; oil of turpentine, and rectified fpirit of wine, of each four ounces; white-wine vinegar, fix ounces; oil of vitriol and Ægyptiacum, of each two ounces.

When the cavities are truly fiftulous, the callofities muft be cut out, where it can be done, with a knife; and the remainder deftroyed by corrofives, *viz.* precipitate, burnt alum, and white vitriol, as we have already obferved in the Section on Ulcers.

Warbles are fmall hard tumours under the faddle-part of the horfe's back, occafioned by the heat of the faddle in travelling, or its uneafy fituation. A hot greafy difhclout at firft frequently applied, will fometimes remove them. Camphorated fpirits of wine are alfo very effectual for this purpofe to difperfe them, to which a little fpirit of fal armoniac may be added. The repellers abovementioned are fuccefsfully applied in thefe cafes; and if you are obliged to work the horfe, take care your faddle is nicely chambered.

A *fit-faft* proceeds generally from a warble, and is the horfe's hide turned horny, which, if it cannot be diffolved and foftened by rubbing with the mercurial ointment, muft be cut out, and treated then as a frefh wound.

Of Wind-galls, Blood *and* Bog Spavins.

A Wind-gall is a flatulent fwelling, which yields to the preffure of the finger, and recovers its fhape on the removal thereof: the tumour is vifible to the eye, and often feated on both fides of the back finew, above the fetlocks, on the fore-legs, but moft frequently on the hind legs; though they are met with in various parts of the body, where-ever membranes can be fo feparated, that a quantity of air and ferofities may be included within their duplicatures.

When they appear near the joints and tendons, they are generally caufed by ftrains, or bruifes on the finews, or the fheath that covers them; which, by being overftretched, have fome of their fibres ruptured; whence probably may ouze out that fluid which is commonly found with the included air: though where thefe fwellings fhew themfelves in the interftices of large mufcles, which appear blown up like bladders, air alone is the chief fluid; and thefe may fafely be opened, and treated as a common wound.

On the firft appearance of wind-galls, their cure fhould be attempted by reftringents and bandage; for which purpofe, let the fwelling be bathed twice a-day with vinegar, or verjuice alone; or let the part be fomented with a decoction of oak-bark, pomegranate, and alum boiled in verjuice, binding over it, with a roller, a woollen cloth foaked in the fame. Some, for this purpofe, ufe red-wine lees, others curriers fhavings wetted with the fame, or vinegar, bracing the part up with a firm bandage.

If this method, after a proper trial, fhould not be found to fucceed, authors have advifed the fwelling to be pierced with an awl, or opened with a knife: but mild bliftering has in general the preference given to thefe methods; the including fluids being thereby drawn off, the impacted air difperfed, and the tumour gradually diminifhed.

A *blood-fpavin* is a fwelling and dilatation of the vein that runs along the infide of the hock, forming a little foft fwelling in the hollow part, and is often attended with a weaknefs and lamenefs of the hock.

The cure fhould be firft attempted with the reftringents and bandage above recommended, which will contribute greatly to ftrengthen all weakneffes of the joints, and frequently will remove this diforder, if early applied: but if by thefe means the vein is not reduced to its ufual dimenfions, the fkin fhould be opened, and the vein tied with a crooked needle and wax-thread paffed underneath it, both above and below the fwelling, and the turgid part fuffered to digeft away with the ligatures: for this purpofe, the wound may be daily dreffed with turpentine, honey, and fpirit of wine, incorporated together.

A *bog-fpavin* is an encyfted tumour on the infide the hough; or, according to Dr Bracken, a collection of brownifh gelatinous matter, contained in a bag, or cyft, which he thinks to be the lubricating matter of the joint altered, the common membrane that inclofes it forming the cyft. This cafe he has taken the pains to illuftrate in a young colt of his own, where he fays, When the fpavin was preffed hard on the infide the hough, there was a fmall tumour on the outfide, which convinced him the fluid was within-fide the joint: he accordingly cut into it, difcharged a large quantity of this gelatinous matter, dreffed the fore with doffils dipped in oil of turpentine, putting into it, once in three or four days, a powder made of calcined vitriol, alum, and bole: by this method of dreffing, the bag floughed off, and came away, and the cure was fuccefsfully compleated without any vifible fcar.

This diforder, according to the above defcription, will fcarcely fubmit to any other method, except firing, when the cyft ought to be penetrated to make it effectual; but in all obftinate cafes that have refifted the above methods, both the cure of this and of the fwellings called wind-galls fhould be attempted in this manner. If, through the pain attending the operation or dreffings, the joint fhould fwell and inflame, foment it twice a-day, and apply a poultice over the dreffings till it is reduced.

Of Mallenders *and* Sallenders.

Mallenders are cracks in the bend of the horfe's knee, that difcharge a fharp indigefted matter; they are often the occafion of lamenefs, ftiffnefs, and the horfe's tumbling.

Sallenders are the fame diftemper, fituate on the bending of the hough, and occafion a lamenefs behind.

They are both cured by wafhing the parts with a lather of foap warmed, or old chamber-lye; and then apply o-

ver the cracks a ſtrong mercurial ointment ſpread on tow, with which they ſhould be dreſſed, night and morning, till all the ſcabs fall off: if this ſhould not ſucceed, anoint them night and morning with a little of the following, and apply the above ointment over it.

TAKE hogs lard, two ounces; ſublimate mercury, two drams.

Or,

TAKE hogs lard, two ounces; oil of vitriol, two drams.

Take the next from Gibſon, which is to be depended on:

ÆTHIOPS mineral, half an ounce; white vitriol, one dram; ſoft green ſoap, ſix ounces.

Anoint with this often; but firſt clip away the hair, and clear the ſcabs. On their drying up, it may be proper to give a gentle purge or two; or the nitre balls may be taken advantageouſly, for a fortnight or three weeks.

Of LAMPAS, BARBS, *and* WOLVES TEETH.

THE *lampas* is an excreſcence in the roof of the horſe's mouth, which is ſometimes ſo luxuriant, that it grows above the teeth, and hinders his feeding. The cure is in lightly cauteriſing the fleſh with a hot iron, taking care that it does not penetrate too deep, ſo as to ſcale off the thin bone that lies under the upper bars; the part may be anointed with burnt alum and honey, which is proper for moſt ſores in the mouth.

This operation is by ſome thought to be entirely unneceſſary; it being a general obſervation with them, that all young horſes have their mouths more or leſs full of what are called lampas; and that ſometimes they riſe higher than the fore-teeth; but they further obſerve, in proportion as a horſe grows older, the roof flattens of itſelf, and the teeth then appear to riſe. We are obliged to the ingenious M. La Foſſe for this remark, and hope it will be the means of aboliſhing this cruel and unneceſſary operation.

Barbs are ſmall excreſcences under the tongue, which may be diſcovered by drawing it aſide, and are cured by cutting cloſe off, and waſhing with brandy or ſalt and water.

A horſe is ſaid to have *wolves-teeth*, when the teeth grow in ſuch a manner, that their points prick, or wound either the tongue, or gums, in eating. Old horſes are moſt liable to this infirmity, and whoſe upper overſhoot the under teeth in a great degree.

To remedy this evil, you may either chop off the ſuperfluous parts of the teeth with a chizzel and mallet, or file them down, which is the better way, till you have ſufficiently waſted them.

Of the GREASE.

IN order to treat this diſorder with ſome propriety; we ſhall conſider it as ariſing from two different cauſes; a fault or relaxation in the veſſels, or a bad diſpoſition in the blood and juices. We muſt here obſerve, that the blood and juices (or humours, for there are always ſome in the beſt ſtate of blood) are brought to the extreme parts by the arteries, and returned by the veins; in which latter, the blood is to riſe in perpendicular columns, to return the circulating fluids from the extremities: hence ſwellings in the legs of horſes may eaſily be accounted for, from a partial ſtagnation of the blood and juices in the finer veſſels, where the circulation is moſt languid; and eſpecially when there is want of due exerciſe, and a proper muſcular compreſſion on the veſſels, to puſh forward the returning blood, and propel the inert and half ſtagnating fluids through their veſſels; in ſhort, the blood in ſuch caſes cannot ſo readily aſcend as deſcend, or a greater quantity is brought by the arteries than can be returned by the veins.

The greaſe then, conſidered in this light, muſt be treated as a local complaint, where the parts affected are alone concerned, the blood and juices being yet untainted, and in good condition; or as a diſorder where they are both complicated: but when it is an attendant on ſome other diſtemper, as the farcy, yellows, dropſy, *&c.* ſuch diſeaſes muſt firſt be cured before the greaſe can be removed. In the former caſe, moderate exerciſe, proper dreſſing, cleanlineſs, and external application, will anſwer the purpoſe; in the latter, internals muſt be called in to our aſſiſtance, with proper evacuations.

When a horſe's heels are firſt obſerved to ſwell in the ſtable, and ſubſide or go down on exerciſe; let care be taken to waſh them very clean every time he comes in, with ſoap-ſuds, chamber-lye, or vinegar and water, which, with proper rubbing, will frequently prevent, or remove this complaint: or let them be well bathed twice a-day with old verjuice, or the following mixture, which will brace up the relaxed veſſels; and if rags dipped in the ſame are rolled on, with a proper bandage, for a few days, it is moſt likely the ſwellings will ſoon be removed by this method only, as the bandage will ſupport the veſſels, till they have recovered their tone. To anſwer this end alſo, a laced ſtocking made of ſtrong canvas or coarſe cloth, neatly fitted to the part, would be found extremely ſerviceable, and might eaſily be contrived by an ingenious mechanic.

TAKE rectified ſpirit of wine, four ounces; diſſolve in it half an ounce of camphor; to which add wine-vinegar, or old verjuice, ſix ounces; white vitriol, diſſolved in a gill of water, one ounce; mix together, and ſhake the phial when uſed.

But if cracks or ſcratches are obſerved, which ouze and run, let the hair be clipped away, as well to prevent a lodgment (which becomes ſtinking and offenſive by its ſtay) as to give room for waſhing out dirt or gravel, which, if ſuffered to remain there, would greatly aggravate the diſorder.

When this is the caſe, or the heels are full of hard ſcabs, it is neceſſary to begin the cure with poultices, made either of boiled turnips and lard, with a handful of linſeed powdered; or oatmeal and rye-flour, with a little common turpentine and hogs lard, boiled up with ſtrong-beer grounds or red-wine lees. The digeſtive ointment being applied to the ſores for two or three days, with either of theſe poultices over it, will, by ſoftening them, promote a diſcharge, unload the veſſels, and take down the ſwelling; when they may be dried up with the following:

Take white vitriol and burnt alum, of each two ounces; Ægyptiacum, one ounce; lime-water, a quart or three pints: wash the sores with a sponge dipped in this, three times a-day, and apply the common white ointment spread on tow; to an ounce of which may be added two drams of sugar of lead.

This method is generally very successful, when the distemper is only local, and requires no internal medicines; but if the horse be full and gross, his legs greatly gorged, so that the hair stares up, and is what some term pen-feathered, and has a large stinking discharge from deep foul sores, you may expect to meet with great trouble, as these disorders are very obstinate to remove, being often occasioned by a poor dropsical state of blood, or a general bad disposition in the blood and juices.

The cure in this case, if the horse is full and fleshy, must be begun by bleeding, rowels, and repeated purging; after which, diuretic medicines are frequently given with success. Thus,

Take four ounces of yellow rosin, one of sal prunellæ; grind them together with an oiled pestle, add a dram of oil of amber, and give a quart of forge-water every morning, fasting two hours before and after taking, and ride moderately.

As this drink is found very disagreeable to some horses, I would recommend the nitre-balls in its stead, given to the quantity of two ounces a-day, for a month or six weeks, mixed up with honey, or in his feeds: take the following also for that purpose.

Yellow rosin, four ounces; salt of tartar, and sal prunellæ, of each two ounces; Venice soap, half a pound; oil of juniper, half an ounce; make into balls of two ounce weight, and give one every morning.

The legs, in this case, should be bathed or fomented, in order to breathe out the stagnant juices, or to thin them, so that they may be able to circulate freely in the common current. For this purpose, foment twice a-day with the discutient fomentation, p. 569. col. 2. par. 3. in which a handful or two of wood-ashes has been boiled; apply then the above poultices, or the following, till the swelling has subsided, when the sores may be dressed with the green ointment till they are properly digested, and then dried up with the water and ointment above recommended.

Take honey, one pound; turpentine, six ounces; incorporate with a spoon; and add of the meal of fenugreek and linseed, each four ounces; boil in three quarts of red-wine lees to the consistence of a poultice; to which add, when taken from the fire, two ounces of camphor in powder; spread it on thick cloths, and apply warm to the legs, securing it on with a strong roller.

If the sores are very foul, dress them with two parts of the wound-ointment, and one of Ægyptiacum; and apply the following, spread on thick cloths, and rolled on.

Take of black soap, one pound; honey, half a pound; burnt alum, four ounces; verdigrease powdered, two ounces; wheat-flour, a sufficient quantity.

If the diuretic balls should not succeed, they must be changed for the antimonial and mercurial alteratives, already mentioned: but turning a horse out in a field, where he has a hovel or shed to run to at pleasure, would greatly contribute to quicken the cure, and indeed would in general effect it alone; but if this cannot be complied with, let him be turned out in the day-time.

If the horse is not turned out, a large and convenient stall is absolutely necessary, with good dressing and care.

The last thing we shall recommend, is a method to oblige a horse to lie down in the stable. This undoubtedly is of the utmost consequence, as it will not a little contribute to the removal and cure of this disorder; for by only changing the position of his legs, a freer circulation would be obtained, and the swelling taken down: whereas in general it is greatly aggravated by the obstinacy of the horse, who refuses to lie down at all (probably from the pain it gives him to bend his legs for that purpose) by which means the stiffness and swelling increases, till the over-gorged and distended vessels are obliged to give way, and by bursting, discharge the fluids, which should circulate through them.

Of Scratches, Crown Scabs, Rat-Tails, *and* Capellets.

Scratches in the heels have so much affinity with the grease, and are so often concomitants of that distemper, that the method of treating them may be selected chiefly from the preceding section; which at first should be by the linseed and turnip poultice, with a little common turpentine to soften them, and relax the vessels; the green ointment may then be applied for a few days to promote a discharge, when they may be dried up with the ointments and washes recommended in the above section. It is best afterwards to keep the heels supple, and softened with currier's dubbing, which is made of oil and tallow. This will keep the hide from cracking, and be as good a preservative as it is to leather; and by using it often before exercise, will prevent the scratches, if care is taken to wash the heels with warm water, when the horse comes in. When they prove obstinate, and the sores are deep, use the following; but if any cavities or hollow places are formed, they should first be laid open; for no foundation can be laid for healing, till you can dress to the bottom.

Take Venice turpentine, four ounces; quicksilver, one ounce; incorporate well together by rubbing some time, and then add honey and sheeps suet, of each two ounces.

Anoint with this once or twice a day; and if the horse is full or fleshy, you must bleed and purge; and if the blood is in a bad state, the alteratives must be given to rectify it.

The *crown-scab* is an humour that breaks out round the coronet, which is very sharp and itching, and attended with a scurfiness: sharp waters prepared with vitriol are generally used for the cure; but the safest way is first to mix marshmallow and yellow basilicon, or the wound ointment, equal parts, and to spread them on tow, and lay all round the coronet. A doze or two of physic may be very proper, with the diuretic medicines, (par. 4. 5. 6. of the preced. col. and the alteratives above recommended

commended, in rebellious cafes. *Vid.* the Section on ALTERATIVES.

Rat-tails are excrefcences, which creep from the paftern to the middle of the fhanks, and are fo called from the refemblance they bear to the tail of a rat. Some are moift, others dry; the former may be treated with the drying ointment and wafhes, p. 577. col. 1. par. 1. the latter with the mercurial ointment, p. 555. col. 2. par. 6. If the hardnefs does not fubmit to the laft medicine, it fhould be pared off with a knife, and dreffed with turpentine, tar and honey, to which verdigreafe or white vitriol may occafionally be added; but before the ufe of the knife, you may apply this ointment.

TAKE black foap, four ounces; quick-lime, two ounces; vinegar enough to make an ointment.

There are particular fwellings which horfes are fubject to, of a wenny nature, which grow on the heel of the hock, and on the point of the elbow, and are called by the French and Italians capellets: they arife often from bruifes and other accidents; and when this is the cafe, fhould be treated with vinegar and other repellers: but when they grow gradually on both heels, or elbows, we may then fufpect the blood and juices in fault that fome of the veffels are broke, and juices extravafated; in this cafe, the fuppuration fhould be promoted, by rubbing the part with marfhmallow ointment, and when matter is formed, the fkin fhould be opened with a lancet, in fome dependent part towards one fide, to avoid a fcar: the dreffings may be turpentine, honey, and tincture of myrrh. The relaxed fkin may be bathed with equal parts of fpirit of wine and vinegar, to which an eighth part of oil of vitriol may be added. The contents of thefe tumours are various, fometimes watery, at others fuety, or like thick pafte; which, if care be not taken to digeft out properly with the cyft, will frequently collect again; was it not for the disfigurement, the fhorteft method would be to extirpate them with a knife, which, if artfully executed, and the fkin properly preferved, would leave very little deformity.

Of the Difeafes of the FEET.

Of NARROW HEELS, *and* BINDING *of the* HOOF, *&c.*

THOUGH narrow heels in general arife from a natural defect, yet they are often rendered incurable by bad fhoeing; for fome farriers hollow the quarters fo deep and thin, that they may be pinched in with the fingers, and think by that method to widen them out by a ftrong broad webbed fhoe; but this turns them narrow above, wires their heels, and dries, or rots the frog. The beft way in all fuch cafes is not to hollow the foot in fhoeing, and to pare nothing out but what is rotten or foul; if the foot be hard and dry, or inclined to be rotten, bathe it often with chamber-lye, or boil two pounds of linfeed bruifed in two quarts of the fame, to the confiftence of a poultice, then add fix ounces of foft green foap, and anoint the foot with it every day, rubbing a little of it upon the fole.

Or,

TAKE bees-wax two ounces; frefh butter or lard, fix ounce; tar, one ounce; as much linfeed, or neatsfoot oil, as will make it the confiftence of a fmooth ointment.

The hoofs, if too dry, may be anointed with the above, or with lard only; fome for this purpofe ufe tar, tallow, and honey, but moft greafy and unctuous applications will anfwer this intention; the feet alfo, if too dry, may be ftuffed with bran and lard heated or worked up together in the hand, which is very proper alfo to apply every night, when your horfe is travelling in hot weather on roads that are dry and hard; cow-dung likewife is a proper ftuffing for the feet, but vinegar fhould cautioufly be mixed with it; for though it is a known cooler, it is a remarkable reftringent, which in this cafe would be extremely prejudicial; inftead of which, a print of frefh butter may be firft applied to the fole, and the cow-dung laid over it.

There is another diforder the hoofs are fubject to, which is their being too foft and moift; this may be conftitutional, or proceed from going much in wet and marfhy grounds, ftanding conftantly on wet litter, or any infirmity that may bring too great a moifture into the feet. In this cafe the horfe's hoofs may be bathed every day with warm vinegar, verjuice, copperas-water, and fuch like reftringents; to which may be added galls, alum, *&c.* remembring to let the horfe ftand conftantly dry.

We fay a horfe is *hoof-bound*, when the hoof is fo tight round the inftep, that it turns the foot fomewhat into the fhape of a bell. This is caufed fometimes by fhoeing as above, to widen the heel, and fometimes by cutting the toes down too much, which gives that fhape to the foot, and caufes the horfe to go lame.

To remedy this diforder, Mr Gibfon recommends the following method: let the foot be drawn down from the coronet almoft to the toe with a drawing knife, making feven or eight lines or razes through the hoof, almoft to the quick; afterwards keep it charged with pitch rofin, till the lines are wore out in fhoeing, which will require feveral months.

Of SAND-CRACKS *and* QUITTORS.

WHAT is called a fand-crack, is a little cleft on the outfide of the hoof: if it runs in a ftrait line downwards, and penetrates through the bony part of the hoof, it often proves troublefome to cure; but if it paffes through the ligament that unites the hoof with the coronet, it is then apt to breed a quittor, or falfe quarter, which is dangerous.

When the crack only penetrates through the hoof, without touching the ligament, unlefs the hoof be hollow, it may eafily be cured, by rafping only the edges fmooth, and applying thick pledgets of bafilicon, and binding them down with a piece of foft lift; if fome precipitate be added to it, this medicine will be improved thereby, and in general anfwers the end, without any other application But if you perceive any hollownefs under the hoof, and that the cleft has a tendency to penetrate through the griftle or ligament, the beft method, in that cafe, is to fire out of hand with irons that are not made

made too hot, firſt raſping very thin and wide from both ſides of the cleft: the horſe muſt not carry any weight for ſome time, but be turned out to graſs, or wintered in a good farm yard.

A quittor is an ulcer formed between the hair and hoof, uſually the inſide quarter of a horſe's foot; it ariſes often from treads and bruiſes, ſometimes from gravel, which, by working its way upwards, lodges about the coronet: if it is only ſuperficial, it may be cured with cleanſing dreſſings, bathing the coronet every day with ſpirit of wine, and dreſſing the ſore with the precipitate medicine.

But if the matter forms itſelf a lodgment under the hoof, there is no way then to come at the ulcer, but by taking off part of the hoof; and if this be done artfully and well, the cure may be affected without danger.

When the matter happens to be lodged near the quarter, the farrier is ſometimes obliged to take off the quarter of the hoof, and the cure is then, for the moſt part, but palliative; for when the quarter grows up, it leaves a pretty large ſeam, which weakens the foot; this is what is called a falſe quarter, and a horſe with this defect ſeldom gets quite ſound.

If the matter, by its confinement, has rotted the coffin bone, which is of ſo ſoft and ſpongy a nature, that it ſoon becomes ſo, you muſt enlarge the opening, cut away the rotten fleſh, and apply the actual cautery, or hot iron pointed pyramidically, and dreſs the bone with doſſils of lint, dipped in tincture of myrrh, and the wound with the green or precipitate ointment. When the ſore is not enlarged by the knife, which is the beſt, and leſs painful method, pieces of ſublimate are generally applied, which bring out with them cores, or lumps of fleſh; blue vitriol powdered, and mixed with a few drops of the oil, is uſed alſo for this purpoſe, and is ſaid to act as effectually, and with leſs pain and danger; during the operation of theſe medicines, the foot ſhould be kept in ſome ſoft poultice, and care ſhould be taken, during the whole dreſſing, to prevent proud fleſh riſing, which otherwiſe will not only retard the cure, but prevent a firm and ſound healing.

Of Wounds *in the* Feet, *from* Nails, Gravel, *&c.*

Accidents of this ſort are very common, and ſometimes for want of early care, prove of bad conſequence; for the parts, being naturally tender, are very ſuſceptible of inflammation; and when matter is once formed, if a free diſcharge is not procured, the bone, which is ſpungy, ſoon becomes affected, and the whole foot is then in danger.

When any extraneous bodies, ſuch as nails, ſtubs, thorns, *&c.* have paſſed into the horſe's foot, you ſhould endeavour to get them out as ſoon as poſſible; and after waſhing the part with oil of turpentine, dreſs the hole with lint dipped in the ſame, melted down with a little tar; the foot may be ſtopped up with bran and hogs-lard heated together, or put it into the turnip, or any ſoft poultice; this method is generally ſucceſsful, when the nail, *&c.* is entirely removed; but if any piece, or particle, ſhould remain behind, which may be ſuſpected by the degree of pain, and diſcharge of matter; after paring away the ſole as thin as poſſible, introduce a bit of ſponge tent, in order to enlarge the hole, that it may be drawn out by a ſmall pair of forceps, or brought away by digeſtion: if this method ſhould not ſucceed, but the lameneſs continues, with a diſcharge of a thin bloody, or ſtinking matter, you muſt no longer delay opening the wound with a drawing-knife to the bottom, and then dreſs as above directed, or with the turpentine digeſtive, divided with the yolk of an egg, and a little tincture of myrrh; afterwards with the precipitate medicine.

If the lameneſs proceeds from pricking in ſhoeing, the foot ſhould be pared thin on the wound ſide, and after dreſſing with the tar and turpentine, let it be ſtopped with the poultices above mentioned, or with two ounces of common turpentine, melted down with four of lard; ſhould this method not ſucceed, follow the above directions.

If the nail penetrates to the joint of the foot, where matter may be formed, and by its long continuance putrify, ſo as to erode the cartilages of the joint, the caſe is incurable.

If the nail has paſſed up to the nut-bone, it is incurable, becauſe this little bone cannot exfoliate, and becauſe the cartilaginous part of it is deſtroyed, as ſoon as injured.

If the nail has not paſſed to the tendon, the horſe will do well, without a neceſſity for drawing the ſole; but if the tendon is wounded, the ſole muſt be carefully drawn, becauſe a ſinovia and gleet is diſcharged.

When gravel is the cauſe, it for the moſt part follows the nail-holes, and if it gets to the quick cannot return, unleſs it is ſcraped out; for the make of the hoof, which is ſpiral like an ear of corn, favours its aſcent, ſo that the gravel continues working upwards towards the coronet, and forms what the farriers call a quittor-bone.

The nature of this diſorder points out the method of cure, which is to be as expeditious and careful as poſſible, in getting out the gravel; if it is found difficult to effect this, let the ſole or hoof be pared thin, and, if neceſſary, the wound enlarged to the bottom, and then dreſſed up as uſual. Should the coffin-bone be affected, you muſt follow the directions laid down in the preceding ſection, remembering always to bathe the hoof with vinegar, or repellers, in order to allay the heat and inflammation, which often happen on ſuch occaſions; and ſhould the pain and anguiſh affect the legs, treat them in the ſame manner, or charge the leg and paſtern with a mixture of wine-lees and vinegar.

Figs are ſpongy ſwellings on the bottom of horſes feet, generally on the ſides of the fruſh. Theſe, or any other kind of excreſcences, ſuch as warts, corns, grapes, *&c.* are beſt removed by the knife; and if any part of them be left behind, or ſhould ſhoot up afreſh, touch them with the cauſtic, or oil of vitriol, and dreſs with Ægyptiacum; to which may be added, when they are very rebellious, a ſmall quantity of ſublimate; when the roots are quite deſtroyed, you may incarn with the precipitate medicines, and dry up the ſore with the following waſh.

Take of white vitriol, alum, and galls in powder, of each two ounces; diſſolve them by boiling a little in two quarts of lime-water, and keep in a bottle for uſe, which ſhould be ſhook when uſed.

Of

Of the Running Thrush, Canker, *and* Loss *of* Hoof.

The *thrush* or *frush* is an imposthume that sometimes gathers in the frog; or a scabby and ulcerous disposition, which sometimes causes it to fall off: when the discharge is natural, the feet should be kept clean, but no drying washes made use of, it being thought as unsafe to repel some of these discharges, as to cure some sweaty feet.

When an imposthume, or gathering appears, the safest way is to pare out the hard part of the frog, or whatever appears rotten; and wash the bottom of the foot two or three times a-day with old chamber-lye; this is the safest and best way of treating them. But when a horse has been neglected, and there is is a strong flux to the part, it is apt to degenerate into a canker; to prevent which, use the following wash.

Take spirit of wine and vinegar of each two ounces, tincture of myrrh and aloes one ounce, Ægyptiacum half an ounce; mix together.

Bathe the thrush with this, where ever there appears a more than ordinary moisture, and lay over the ulcer a little tow dipped in the same. The purges and diuretics recommended in the grease, should be given at this time, to prevent the inconveniencies that the drying up these discharges frequently occasion.

A *canker* in the foot proceeds, for the most part, from thrushes, when they prove rotten and putrid, though many other causes may produce this disorder. The method used by farriers for the cure is generally with hot oils, such as vitriol, aqua-fortis, and butter of antimony, which are very proper to keep down the rising flesh, and should be used daily, till the fungus is suppressed, when once in two days will be sufficient, strewing fine precipitate powder over the new-grown flesh, till the sole begins to grow.

There is one great error committed often in this cure, that is, in not having sufficient regard to the hoof; for it should not only be cut off, where-ever it presses on the tender parts, but should be kept soft with linseed oil; and as often as it is dressed, bathe the hoof all round the coronet with chamber-lye. Purging is very proper to complete the cure.

The *loss of the hoof* may be occasioned by whatever accident may bring an imposthumation in the feet, whereby the whole hoof becomes loosened, and falls off from the bone. If the coffin-bone remains uninjured, a new hoof may be procured by the following method.

The old hoof should by no means be pulled off, unless some accident happens that requires its removal; for it serves as a defence to the new one, and makes it grow more smooth and even; and indeed nature will generally do this office at her own proper time.—On the removal of the hoof, a boot of leather, with a strong sole, should be laced about the pastern, bolstering and stopping the foot with soft flax, that the tread may be easy: dress the sore with the wound ointment, to which should be added the fine powders of myrrh, mastich, and olibanum. If this medicine should not be sufficient to prevent a fungus, burnt alum or precipitate may be added to it, and the luxuriant flesh may be daily washed with the sublimate water.

Of Ruptures, Anticor, Colt-evil *or* Gonorrhoea, *and Diseases of the* Mouth.

In regard to ruptures, though they are generally divided into particular classes, we shall only observe, that by violent efforts of the horse, or other accidents, the guts or caul may be forced between the muscles of the belly at the navel, and through the rings of the muscles into the scrotum or cod. The swellings are generally about the size of a man's fist, sometimes much larger, descending to the very hock; they are frequently soft, and yield to the pressure of the hand, when they will return into the cavity of the belly with a rumbling noise; and, in most, the vacuity may be felt through which they passed.

On their first appearance, endeavours should be made to return them by the hand; but if the swelling should be hard and painful, in order to relieve the stricture, and relax the parts, through which the gut or caul has passed, let a large quantity of blood be immediately taken away, and the part fomented twice or thrice a-day, applying over it a poultice made with oatmeal, oil and vinegar, which should be continued till the swelling grows soft and easier, or the gut is returned. In the mean time it would be proper to throw up emollient oily glysters twice a-day, and to let the horse's chief diet be boiled barley, scalded malt, or bran.

Should the swelling afterwards return, we apprehend the restringent applications, usually recommended on these occasions, will avail little without a suspensory bandage; so that an ingenious mechanic in that art is chiefly to be relied on for any future assistance; though it has been observed, that with moderate feeding, and gentle exercise, some horses have continued to be very useful under this complaint.

The *anticor* is a disorder not very common among our horses, or those in northern climates; but is particularly taken notice of by the French, Spanish, and Italian writers; who describe it a malignant swelling in the breast, which extends sometimes to the very sheath under the belly; it is attended with a fever, great depressions, and weakness, and a total loss of appetite.

The cure should first be attempted by large and repeated bleedings, to abate the inflammation; emollient glysters should be injected twice or thrice a-day, with an ounce of sal prunella in each, and the cooling drink in the Section on Fevers should be given inwardly; the swelling should be bathed with the marshmallow ointment, and a ripening poultice, with onions boiled in it, should be daily applied over it. If by this method, continued four or five days, the inflammation in the throat and gullet is removed, our attention should more particularly turn to encourage the swelling at the breast, and bring it, if possible, to matter; to which end, continue the poultice, and give two ounces of Venice treacle dissolved in a pint of beer every night; when the swelling is grown soft, it must be opened with the knife, and dressed with turpentine digestive, the danger now being over.

But

But ſhould it be found impracticable to bring the ſwelling to matter, and it increaſes upwards, ſo as to endanger ſuffocation; authors have adviſed to pierce the tumour with a hot pointed cautery in five or ſix places, to dreſs with the above digeſtive; and in order to ſtimulate and promote a greater diſcharge, to add to it a ſmall quantity of Spaniſh flies and euphorbium in powder; fomenting at the ſame time, and bathing the circumjacent parts with ointment of marſhmallows. M. Gueriniere, as well as Soleyſell, have adviſed opening the ſkin, when the tumour cannot be brought to matter, in order to introduce a piece of black hellebore-root ſteeped in vinegar, and to confine it there for twenty-four hours; this alſo is intended as a ſtimulant, and is ſaid to anſwer the intention, by occaſioning ſometimes a ſwelling as big as a man's head.

Beſides the diſorders of the mouth, which we have already animadverted on, there are frequently obſerved on the inſide the lips and palate, little ſwellings or bladders called *giggs*: ſlitting them open with a knife, or lancet, and waſhing them afterwards with ſalt and vinegar, is in general their cure; but when they degenerate into what are called cankers, which are known by little white ſpecks, that ſpread and occaſion irregular ulcers, the beſt method then is to touch them daily with a ſmall flat cautery, moderately heated, till the ſpreading is ſtopped, and to rub the ſores three or four times a-day with Ægyptiacum, and tincture of myrrh, ſharpened with oil, or ſpirit of vitriol; when by this dreſſing the ſloughs are ſeparated, they may be waſhed frequently with a ſponge dipped in copperas, or ſublimate water, if they continue to ſpread; or a tincture made by diſſolving half an ounce of burnt alum, and two ounces of honey, in a pint of tincture of roſes. Either of theſe will dry them up, and are very uſeful in moſt diſorders of the mouth.

A relaxation and ſwelling of the palate ſometimes happens to horſes on catching cold. To remedy this diſorder, blow pepper on the part, or anoint it with the ſame mixed up with honey. The tincture above-mentioned may be uſed for this purpoſe, to which may be added half an ounce of ſpirit of ſal armoniac.

The colt-evil is ſuppoſed to ariſe from ſtoned colts having full liberty with mares, before they are able to cover them; whence frequently enſues an excoriation or fretting on the glands, and a ſwelling on the ſheath; this laſt diſorder frequently proceeds too from dirt, or filth lodging there, and is often removed by waſhing the part clean with butter and beer: but when the yard itſelf is ſwelled, foment it twice a day with marſhmallows boiled in milk, to which may be added a little ſpirit of wine; anoint the excoriation with the white ointment, or waſh it with a ſponge dipped in lime, to a pint of which may be added two drams of ſugar of lead: the yard ſhould be ſuſpended up to the belly; and if the ſwelling ſhould increaſe with the inflammation, bleed, and give the cooling phyſic, anoint with ointment of elder, and apply the bread and milk poultice.

If a ſimple gonorrhœa or ſeminal gleet is obſerved to drip from the yard, (which is often the caſe in high-fed young horſes, where a relaxation of the glands and ſeminal veſſels has been brought on by frequent emiſſions) let the horſe be plunged every day into a river or pond; give him two or three rhubarb purges, at proper diſtances; and intermediately the following balls.

> Take of balſam of copivi, or Venice turpentine, olibanum, and maſtich powdered, of each two drams; bole armoniac half an ounce: mix up into a ball with honey, and give it night and morning, till the diſcharge leſſens, and then every night, till it goes off.

Balls prepared with rhubarb and turpentine may alſo be given for this purpoſe; two drams of the former, with half an ounce of the latter.

F A S

FASCES, in Roman antiquity, axes bound up together with rods or ſtaves, and carried before the Roman magiſtrates as a badge of their authority and office.

FASCETS, in the art of making glaſs, are the irons thruſt into the mouths of bottles, in order to convey them into the annealing tower.

FASCIA, in architecture, ſignifies any flat member having a conſiderable breadth and but a ſmall projecture, as the band of an architrave, larmier, *&c.*

Fascia lata, in anatomy. See Anatomy, p. 206.

FASCIÆ, in aſtronomy, certain parts on Jupiter's body reſembling belts or ſwaths. They are more lucid than the reſt of that planet, and are terminated by parallel lines, ſometimes broader and ſometimes narrower.

FASCIALIS, in anatomy. See Sartorius.

FASCINATION, a kind of witchcraft or enchantment ſuppoſed to operate by the influence either of the eye or tongue.

FASCINES, in fortification, faggots of ſmall wood, of about a foot diameter and ſix feet long, bound in the middle and at both ends. They are uſed in raiſing batteries, making chandeliers, in filling up the moat to facilitate the paſſage to the wall, in binding the ramparts where the earth is bad, and in making parapets of trenches to ſcreen the men.

F A T

FASHION-pieces, in the ſea-language, are two compaſſing pieces of timber, into which is fixed one on each ſide the tranſom. See Transom.

FAST, or Fasting, in general, denotes the abſtinence from food; but is more particularly uſed for ſuch abſtinence on a religious account.

FASTERMANS, among our Saxon anceſtors, were pledges or bondſmen, who were anſwerable for each other's good behaviour.

FASTI, in Roman antiquity, the calendar wherein were expreſſed the ſeveral days of the year, with their feaſts, games, and other ceremonies.

FAT, in anatomy, an oleaginous or butyraceous matter, ſecreted from the blood, and filling up the cavity of the adipoſe cells. Fat, properly and diſtinctly ſo called,

ed, is not secreted from glandules, but from the little arteries of the adipose membrane. Authors distinguish it into two kinds, which they express by the words *sevum* or *adeps*, and *pinguedo*. According to this distinction, there is no such thing as sevum or hard fat in the human body, its fat being all of that sort expressed by pinguedo, or soft and oily. That this oleaginous matter has a circulatory motion, or an egress into the veins, is very evident from the sudden consumption of it in many diseases, and from its vast diminution by exercise or labour.

FAT, in the sea-language, signifies the same with broad. Thus a ship is said to have a fat quarter, if the trussing in or tuck of her quarter be deep.

FAT is used also for several utensils; as, 1. A great wooden vessel, used for the measuring of malt, and containing a quarter or eight bushels. 2. A large brewing vessel, used by bewers to run their wort in. 3. A leaden pan or vessel for the making of salt at Droitwich.

FAT likewise denotes an uncertain measure of capacity. Thus a fat of ising-glass contains from $3\frac{1}{4}$ hundred weight to 4 hundred weight; a fat of unbound books, half a maund or four bales; of wire, from 20 to 25 hundred weight; and of yarn, from 220 to 221 bundles.

FATE, denotes an inevitable necessity depending upon a superior cause. It is also used to express a certain unavoidable designation of things, by which all agents, both necessary and involuntary, are swayed and directed to their ends.

FATES, in mythology. See PARCÆ.

FATHOM, a long measure containing six feet, used chiefly at sea for measuring the length of cables and cordage.

FATUUS IGNIS, in physiology, a meteor otherwise called Will-with-a-wisp. See WILL.

FAVIFORM, in general, something resembling a honeycomb. Surgeons give this appellation to certain ulcers, which emit a sanies through little holes, especially in the head.

FAVISSÆ, in antiquity, were, according to Festus and Gellius, cisterns to keep water in: but the favissæ in the Capitol at Rome were dry cisterns or subterraneous cellars, where they laid up the old statues, broken vessels, and other things used in the temple. These were much the same with what, in some of the modern churches, are called the archives and treasury.

FAUNALIA, in Roman antiquity, three annual festivals in honour of the god Faunus; the first of which was observed on the ides of February, the second on the 16th of the calends of March, and the third on the nones of December. The principal sacrifices on this occasion were lambs and kids. Faunus was a deity of the Romans only, being wholly unknown to the Greeks.

FAUNS, a kind of rural deities, among the ancient Romans, represented with horns on their heads, sharp-pointed ears, and the rest of their bodies like goats.

FAWN, among sportsmen, a buck or doe of the first year; or the young one of the buck's breed in its first year.

FE, or *St* FE, the capital of New Mexico: W. long. 109°, N. lat. 36°.

St FE *de bagota*, the capital of the kingdom of New Granada: W. long. 73°, N. lat. 4°. It is an archbishoprick and the seat of the governor of the province, *&c.*

St FE is also a town of Spain, in the province of Granada, situated on the river Xemil: W. long. 3° 45′, N. lat. 37° 20′.

St FE is also the capital of a province of the same name, in Terra Firma in South America, situated on the river of St Martha, 200 miles south of Carthagena: W. long. 77°, N. lat. 7° 25′.

FEALTY, in law, an oath taken on the admittance of any tenant, to be true to the lord of whom he holds his land.

FEAST, or FESTIVAL, in a religious sense, is a day of feasting and thanksgiving.

Among the ancients, feasts were instituted upon various accounts, but especially in memory of some favourable interposition of Providence. Thus, the Jews had their feast of passover, pentecost, and tabernacles; the Greeks their cerealia, panathenæa, *&c.* and the Romans their saturnalia, ambarvalia, *&c.* See PASSOVER, CEREALIA, *&c.*

FEATHER, in physiology, a general name for the covering of birds; it being common to all the animals of this class to have their whole body, or at least the greatest part of it, covered with feathers or plumage.

FEBRIFUGE, in medicine, an apellation given to such medicines as mitigate, or remove a fever.

FEBRIS, FEVER, in medicine. See FEVER.

FEBRUARY, in chronology, the second month of the year, reckoning from January, first added to the calendar of Romulus by Numa Pompilius.

February derives its name from Februa, a feast held by the Romans in this month, in behalf of the manes of the deceased; at which ceremony sacrifices were performed, and the last offices were paid to the shades of the defunct.

February, in a common year, consists only of twenty-eight days; but in the bissextile year, it has twenty-nine, on account of the intercallary day, added that year.

FECIALES, or FOECIALES, a college of priests instituted at Rome by Numa, consisting of twenty persons, selected out of the best families. Their business was to be arbitrators of all matters relating to war and peace, and to be the guardians of the public faith.

FEE, in Scots law, signifies a complete feudal property. See SCOTS LAW, title 10. Hence, where the bare liferent of any feudal subject is meant to be conveyed to A, and the absolute property to B; that meaning is expressed thus, to A in liferent, and to B in fee.

FEELERS, in natural history, a name used by some for the horns of insects.

FEELING, one of the five external senses, by which we obtain the ideas of solid, hard, soft, rough, hot, cold, wet, dry, and other tangible qualities.

FEINT, in fencing, a shew of making a thrust at one part

Fig. 1. Felis Leo
or
Lion

Fig. 2. Felis Tigris
or
Tiger

A Bell Sculp

part, in order to deceive the enemy, that you may really ftrike him in another.

A fimple feint is a mere motion of the wrift, without ftirring the foot.

FELAPTON, in logic, one of the fix firft modes of the third figure of fyllogifms; whereof the firft propofition is an univerfal negative, the fecond an univerfal affirmative, and the third a particular negative.

FELIN, a town of Livonia, about an hundred miles north-eaft of Riga.

FELIS, the CAT, a genus of quadrupeds belonging to the order of feræ, the characters of which are thefe: The fore teeth are equal; the molares or grinders have three points; the tongue is furnifhed with rough fharp prickles, and pointing backwards; and the claws are fheathed, and retractile. This genus comprehends feven genera, *viz.*

1. The LEO, or LION. The largeft lions are from eight to nine feet in length, and from four to eight feet high: thofe of a fmaller fize are generally about $5\frac{1}{2}$ feet long, and about $3\frac{1}{2}$ high. His head is very thick, and his face is befet on all fides with long bufhy yellowifh hair; this fhaggy hair extends from the top of the head to below the fhoulders, and hangs down to his knees: the belly and breaft are likewife covered with long hair. The reft of the body is covered with very fhort hair, excepting a bufh at the point of the tail. The ears are roundifh, fhort, and almoft entirely concealed under the hair of his front. The fhagginefs of the fore-part of his body makes the hinder part have a naked appearance. The tail is long and very ftrong; the legs are thick and flefhy; and the feet are fhort; the length of the claws is about an inch and a quarter, are of a whitifh colour, very crooked, and can be extended or retracted into the membranous fheath at pleafure: Their points are feldom blunted, as they are never extended but when he feizes his prey.

The female, or lionnefs, has no mane, or long hair about her head or fhoulders; in her we fee diftinctly the whole face, head, ears, neck, fhoulders, breaft, *&c.* all thefe parts being in fome meafure concealed under the long hair of the male, give the female a very different appearance: befides, fhe is confiderably lefs than the male. The hair of both male and female is of a yellowifh colour, and whitifh on the fides and belly.

In warm countries, quadrupeds in general are larger and ftronger than in the cold or temperate climates. They are likewife more fierce and hardy; all their natural qualities feem to correfpond with the ardour of the climate. The lions nourifhed under the fcorching fun of Africa or the Indies, are the moft ftrong, fierce, and terrible. Thofe of mount Atlas, whofe top is fometimes covered with fnow, are neither fo ftrong or fo ferocious as thofe of Biledulgerid or Zaara, whofe plains are covered with burning fand. It is in thefe hot and barren defarts, that the lion is the dread of travellers, and the fcourge of the neighbouring provinces. But it is a happy circumftance, that the fpecies is not very numerous: they even appear to diminifh daily. The Romans, fays Mr Shaw, brought many more lions out of Lybia for their public fhews, than are now to be found in that country. It is likewife remarked, that the lions in Turkey, Perfia, and the Indies are lefs numerous than formerly. As this formidable and courageous animal makes a prey of moft other animals, and is himfelf a prey to none, this diminution in the number of the fpecies can be owing to nothing but an increafe in the number of mankind: for it muft be acknowledged, that the ftrength of this king of animals is not a match for the dexterity and addrefs of a Negro or Hottentot, who will often dare to attack him face to face, and with very flight weapons.

The ingenuity of mankind augments with their number; that of other animals continues always the fame. All the noxious animals, as the lion, are reduced to a fmall number, not only becaufe mankind are become more numerous, but likewife becaufe they have become more ingenious, and have invented weapons which nothing can refift. This fuperiority in the numbers and induftry of mankind, at the fame time that it has broke the vigour of the lion, feems likewife to have enervated his courage. This quality, though natural, is exalted or lowered according to the good or bad fuccefs with which any animal has been accuftomed to employ his force. In the vaft defarts of Zaara; in thofe which feem to feparate two very different races of men, the Negroes and Moors, between Senegal and the boundaries of Mauritania; in thofe uninhabited regions above the country of the Hottentots; and, in general, in all the meridional parts of Africa and Afia, where mankind have difdained to dwell, lions are ftill as numerous, and as ferocious as ever. Accuftomed to meafure their ftrength by that of all other animals which they encounter, the habit of conquering renders them haughty and intrepid. Having never experienced the ftrength of man, or the power of his arms, inftead of difcovering any figns of fear, they difdain and fet him at defiance. Wounds irritate, but do not terrify them: they are not even difconcerted at the fight of numbers. A fingle lion of the Defart has been known to attack a whole caravan; and if, after a violent and obftinate engagement, he found himfelf weakened, he retreats fighting, always keeping his face to the enemy. On the other hand, the lions which live near the villages or huts of the Indians or Africans, being acquainted with man and the force of his arms, are fo daftardly as to fly and leave their prey at the fight of women or children.

This foftening in the temper and difpofition of the lion, fhews that he is capable of culture, and fufceptible, at leaft to a certain degree, of the impreffions that he receives: accordingly, hiftory informs us of lions yoked in triumphal chariots, trained to war, or the chace; and that, faithful to their mafters, they never employed their ftrength or courage but againft their enemies. It is, however, certain, that a lion taken young and brought up among domeftic animals, will eafily be accuftomed to live and fport with them; that he is mild and careffing to his mafter, efpecially when he is young; and that, if his natural ferocity fometimes breaks out, it

is

is rarely turned againſt thoſe who have been kind to him. But, as his paſſions are impetuous and vehement, it is not to be expected that the impreſſions of education will at all times be ſufficient to balance them: for this reaſon it is dangerous to l t him ſuffer hunger long, or to vex him by ill-timed teazings: bad treatment not only irritates him, but he remembers it long, and meditates revenge. On the other hand, he is exceedingly grateful, and ſeldom forgets benefits received. He has been often obſerved to diſdain weak or inſignificant enemies, to deſpiſe their inſults, and to pardon their offenſive liberties. When led into captivity, he will diſcover ſymptoms of uneaſineſs, without anger or peeviſhneſs: on the contrary, his natural temper ſoftens, he obeys his maſter, careſſes the hand that gives him food, and ſometimes gives life to ſuch animals as are thrown to him alive for prey; by this act of generoſity he ſeems to conſider himſelf as for ever bound to protect them; he lives peacably with them, allows them a part, and ſometimes the whole of his food, and will rather ſubmit to the pangs of hunger than fill his ſtomach with the fruit of his beneficence. We may likewiſe obſerve, that the lion is not a cruel animal; he kills rather from neceſſity than choice, never deſtroying more than he eats, and whenever his appetite is ſatisfied he is mild and peaceable.

The aſpect of the lion does not detract from the noble and generous qualities of his mind. His figure is reſpectable; his looks are determined; his gate is ſtately; and his voice is tremenduous. In a word, the body of the lion appears to be the beſt model of ſtrength joined to agility. The force of his muſcles is expreſſed by his prodigious leaps and bounds, often 20 feet at once; by the briſk motion of his tail, a ſingle ſweep of which is ſufficient to throw a man to the ground; by the eaſe with which he moves the ſkin of his face, and particularly of his forehead; and, laſtly, by the faculty of erecting and agitating the hair of his main when irritated.

Lions are very ardent in their amours: when the female is in ſeaſon, ſhe is often followed by eight or ten males, who roar inceſſantly, and enter into furious engagements, till one of them completely overcomes the reſt, takes peaceable poſſeſſion of the female, and carries her off to ſome ſecret receſs. The lionneſs brings forth her young in the ſpring, and produces but once every year.

All the paſſions of the lion, the ſoft paſſion of love not excepted, are exceſſive; the love of offſpring is extreme: the lionneſs is naturally weaker, leſs bold, and more gentle than the lion; but ſhe becomes perfectly rapacious and terrible when ſhe has young. Then ſhe exhibits more courage than the male; ſhe knows no danger; ſhe attacks indifferently men and all other animals, kills them, and carries them to her young ones, whom ſhe thus early inſtructs to ſuck their blood and tear their fleſh. She generally brings forth in the moſt ſecret and inacceſſible places; and, when afraid of a diſcovery, ſhe endeavours to conceal the traces of her feet, by returning frequently on her ſteps, or rather by effacing them with her tail; and, when the danger is great, ſhe carries off her young and conceals them ſome where elſe. But, when an actual attempt is made to deprive her of her young, ſhe becomes perfectly furious, and defends them till ſhe be torn to pieces.

The lion ſeldom goes abroad in the middle of the day; he goes round in the evening and night, in queſt of prey. He is afraid of fire, never approaches the artificial fires made by the ſhepherds for the protection of their flocks; he does not trace other animals by the ſcent, but is obliged to truſt to his eyes. Many hiſtorians have even miſrepreſented him as incapable of finding out his prey; but that he is obliged to the jackal, an animal of exquiſite ſcent, in order to provide for him, and that this animal either accompanies or goes before him for this purpoſe. The jackal is a native of Arabia, Lybia, *&c.* and, like the lion, lives upon prey; perhaps ſometimes he follows the lion, but it is with a view to pick up what he leaves behind, not to provide for him; for, being a ſmall and feeble animal, he ought rather to fly than to ſerve the lion.

The lion, when hungry, will attack any animal that preſents itſelf: but he is ſo very formidable, that all endeavour to avoid his rencountre; this circumſtance often obliges him to conceal himſelf, and lie in wait till ſome animal chances to paſs. He lies ſquat on his belly in a thicket; from which he ſprings with ſuch force and velocity, that he often ſeizes them at the firſt bound. He endures hunger longer than thirſt; he ſeldom paſſes water without drinking, which he does by lapping like a dog. For his ordinary ſubſiſtence, he requires about 15 pounds of raw fleſh each day.

The roaring of the lion is ſo ſtrong and loud, that it reſembles the rumbling of diſtant thunder. His roaring is his ordinary voice: but when he is irritated, his cry is ſhorter, repeated more ſuddenly, and is ſtill more terrible than the roaring: beſides he beats his ſides with his tail, ſtamps with his feet, erects and agitates the hair of his head and main, moves the ſkin of his face, ſhows his angry teeth, and lolls out his tongue.

The gait of the lion is ſtately, grave, and ſlow, though always in an oblique direction. His movements are not equal or meaſured, but conſiſt of leaps and bounds; which prevents him from ſtopping ſuddenly, and makes him often over-leap his mark. When he leaps upon his prey, he makes a bound of 12 or 15 feet, falls above it, ſeizes it with his fore-feet, tears the fleſh with his claws, and then devours it with his teeth.

The lion, however terrible, is hunted by large dogs, well ſupported by men on horſeback: they diſlodge him, and oblige him to retire. But it is neceſſary that both the dogs and horſes be trained before-hand; for almoſt every animal frets and flies as ſoon as he feels the very ſmell of a lion. His ſkin, although hard and firm, does not reſiſt either a ball or a javelin: however, he is ſeldom killed by a ſingle ſtroke; and is more frequently taken by addreſs than force. They put a live animal above a deep pit covered with light ſubſtances, and thus decoy him into the ſnare.

2. The Tiger. The ſize of this animal, according to ſome authors, is larger, and, according to others, ſomewhat leſs than the lion. M. de la Landemagon aſſures us, that he has ſeen a tiger in the Eaſt-Indies 15 feet long, including undoubtedly the length of the

Plate LXXIX.

Fig. 1. Felis Pardus *or* Panther

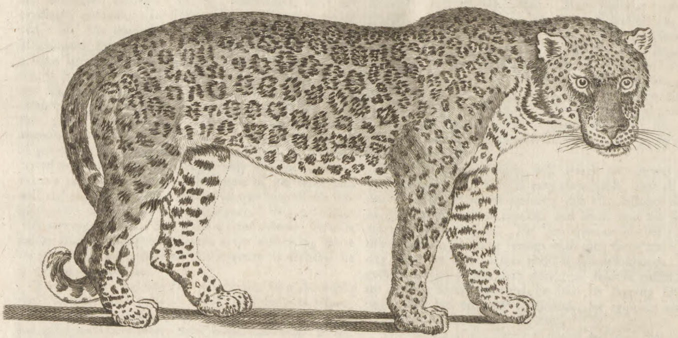
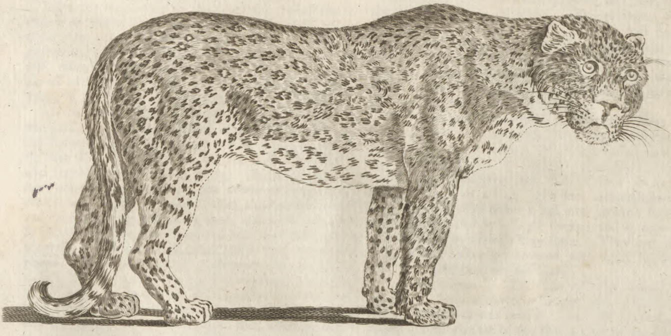


Fig. 2. Felis Leopardus *or* Leopard



A. Bell Sculpt.

the tail, which, ſuppoſing it to be four feet, makes the body of the tiger about 10 feet in length. The ſkeleton preſerved in the cabinet of the French king, indicates that the animal was about 7 feet long from the point of the muzzle to the origin of the tail; but then it muſt be conſidered that he was caught young, and lived all his days in confinement. The head of the tiger is large and roundiſh; and the ears are ſhort, and at a great diſtance from each other. The form of the body has a great reſemblance to that of the panther. The ſkin is of a darkiſh yellow colour, ſtriped with long black ſtreaks; the hair is ſhort, excepting on the ſides of the head, where it is about four inches long. The point of the tail is black, and the reſt of it is interſperſed with black rings. His legs and claws reſemble thoſe of the lion, only the legs are much ſhorter in proportion to the ſize of the animal.

The tiger is more ferocious, cruel, and ſavage than the lion. Although gorged with carnage, his thirſt for blood is not appeaſed; he ſeizes and tears in pieces a new prey with equal fury and rapacity, the very moment after devouring a former one; he lays waſte the country he inhabits; he neither dreads the aſpect nor the weapons of men; puts to death whole troops of domeſtic animals; and attacks young elephants, rhinoceros's, and ſometimes even braves the lion himſelf. The tiger ſeems to have no other inſtinct but a conſtant thirſt after blood, a blind fury which knows no bounds or diſtinction, and which often ſtimulates him to devour his own young, and to tear the mother in pieces for endeavouring to defend them. He lies in wait at the banks of rivers, *&c.* where the heat of the climate obliges the other animals to repair for drink. Here he ſeizes his prey, or rather multiplies his maſſacres: for he no ſooner kills one animal, than he flies with equal fury upon the next, with no other view but to plunge in his head into their bodies and drink their blood. However, when he kills a large animal, as a horſe or a buffalo, he ſometimes does not tear out the entrails on the ſpot; but, to prevent any interruption, he drags them off to the wood, which he executes with incredible ſwiftneſs. This is a ſufficient ſpecimen of the ſtrength of this rapacious animal.

Neither force, reſtraint, or violence can tame the tiger. He is equally irritated with good as with bad treatment: he tears the hand which nouriſhes him with equal fury as that which adminiſters blows: he roars, and is enraged at the ſight of every living creature. Almoſt every natural hiſtorian agrees in this horrible character. When viewing the beautiful tiger which is at preſent exhibiting in the city of Edinburgh, we at firſt ſuſpected that his character was not ſo bad or ferocious as repreſented by hiſtorians: he allowed the keeper not only to come near him, but to ſtroke his head and take his paw in his hand. However, this appeared to be only a forced complaiſance; he was chained ſo cloſe to the floor, that he had only juſt room to ſtand: he ſnarled and roared when his maſter troubled him more than he inclined; and, upon throwing him a piece of fleſh, his eyes inſtantly ſparkled with rage; he put himſelf in a poſture of defence, ſet up the moſt horrible roarings, and made ſeveral bounds to get at the keeper as well as the ſpectators.

It is happy for other animals, that the ſpecies of the tiger is not numerous, and that they are confined to the warm climates. They are found in Malabar, Siam, Bengal, the interior parts of Africa, and, in general, in all the regions that are inhabited by the elephant and rhinoceros.

The tiger has always been a more rare animal than the lion, and yet brings forth an equal number of young, namely, four or five at a litter. The female is furious at all times; but, when her young are attempted to be taken from her, her rage is redoubled: ſhe braves every danger; ſhe purſues the raviſhers, who are obliged, when hard preſſed, to drop one of the young in order to retard her motion; ſhe ſtops, takes it up, and carries it into ſome ſecret part of the foreſt; but ſhe inſtantly returns and purſues the hunters into their villages or boats.

The tiger moves the ſkin of his face, grinds his teeth, and roars, like the lion; but the ſound of his voice is different.

3. The PANTHER.—It is about the ſize of a large dog, and has a great reſemblance to a domeſtic cat. The tongue is rough and remarkably red; the teeth are ſtrong and ſharp; the ſkin is exceedingly beautiful, being of a yellow colour, variegated with roundiſh black ſpots, and the hair is ſhort.

The panther has a cruel and ferocious aſpect; his motions are briſk and lively; his cry reſembles that of an enraged dog, but more ſtrong and rough. He is not ſo perfectly ungovernable as the tiger: but, notwithſtanding all attempts to render him obedient and tractable, he may rather be ſaid to be ſubdued than tamed; for he never entirely loſes his natural ferocity. Accordingly, when kept with a view to hunting bucks, goats, or other animals, great care is neceſſary in training him, and ſtill greater in conducting him. When leading out to the field, they put him in a cage and carry him on a cart. When the game is ſprung, they open the door of the cage; he inſtantly ſprings towards the animal, often ſeizes him in a few bounds, throws him to the ground, and ſtrangles him. But, if he happens to miſs his aim, he becomes mad with rage, and ſometimes falls upon his maſter, who, in order to prevent accidents of this kind, generally carries along with him pieces of fleſh, or perhaps a lamb or a kid, which he throws to him in order to appeaſe his fury.

The panther is no where to be found but in Africa, and the regions of the Indies.

4. The ONCA or ONCE, is leſs than the panther; the tail is longer; the hair is likewiſe longer, and of a whitiſh grey colour. The once is eaſily tamed; and is employed in hunting in ſeveral parts of Aſia, where dogs are very ſcarce. He has not the delicate ſcent of a dog; does not trace other animals by the ſmell; neither can he run them down in a fair chaſe; but lies in wait for their approach, and then darts upon them unawares. He leaps ſo nimbly, that he eaſily clears a ditch or a wall ſeveral feet high: beſides, he often climbs trees, waits till ſome animal paſſes, and inſtantly leaps down upon them. This method of catching their prey, is practiſed by the panther and leopard, as well as the once.

5. The LEOPARD differs from the panther and the once in the beauty of his colour, which is a lively yellow, with ſmaller ſpots than thoſe of the two latter, and

difpofed in groups. He is larger than the once, and lefs than the panther. The manners and difpofition of the leopard are nearly the fame with thofe of the panther. He is never tamed or employed in hunting. The panther, once, and leopard, are inhabitants of Africa and the warmer regions of Afia. In general, thefe animals delight in thick forefts, and frequent the banks of rivers, and the neighbourhood of folitary villages, where they lie in wait to furprife domeftic animals and the wild beafts that come in queft of water. They feldom attack men, even when provoked. With regard to their fkins, they are all valuable, and make excellent furs.

6. The LYNX is about $2\frac{1}{2}$ feet long and 15 inches high. He has a great refemblance to the cat; but his ears are longer, and his tail is much fhorter; his hair is ftreaked with yellow, white, and black colours. The lynx is an inhabitant of Mufcovy, Poland, Canada, *&c.* his eyes are brilliant, his afpect is foft, and his air is gay and fprightly; like the cat, he covers his urine with earth; he howls fomething like the wolf, and is heard at a confiderable diftance; he does not run like the dog or wolf, but walks and leaps like a cat; he purfues his prey even to the tops of trees; neither wild-cats nor fquirrels can efcape him; he lies in wait for ftags, goats, hares, *&c.* and darts fuddenly upon them; he feizes them by the throat and fucks their blood, then opens the head and eats the brain; after this, he frequently leaves them and goes in queft of frefh prey; the colour of his fkin changes according to the feafon or the climate; the winter furs are more beautiful than thofe of fummer.

7. The CAT, is a well-known domeftic animal, and therefore requires no particular defcription. The wild-cat, the cat of Angora, *&c.* differ only in the length of their hair, and fome fmall varieties arifing from climate and their manner of living.

Of all domeftic animals, the character of the cat is the moft equivocal and fufpicious. He is kept, not for any amiable qualities, but purely with a view to banifh rats, mice, and other noxious animals from our houfes, granaries, *&c.* Although cats, when young, are playful and gay, they poffefs at the fame time an innate malice and perverfe difpofition, which increafes as they grow up, and which education learns them to conceal, but never to fubdue. Conftantly bent upon theft and rapine, though in a domeftic ftate, they are full of cunning and diffimulation; they conceal all their defigns; feize every opportunity of doing mifchief, and then fly from punifhment. They eafily take on the habits of fociety, but never its manners; for they have only the appearance of friendfhip and attachment. This difingenuity of character is betrayed by the obliquity of their movements, and the ambiguity of their looks. In a word, the cat is totally deftitute of friendfhip; he thinks and acts for himfelf alone. He loves eafe, fearches for the fofteft and warmeft places to repofe himfelf. The cat is likewife extremely amorous; and, which is very fingular, the female is more ardent than the male; fhe not only invites, but fearches after and calls upon him to fatisfy the fury of her defires; and, if the male difdains or flies from her, fhe purfues, bites, and in a manner compels him. This heat of paffion in females lafts but nine or ten days, and happens twice in the year, namely in the fpring and autumn; however, in fome it happens thrice or four times in the year. The female goes with young 55 or 56 days, and generally produces four or five at a litter. As the male has an inclination to deftroy the young, the female takes care to conceal them from him; and, when fhe is apprehenfive of a difcovery, fhe takes them up in her mouth one by one, and hides them in holes or inacceffible places. When fhe has nurfed a few weeks, fhe brings them mice, fmall birds, *&c.* in order to learn them to eat flefh. But, it is worth notice, that thefe careful and tender mothers fometimes become unnaturally cruel, and devour their own offspring.

The cat is incapable of reftraint, and confequently of being educated to any extent. However, we are told, that the Greeks in the ifland of Cyprus trained this animal to catch and devour ferpents, with which that ifland was greatly infefted. This however was not the effect of obedience, but of a general tafte for flaughter; for he delights in watching, attacking, and deftroying all kinds of weak animals indifferently. He has no delicacy of fcent, like the dog; he hunts only by the eye: neither does he properly purfue; he only lies in wait, and attacks animals by furprife: and after he has caught them, he fports with and torments them a long time, and at laft kills them (when his belly is full) purely to gratify his fanguinary appetite.

The eye of the cat differs greatly from that of moft other animals. The pupil is capable of a great degree of contraction and dilatation; it is narrow and contracted like a line during the day, round and wide in the dark; it is from this conformation of the eye that the cat fees beft in the night, which gives him a great advantage in difcovering and feizing his prey.

Although cats live in our houfes, they can hardly be called domeftic animals; they may rather be faid to enjoy full liberty; for they never act but according to their own inclination. Befides, the greateft part of them are half wild; they do not know their mafters, and frequent only the barns, out-houfes, *&c.* unlefs when preffed with hunger.

Cats have a natural antipathy at water, cold, and bad fmells. They love to bafk in the fun, and lie in warm places. They likewife have an affection for certain aromatic fmells; they are tranfported with the root of the valerian.

Cats take about eighteen months before they come to their full growth; but they are capable of propagation in twelve months, and retain this faculty all their life, which generally extends to nine or ten years. They eat flowly, and are peculiarly fond of fifhes. They drink frequently; their fleep is light; and they often affume the appearance of fleeping, when in reality they are meditating mifchief. They walk foftly, and without making any noife. As their hair is always dry, it eafily gives out an electrical fire, which becomes vifible when rubbed a-crofs in the dark. Their eyes likewife fparkle in the dark like diamonds.

The wild, or favage cat, couples with the domeftic one, and is confequently the fame fpecies. It is not unufual for domeftic cats, both male and female, when ftimulated by love, to repair to the woods in queft of thefe

favage

Plate LXXX.

Fig. 4.
FER DE FOURCHETTE

Fig. 5. FESS

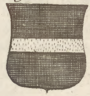


Fig. 6.
FITCHEE

Fig. 7.
FLORY

Fig. 8.
FOURCHEE

Fig. 9.
FRET

Fig. 10.
FUSIL

Fig. 1.
FELIS LINX

Fig. 3.
ORMICA HERCULANEA
LARGEST ANT

Fig. 2.
FISTULAPIA TABACARIA or TOBACCO PIPE FISH

A Bell Sculp^t

vage cats. The only difference between them is, that the ſavage cat is ſtronger, larger, and more ferocious. The cat is a native of almoſt every country in the world; and all the varieties in their appearance may be reaſonably enough attributed to the climates which produce them. See figures of the principal ſpecies of the FELIS, on Plate LXXVIII, LXXIX, and LXXX.

FELKIRK, a town of Auſtria, in Germany, thirty-five miles ſouth eaſt of Conſtance.

FELLOWSHIP, or COMPANY, in arithmetic. See ARITHMETIC, p. 386.

FELO DE SE, in law, a perſon that lays deliberately violent hands on himſelf, and is the occaſion of his untimely death, whether by hanging, drowning, ſtabbing, ſhooting, or any other way.

FELON, in law, a perſon guilty of felony. See FELONY.

FELONY, in law, a capital crime, next in degree to petit treaſon, and committed with an evil intention; ſuch are murder, theft, ſuicide, ſodomy, rape, *&c.*

FELT, in commerce, a ſort of ſtuff deriving all its conſiſtence merely from being fulled, or wrought with lees and ſize, without either ſpinning or weaving.

Felt is made either of wool alone, or of wool and hair. Thoſe of French make, $3\frac{1}{2}$ yards long, and $1\frac{1}{2}$ broad, for cloaks, pay each 2 l. 14 s. $1\frac{80}{100}$ d. on importation; and draw back 1 l. 12 s. 3 d. on exporting them again.

FELTRI, a town of Italy, ſubject to Venice, thirty-five miles north of Padua.

FELUCCA, in ſea-affairs, a little veſſel with ſix oars, frequent in the Mediterranean, which has this peculiarity, that its helm may be applied either in the head or ſtern, as occaſion requires.

FEMALE, a term peculiar to animals, ſignifying that ſex which conceives and generates its young within itſelf.

FEMININE, in grammar, one of the genders of nouns. The feminine gender ſerves to intimate that the noun belongs to the female. In Latin, the femine gender is moſt commonly diſtinguiſhed by the article *hæc*, as it is in the Greek by ἡ. In the French, the article *la* commonly denotes this gender; but we have no ſuch diſtinction by articles in the Engliſh language.

FEMUR, OS FEMORIS, in anatomy. See ANATOMY, p. 182.

FEN, a place overflowed with water, or abounding with bogs.

FENCE, in country-affairs, a hedge, wall, ditch, bank, or other incloſure, made around gardens, woods, cornfields, *&c.*

The chief reaſon why wood-lands and plantations ſo ſeldom proſper, is in a great meaſure owing to the neglect of fencing them round to keep out the cattle. This neglect prevails much in the northern parts of this iſland, though the uſe of fences is certainly more neceſſary there than in the ſouth, as the lands require more ſhelter and warmth. There are ſeveral ways of fencing lands, but the uſual is that of hedging it with either white or black thorn, crab, holly, alder, or furze, *&c.*

FENCE MONTH, the month wherein deer begin to fawn, during which it is unlawful to hunt in the foreſt.

It commences fifteen days before mid-ſummer, and ends fifteen days after it. This month, by ancient foreſters is called defence-month.

FENCING, the art of making a proper uſe of the ſword, as well for attacking an enemy, as for defending one's ſelf.

FENNEL, in botany. See ANETHUM.

FEOD, the ſame with fee. See FEE.

FEODAL, and FEODATORY. See FEUDAL, and FEUDATORY.

FEOFFMENT, in law, is a gift or grant of any manors, meſſuages, lands, or tenements, to another in fee; that is, to him and his heirs for ever, by delivery of ſeiſin, and poſſeſſion of the eſtate granted.

FERÆ, in zoology, an order of quadrupeds, the diſtinguiſhing characters of which are, that all the animals belonging to it have ſix fore-teeth in each jaw, and the canine, or dog-teeth, conſiderably long.

Under this order are comprehended the following genera, *viz.* the phoca, canis, felis, viverra, muſtela, urſus, didelphis, talpa, ſorex, and erinaceus. See CANIS, FELIS, *&c.*

FERALIA, in antiquity, a feſtival obſerved among the Romans on February 21ſt, or, according to Ovid, on the 17th of that month, in honour of the manes of their deceaſed friends and relations. During the ceremony, which conſiſted in making preſents at their graves, marriages were forbidden, and the temples of the divinities ſhut up; becauſe they fancied that, during this feſtival, the ghoſts ſuffered no pains in hell, but were permitted to wander about their graves, and feaſt upon the meats prepared for them.

FER DE FOURCHETTE, in heraldry, a croſs having at each end a forked iron, like that formerly uſed by ſoldiers to reſt their muſquets on. It differs from the croſs fourché, the ends of which turn forked, whereas this has that ſort of fork fixed upon the ſquare end. See Plate LXXX. fig. 4.

FER DE MOULIN, *milrinde, inke de moulin*, in heraldry, is a bearing ſuppoſed to repreſent the iron-ink or ink of a mill, which ſuſtains the moving mill-ſtone.

FERDEN, or VERDEN, a city of Germany, ſubject to Hanover; it is ſituated in lower Saxony, on the river Aller, twenty ſix miles ſouth eaſt of Bremen: E. lon. 9°, and N. lat. 53° 24′.

FERENTARII, in Roman antiquity, were auxiliary troops, lightly armed; their weapons being a ſword, bow, arrows, and a ſling.

FERETINO, a city and biſhop's ſee of Italy, about fifty miles eaſt of Rome: E. long. 14° 5′, and N. lat. 41° 45′.

FERIÆ, in Roman antiquity, holidays, or days upon which they abſtained from work.

The Romans had two kinds of feriæ: 1. The public, common to all the people in general. 2. The private, which were only kept by ſome private families.

The public feriæ were fourfold: 1. Stativæ feriæ, holidays which always fell out upon the ſame day of the

the month, and were marked in the calendar; of these the chief were the agonalia, carmentalia, and lupercalia. 2. Conceptivæ feriæ, holidays appointed every year upon certain or uncertain days by the magiſtrates or the pontiff; ſuch were the latinæ, paganalia, compitalia, *&c.* See PAGANALIA, *&c.* 3. Imperativæ feriæ, holidays commanded or appointed by the authority of the conſuls or prætors; of this kind we may reckon the lectiſternium. See LECTISTERNIUM. 4. Nundinæ, the days for fairs. See NUNDINÆ.

FERIÆ LATINÆ were inſtituted by Tarquinius Superbus, who having overcome the Tuſcans, made a league with the Latins, and propoſed to them to build a temple in common to Jupiter Latialis, in which both nations might meet, and offer ſacrifice for their common ſafety. At this feſtival a white bull was ſacrificed; and each town, both of the Latins and Romans, provided a certain quantity of meat, wine, and fruits. At firſt the ſolemnity continued but one day; after the expulſion of the kings, the ſenate added a third, a fourth, and ſo on to ten days.

FERIA, in the Romiſh breviary, is applied to the ſeveral days of the week; thus Monday is the feria ſecunda, Tueſday the feria tertia; though theſe days are not working days, but holidays. The occaſion of this was, that the firſt Chriſtians were uſed to keep the eaſter week holy, calling Sunday the prima feria, *&c.* whence the term feria was given to the days of every week. But beſides theſe, they have extraordinary feriæ, *viz.* the three laſt days of paſſion-week, the two following eaſter-day, and the ſecond feriæ of rogation.

FERMANACH, a county of Ireland, in the province of Ulſter, the chief town of which is Inniſkilling.

FERMENT, any body which, being applied to another, produces fermentatton.

Ferments are either matters already in the act of fermentation, or that ſoon run into this act. Of the firſt kind are the flowers of wine, yeaſt, fermenting beer, or fermenting wine, *&c.* and of the ſecond are the new expreſſed vegetable juices of ſummer-fruit.

Among diſtillers, ferments are all thoſe bodies which, when added to the liquor, only correct ſome fault therein, and, by removing ſome obſtacle to fermentation, forward it by ſecondary means; as alſo ſuch as, being added in time of fermentation, make the liquor yield a larger proportion of ſpirit, and give it a finer flavour.

FERMENTATION, may be defined a ſenſible internal motion of the conſtituent particles of a moiſt, fluid, mixt or compound body; by the continuance of which motion, theſe particles are gradually removed from their former ſituation or combination, and again, after ſome viſible ſeparation is made, joined together in a different order and arrangement. See CHEMISTRY. p. 94.

FERMO, a port-town of Italy, ſituated on the gulf of Venice, about thirty miles ſouth of Ancona. It is an archbiſhop's ſee.

FERN, *filix*, in botany. See FILIX, OSMUNDA, ACROSTICUM, *&c.*

FERNANDO, or FERNANDES, an iſland in the Pacific ocean: W. long. 83°, S. lat. 33°.

FERRARA, a city and archbiſhop's ſee of Italy: E. long. 12° 6′, N. lat. 44° 50′.

FERRE, or *le* FERRE, a city of Picardy, in France, forty miles ſouth-eaſt of Amiens: E. long. 3° 26′, N. lat. 49° 45′.

FERRET, in zoology. See MUSTELA.

FERRETS, among glaſs-makers, the iron with which the workmen try the melted metal, to ſee if it be fit to work.

It is alſo uſed for thoſe irons which make the rings at the mouth of bottles.

FERRETTO, in glaſs-making, a ſubſtance which ſerves to colour glaſs.

This is made by a ſimple calcination of copper, but it ſerves for ſeveral colours: there are two ways of making it, the firſt is this. Take thin plates of copper, and lay them on a layer of powdered brimſtone, in the bottom of a crucible; over theſe lay more brimſtone, and over that another lay of the plates, and ſo on alternately till the pot is full. Cover the pot, lute it well, place it in a wind furnrce, and make a ſtrong fire about it for two hours. When it is taken out and cooled, the copper will be found ſo calcined, that it may be crumbled to pieces between the fingers, like a friable earth. It will be of a reddiſh, and, in ſome parts, of a blackiſh colour. This muſt be powdered and ſifted fine for uſe.

FERRO, W. long. 19.°, N. lat. 28°, the moſt weſterly of the Canary iſlands, near the African coaſt, where the firſt meridian was lately fixed in moſt maps; but now, the geographers of almoſt every kingdom make their reſpective capitals the firſt meridian, as we do London.

FERRO, ſome little iſlands ſituated in the northern ocean, 200 miles north-weſt of the Orcades, and as many ſouth-eaſt of Iceland: W. long. 7°, N. lat. 63°.

FERROL, a ſea-port-town of Spain, in the principality of Galicia, ſituated on a bay of the Atlantic ocean, twenty miles north-eaſt of the Groyne, and fifty miles north of Compoſtella, a good harbour, where the Spaniſh ſquadrons frequently ſecured themſelves in the late war: W. long 8° 40′, N. lat. 43° 30′.

FERRUGINOUS, any thing partaking of iron, or which contains particles of that metal.

FERRUGO, RUST. See RUST.

FERRUM, IRON. See IRON.

FERRY, a liberty by preſcription, or the king's grant, to have a boat for paſſage, on a firth or river, for carrying paſſengers, horſes, *&c.* over the ſame for a reaſonable toll.

FERTILITY, that quality which denominates a thing fruitful or prolific.

FERULA, in botany, a genus of the pentandria digynia claſs. The fruit is oval, compreſſed, and has three furrows on each ſide. There are nine ſpecies, none of them natives of Britain.

FESSE, in heraldry, one of the nine honourable ordinaries, consisting of a line drawn directly across the shield, from side to side, and containing the third part of it, between the honour-point and the nombril.

It represents a broad girdle or belt of honour, which knights at arms were anciently girded with. See Plate LXXX. fig. 5.

FESSE POINT, is the exact centre of the escutcheon. See POINT.

FESSE-WAYS, or *in* FESSE, denotes any thing borne after the manner of a fesse; that is, in a rank across the middle of the shield.

Party per FESSE, implies a parting across the middle of the shield, from side to side, through the fesse point.

FESTI DIES, in Roman antiquity, certain days in the year, devoted to the honour of the gods.

Numa, when he distributed the year into twelve months, divided the same into the dies festi, dies profesti, and dies intercisi.

The festi were again divided into days of sacrifices, banquets, games and feriæ. See SACRIFICE, EPULÆ, LUDI, and FERIÆ.

The profesti were those days allowed to men for the administration of their affairs, whether of a public or private nature: these were divided into fasti, comitiales, comperendini, stati, and præliares See FASTI, COMITIALES, *&c.*

The intercisi were days common both to gods and men, some parts of which were allotted to the service of the one, and some to that of the other.

FESTINO, in logic, the third mood of the second figure of the syllogism, the first proposition whereof is an universal negative, the second a particular affirmative, and the third a particular negative: as in the following example:

FES No bad man can be happy,
TI Some rich men are bad men:
NO *Ergo*, some rich men are not happy.

FESTIVAL, the same with feast. See FEAST.

FESTOON, in architecture and sculpture, *&c.* an ornament in form of a garland of flowers, fruits and leaves, intermixed or twisted together.

FESTUCA, in botany, a genus of grasses, belonging to the triandria digynia class. The calix has two valves; and the spica is oblong and cylindrical. There are sixteen species, eleven of which are natives of Britain, *viz.* the ovina, or sheep's fescue-grass; the rubiuscula, or hard fescue-grass; the rubra, or purple fescue-grass; the bromoides, or barren fescue-grass; the myuros, or wall fescue-grass; the pratensis, or meadow fescue-grass; the elatior, or tall fescue-grass; the decumbens, or small fescue-grass; the fluitans, or flat fescue grass; the loliacea, or spiked fescue-grass; and the sylvatica, or wood fescue grass.

FETIPOUR, a city of the hither India, twenty-five miles west of Agra: E. long. 78° 40′, N. lat. 27°.

FETLOCK, in the menage, a tuft of hair growing behind the pastern joint of many horses; for those of a low size have scarce any such tuft.

FEUD, the same with fee. See FEE.

FEUDAL, or FEODAL, denotes any thing belonging to a fee. See FEE.

FEUDATORY, or FEODATORY, a tenant who formerly held his estate by feodal service.

FEU DUTY, in Scots law, is the annual rent or duty which a vassal, by the tenor of his right, becomes bound to pay to his superior. See SCOTS LAW, title 11.

FEU-HOLDING, in Scots law, is that particular tenor by which a vassal is taken bound to pay an annual rent or feu-duty to his superior. See SCOTS LAW, tit. 11.

FEVER, in medicine. See MEDICINE.

FEVERFEW, in botany. See MATRICARIA.

FEVERSHAM, a port-town of Kent, and one of the cinqueports See CINQUEPORT.

It stands seven miles west of Canterbury.

FEZ, the capital of the empire of Fez and Morocco, in Africa: W. long 6°, N. lat. 33° 30′.

It is a large and populous city, and the usual residence of the emperor.

FIAR, in Scots law, the person vested in the feudal property of a subject. See FEE.

FIASCONE, a city and bishop's see of Italy, about twelve miles south of Orvietto.

FIAT, in law, a short order or warrant signed by a judge, for making out and allowing certain processes.

FIBRARIÆ, a class of fossils, naturally and essentially simple, not inflammable nor soluble in water, and composed of parallel fibres, some shorter, others longer; their external appearance being bright, and in some degree transparent: add to this, that they never give fire with steel, nor ferment with, or are soluble in acid menstrua.

FIBRE, in anatomy, a perfectly simple body, or at least as simple as any thing in the human structure; being fine and slender like a thread, and serving to form other parts. Hence some fibres are hard, as the bony ones; and others soft, as those destined for the formation of all the other parts.

The fibres are divided also, according to their situation, into such as are straight, oblique, transverse, annular, and spiral; being found arranged in all these directions, in different parts of the body.

FIBROSE, something consisting of fibres, as the roots of plants. See ROOT.

FIBULA, in anatomy. See ANATOMY, p. 184.

FICARIA, in botany. See RANUNCULUS.

FICEDULA, in ornithology. See MOTACILLA.

FICOIDEA, in botany. See AIZOON.

FICOIDES, a name given to several distinct plants, as the mesembryanthemum musa, and opuntia. See MESEMBRYANTHEMUM.

FICTION. See FABLE.

FICUS, the FIG-TREE, in botany, a genus of the polygamia polyœcia class. The common receptacle is turbinated, fleshy, and conceals the floscules. The calix of the male consists of three segments; it has no corolla, but has three stamina: the calix of the female consists of five segments; it has no corolla, and but one pistil, and one seed. There are seven species, all of them natives of warm climates. The fruit of the fig-tree is a soft emollient sweet, and as such enters into several compositions.

FIDA, a town on the flave-coaft of Guinea: E. long. 3°, N. lat. 6°.

FIDD, in the fea-language, an iron, or wooden pin, to fplice and faften ropes together.

FIDD-HAMMER, one whofe handle is a fidd, or made taper-wife.

FIDDLE. See VIOLIN.

FIDEI COMMISSUM, in Roman antiquity, an eftate left in truft with one perfon, for the ufe of another. See TRUSTEE.

FIDICINALES, mufcles of the fingers. See LUMBRICALES.

FIEF, or FEE. See FEE.

FIELD, in agriculture, a piece of ground inclofed, whether for tillage or pafture.

FIELD, in heraldry, is the the whole furface of the fhield, or the continent, fo called becaufe it containeth thofe atchievements anciently acquired in the field of battle. It is the ground on which the colours, bearings, metals, furs, charges, *&c.* are reprefented. Among the modern heralds, field is lefs frequently ufed in blazoning than fhield or efcutcheon. See the article SHIELD, *&c.*

FIELD-BOOK, in furveying, that wherein the angles, ftations, diftances, *&c.* are fet down.

FIELD-COLOURS, in war, are fmall flags of about a foot and half fquare, which are carried along with the quarter-mafter general, for marking out the ground for the fquadrons and battalions.

FIELD-FARE, in ornithology. See TURDUS.

FIELD-OFFICERS, in the art of war. See OFFICER.

FIELD-PIECES, fmall cannons, from three to twelve pounders, carried along with an army in the field.

FIELD-STAFF, a weapon carried by the gunners, about the length of a halbert, with a fpear at the end; having on each fide ears fcrewed on, like the cock of a match-lock, where the gunners fcrew in lighted matches, when they are upon command; and then the field-ftaffs are faid to be armed.

FIELD WORKS, in fortification, are thofe thrown up by an army in befieging a fortrefs, or by the befieged to defend the place. Such are the fortifications of camps, highways, *&c.*

Elyfian FIELDS. See ELYSIAN.

FIERI FACIAS, in law, a writ that lies where a perfon has recovered judgment for debt or damages in the king's courts againft one, by which the fheriff is commanded to levy the debt and damages on the defendant's goods and chattels.

FIFE, in mufic, is a fort of wind-inftrument, being a fmall pipe. See PIPE.

FIFE, in geography, a county of Scotland bounded by the Frith of Tay on the north; by the German fea on the eaft; by the Frith of Forth on the fouth; and by Monteeth and Stirling on the weft.

FIFE-RAILS, in a fhip, are thofe that are placed on banifters, on each fide of the top of the poop, and fo along with hances or falls.

They reach down to the quarter-deck, and to the ftair of the gang-way.

FIFTH, in mufic, one of the harmonical intervals or concords. See MUSIC.

FIG, or fig-tree. See FICUS.

FIGWORT, a plant called by the botanifts fcrophularia. See SCROPHULARIA.

FIGURAL, FIGURATE, or FIGURATIVE, a term applied to whatever is expreffed by obfcure refemblances. The word is chiefly applied to the types and myfteries of the Mofaic law; as alfo to any expreffion whch is not taken in its primary and literal fenfe.

FIGURE, in phyfics, expreffes the furface or terminating extremities of any body.

FIGURES, in arithmetic, are certain characters whereby we denote any number which may be expreffed by any combination of the nine digits, *&c.* See ARITHMETIC.

FIGURE, among divines, is ufed for the myfteries reprefented under certain types.

FIGURE, in dancing, denotes the feveral fteps which the dancer makes in order and cadence, confidered as they mark certain figures on the floor.

FIGURE, in painting and defigning, denotes the lines and colours which form the reprefentation of any animal, but more particularly of a human perfonage.

FIGURE, in compofition. See ALLEGORY, APOSTROPHE, HYPERBOLE, PERSONIFICATION, *&c.*

FIGURED, in general, fomething marked with figures.

The term figured is chiefly applied to ftuffs, whereon the figures of flowers, and the like, are either wrought or ftamped.

FILAMENT, in phyfiology and anatomy. See FIBRE.

FILAMENTS, among botanifts, is particularly ufed for the ftamina. See BOTANY, Sect. II.

FILBERT, or FILBERD, the fruit of the corylus, or hazel. See CORYLUS.

FILE, among mechanics, a tool ufed in metal, *&c.* in order to fmooth, polifh, or cut.

This inftrument is of iron, or forged fteel, cut in little furrows, with chiffels and a mallet, this and that way, and of this or that depth, according to the grain or touch required. After cutting the file, it muft be tempered with a compofition of chimney foot, very hard and dry, diluted, and wrought up with urine, vinegar, and falt; the whole being reduced to the confiftence of muftard. Tempering the files confifts in rubbing them over with this compofition, and covering them in loam; after which they are put in a charcoal fire, and taken out by that time they have acquired a cherry colour, which is known by a fmall rod of the fame fteel put in along with them. Being taken out of the fire, they are thrown into cold fpring-water; and when cold, they are cleaned with charcoal and a rag; and being clean and dry, are kept from ruft by laying them up in wheat bran. Iron files require more heating than fteel ones. Files are of different forms, fizes, cuts, and degrees of finenefs, according to the different ufes and occafions for which they are made.

FILE, in the art of war, a row of foldiers, ftanding one behind another, which is the depth of the battalion or

or ſquadron. The files of a battalion of foot are generally three deep; as are ſometimes thoſe of a ſquadron of horſe. The files muſt be ſtraight, and parallel one to another.

FILIGRANE, or FILIGREE-WORK, any piece of gold or ſilver-work that is curiouſly done with grains or drops on the filaments or threads.

FILIPENDULA, in botany. See SPIRÆA.

FILIX, in botany, an order of the cryptogamia claſs of plants. See BOTANY, p. 636.

FILLET, in anatomy. See FROENUM.

FILLET, or FILET, in architecture, a little ſquare member, ornament, or moulding, uſed in divers places, and upon divers occaſions, but generally as a crowning over a greater moulding.

FILLET, in heraldry, a kind of orle or bordure, containing only a third or fourth part of the breadth of the common bordure. It is ſuppoſed to be withdrawn inwards, and is of a different colour from the field. It runs quite round, near the edge, as a lace over a cloak.

FILLET, in the menage, the loins of an horſe, which begin at the place where the hinder part of the ſaddle reſts.

FILLER HORSE, one yoked immediately to a cart.

FILLY, a term among horſe-dealers, to denote the femaleor mare-colt.

FILM, a thin ſkin or pellicle. In plants, it is uſed for that thin, woody ſkin, which ſeparates the ſeeds in the pods, and keeps them apart.

FILTER, or FILTRE, in chemiſtry, a ſtrainer commonly made of bibulous or filtering paper in the form of a funnel, through which any fluid is paſſed, in order to ſeparate the groſs particles from it, and render it limpid.

FIMBRIÆ, denotes appendages diſpoſed by way of fringe round the border of any thing.

FIMBRIATED, in heraldry, an ordinary with a narrow bordure or hem of another tincture.

FIN, in natural hiſtory, a well-known part of fiſhes, conſiſting of a membrane ſupported by rays, or little bony or cartilaginous oſſicles.

FINAL, in general, whatever terminates or concludes a thing.

FINAL LETTERS, among Hebrew grammarians, five letters ſo called, becauſe they have a different figure at the end of words from what they have in any other ſituation.

FINAL, in geography, a port town of Italy, ſubject to Genoa, and ſituated on the Mediterranean, about thirty-ſeven miles ſouth-weſt of that city.

FINANCES, in the French polity, ſignify the revenues of the king and ſtate.

FINCH-KIND, in ornithology, an appellation given to a genus of birds, known among authors by the name of fringilla. See FRINGILLA.

FINE, in law, has divers ſignifications, it being ſometimes taken for a ſum of money advanced and paid for the income of lands. It is likewiſe uſed in another ſenſe, where a ſum is paid as an amends, or by way of puniſhment for an offence committed.

FINERS *of gold and ſilver*, are thoſe who ſeparate theſe metals from coarſer ores. See REFINERS.

FINERY, in the iron works, one of the forges at which the iron is hammered and faſhioned into what they call a bloom, or ſquare bar.

FINGERS, in anatomy, the extreme part of the hand divided into five members. See ANATOMY, part I. and II.

FINISTERRA, the moſt weſterly cape or promontory of Spain, in 10° 15′ W. long. and 43° N. lat. This cape is likewiſe the moſt weſterly part of the continent of Europe.

FINITE, ſomething bounded or limited, in contradiſtinction to infinite See INFINITE.

FINLAND, a province of Sweden, lying northward of the gulph of Finland, and eaſtward of the Bothnick gulph. It is a frontier province, bounded by Ruſſia on the eaſt.

FIR-TREE, in botany. See PINUS.

FIRE, a general name, by which men ſeem to underſtand a certain ſenſation or complex notion of light, heat, burning, melting, *&c.*

The power of fire is ſo great, its effects ſo extenſive, and the manner of its acting ſo wonderful, that ſome of the wiſeſt nations of old reverenced and worſhipped it, as the ſupreme deity. Some of the chemiſts alſo, after they had diſcovered its ſurpriſing operations, ſuſpected it to be an uncreated being: and indeed the moſt famous of them have acknowledged it as the ſource of all their knowledge; and hence have profeſſed themſelves philoſophers by fire, nor thought they could be honoured with a nobler title. Now, amongſt all the wonderful properties of fire, there is none more extraordinary than this, that though it is the principal cauſe of almoſt all the ſenſible effects that continually fall under our obſervation, yet it is itſelf of ſo infinitely a ſubtile nature, that it illudes the moſt ſagacious enquiries, nor ever comes within the cognizance of our ſenſes. Fire is generally divided into three kinds or ſpecies, *viz.* celeſtial, ſubterraneous, and culinary.

By celeſtial fire is principally underſtood that of the ſun, without regard to that of the fixed ſtars, though this perhaps may be of the ſame nature.

By ſubterraneous fire we underſtand that which maniſeſts itſelf in fiery eruptions of the earth, volcanoes, or burning mountains; or by any other effects it produces in mines, or the more central parts of the earth.

By culinary fire we mean that employed in all chemical operations, and the common occaſions of life.

The ſun's heat appears to be the actuating principle, or general inſtrument of all the operations in the animal, vegetable, atmoſpherical, marine, and mineral kingdoms.

Fire, conſidered in itſelf, ſeems to exiſt in the greateſt purity and perfection in the celeſtial regions; at leaſt we are inſenſible of any conſiderable ſmoke it yields;

yields: for the rays of light come to us from the ſun, unmixed with any of that groſs, feculent, or terreſtrial matter, found in culinary and ſubterranean fires: but, allowing for this difference, the effects of the ſolar fire appear the ſame as thoſe of culinary fire.

If we to examine the effects of ſubterraneous fires, we ſhall find them the ſame with thoſe produced by culinary fire. Thus, burnt coals, cinders, and melted minerals, are thrown up by Veſuvius and other burning mountains. Warm nephritical exhalations, natural hot ſprings, ſteams, vapours, ſmoke, *&c.* are found in ſeveral parts of the globe, riſing nearly in the ſame manner as if they were produced by the heat of a furnace. Whence it appears, that ſubterraneous fires are of the ſame nature with the culinary.

As men generally affix to the word fire, a complex idea of burning, light, heat, melting, *&c.* this idea ſhould be analyſed, in order to ſee what parts are eſſential, and what precarious or arbitrary.

We frequently find the effects of fire produced where no viſible fire appeared. Thus the fingers are eaſily burnt by an iron heated below the degree of ignition, or ſo as to be no ways viſibly red-hot or fiery: whence it follows, that the eye is no judge of fire.

So likewiſe the touch gives no poſitive notice of any degree of fire below the natural heat of the body, or any ſo great as to deſtroy the organ.

Again, the effects of fire are often produced without any manifeſt ſigns of burning, melting, *&c.* as in evaporations, *&c.* If this method of excluſion and rejection were purſued to its due length, we ſhould perhaps find no criterion, infallible mark, or characteriſtic of fire in general, but that of a particular motion ſtruggling among the minute parts of bodies, and tending to throw them off at the ſurface. If this ſhould prove the caſe, then ſuch a motion will be the form and eſſence of fire; and which, being preſent, makes fire alſo preſent: and, when abſent, makes fire alſo abſent: whence to produce fire, and produce this motion in bodies, will be one and the ſame thing.

The great and fundamental difference in reſpect to the nature of fire is, whether it be originally ſuch, formed thus by the Creator himſelf at the beginning of things; or whether it be mechanically producible from other bodies, by inducing ſome alterations in the particles thereof. The former opinion is mantained by Homberg, Boerhaave, the younger Lemery, and s'Graveſande; the latter is chiefly ſupported by the Engliſh philoſophers, lord Bacon, Mr Boyle, and Sir Iſaac Newton.

Bacon, in the treatiſe De Forma Calicli, deduces, from a great number of particulars, that heat in bodies is no other than motion ſo and ſo circumſtanced; ſo that to produce heat in a body, nothing is required but to excite a certain motion in the parts thereof.

Boyle ſeconds him in an expreſs treatiſe of the mechanical origin of heat and cold, and maintains the ſame doctrine with new obſervations and experiments; as a ſpecimen of which, we ſhall hear give the two following.

1. In the production of heat, ſays that able philoſopher, there appears nothing on the part either of the agent or patient, but motion and its natural effects. When a ſmith briſkly hammers a piece of iron, the metal thereby becomes exceedingly hot; yet there is nothing to make it ſo, except the forcible motion of the hammer impreſſing a vehement and variouſly determined agitation on the ſmall parts of the iron, which, being a cold body before, grows, by that ſuper-induced commotion of its ſmall parts, hot: firſt, in a more looſe acceptation of the word, with regard to ſome other bodies, compared with which it was cold before; then ſenſibly hot, becauſe this agitation ſurpaſſes that of the points of our fingers; and in this inſtance oftentimes the hammer and anvil continue cold after the operation; which ſhews, that the heat acquired by the iron was not communicated by either of thoſe implements, as heat; but produced in it by a motion, great enough ſtrongly to agitate the parts of ſo ſmall a body as the piece of iron, without being able to have the like effect upon ſo much greater maſſes of metal as the hammer and the anvil: though if the percuſſions were often and briſkly renewed, and the hammer were ſmall, this alſo might be heated: whence it is not neceſſary that a body itſelf be hot to give heat.

2. If a large nail be driven by a hammer into a plank of wood, it will receive ſeveral ſtrokes on its head before it grows hot; but when it is once driven to the head, a few ſtrokes ſuffice to give it a conſiderable heat; for while, at every blow of the hammer, the nail enters further into the wood, the motion produced is chiefly progreſſive, and is of the whole nail tending one way; but when that motion ceaſes, the impulſe given by the ſtroke being unable to drive the nail further on, or break it, muſt be ſpent in making a various, vehement, and inteſtine commotion of the parts among themſelves, wherein the nature of heat conſiſts.

Agreeable to this is the opinion of Sir Iſaac Newton, who conceives that groſs bodies may be converted into light, by the agitation of their particles; and light, again, into groſs bodies, by being fixed therein.

On the other hand, M. Homberg, in his Eſſai du Souffre Principe, holds, that the chemical principle, or element ſulphur, which is ſuppoſed one of the ſimple, primary, pre-exiſtent ingredients of all natural bodies, is real fire, and conſequently that fire is coeval with bodies.

Dr s'Graveſande goes on much the ſame principle: fire, according to him, enters the compoſition of all bodies, is contained in all bodies, and may be ſeparated or procured from all bodies, by rubbing them againſt each other; and thus putting their fire in motion: but fire, he adds, is by no means generated by ſuch motion.

Mr Lemery, the younger, agrees with theſe two authors in aſſerting this abſolute and ingenerable nature of fire: but he extends it farther. Not contented to confine it as an element to bodies, he endeavours to ſhew, that it is equally diffuſed through all ſpace, and that it is preſent in all places; in the void ſpaces between bodies, as well as in the inſenſible interſtices between their parts.

This

This laft fentiment falls in with that of Boerhaave and the celebrated M. Muffchenbroek. But notwithftanding what thofe able philofophers have advanced, it is evident that fire, heat, flame, *&c.* are only the different modifications of the particles of light, and that the particles of light themfelves depend entirely on velocity for their lucific quality; fince, by many experiments, we know, that the particles of bodies become lucid, or particles of light, by only producing in them a requifite degree of velocity: thus the particles in a rod of iron, being hammered very nimbly, fhine and become red-hot: thus alfo the violent ftroke of the flint againft the fteel, in ftriking fire, puts the particles of the fteel, which it takes off, into fuch a motion as caufes them to melt, and become red-hot, which makes the fparks of fire produced by each ftroke: as, therefore, fire confifts in the great velocity of the particles, fo it may be communicated from one body in which it is, to another in which it is not, after the fame manner that one body in motion will communicate motion to another that has got none.

Fire differs from heat only in this, that heat is a motion in the particles of a body, with a leffer degree of velocity; and fire, a motion with a greater degree of velocity, *viz.* fuch as is fufficient to make the particles fhine; though we often call fuch a ftate as will burn, *fire*, though it does not actually fhine; and we feldom call thofe lucid bodies fires, which only fhine, and do not burn. Thefe are a fort of phofphori, which, though they have no heat, yet feem to owe their lucidity to the motion of their parts.

There feems to be no other difference between fire and flame, than this; that fire confifts in a glowing degree of velocity in the parts of a body, while yet fubfifting together in the mafs; but flame is the fame degree of velocity in the particles diffipated and flying off in vapours: or, to ufe Sir Ifaac Newton's expreffion, flame is nothing elfe but a red-hot vapour. See FLAME.

FIRE, in chemiftry. See CHEMISTRY, p. 67. and 110. Vol. II.

Electrical FIRE. See ELECTRICITY.

Walking FIRE, in meteorology. See WILL-WITH-A WHISP.

FIRE, in theology. See HELL.

We read of the facred fire in the firft temple of Jerufalem, concerning which the Jews have a tradition that it came down from heaven: it was kept with the utmoft care, and it was forbidden to carry any ftrange fire into the temple. This fire is one of the five things which the Jews confefs were wanting in the fecond temple.

The Pagans had their facred fires, which they kept in their temples with the moft religious care, and which were never to be extinguifhed. Numa was the firft who built a temple to Fire as a goddefs, at Rome, and inftituted an order of priefteffes for the prefervation of it. See VESTALS.

Fire was the fupreme god of the Chaldæans; the magi were worfhippers of fire; and the Greeks and Armenians ftill keep up a ceremony called the Holy Fire, upon a perfuafion that every Eafter-day a miraculous fire defcends from heaven into the holy fepulchre, and kindles all the lamps and candles there.

FIRE-LOCK. See GUN, MUSQUET, *&c.*

FIRE-POTS, in the military art, fmall earthern pots, into which is put a charged grenade, and over that powder enough till the grenade is covered; then the pot is covered with a piece of parchment, and two pieces of match acrofs lighted: this pot being thrown by a handle of matches where it is defigned, it breaks and fires the powder, and burns all that is near it, and likewife fires the powder in the grenade, which ought to have no fufe, to the end its operations may be the quicker.

FIRE-WORKS. See PYROTECHNIA.

FIRE-SHIP, in the navy, a veffel charged with artificial fire-works, which having the wind of an enemy's fhip, grapples her, and fets her on fire.

FIRE-OFFICE, an office of infurance from fire. See ASSURANCE.

Wild-FIRE, a kind of artificial or factitious fire, which burns even under water, and that with greater violence than out of it. It is compofed of fulphur, naphtha, pitch, gum, and bitumen; and is only extinguifhable by vinegar mixed with fand and urine, or by covering it with raw hides. Its motion or tendency is faid to be contrary to that of natural fire, and it always follows the direction in which it is thrown, whether it be downwards, fideways, or otherwife.

FIRING-IRON, in farriery, an inftrument not unlike the blade of a knife; which being made red-hot, is applied to a horfe's hams, or other places ftanding in need of it, as in preternatural fwellings, farcy, knots, *&c.* in order to difcufs them.

FIRKIN, an Englifh meafure of capacity, for things liquid, being the fourth part of the barrel: it contains 8 gallons of ale, foap, or herrings; and 9 gallons of beer. See MEASURE and BARREL.

FIRLOT, a dry meafure ufed in Scotland. The oat-firlot contains $21\frac{1}{4}$ pints of that country; the wheat-firlot contains about 2211 cubical inches; and the barley-firlot, 31 ftandard pints. Hence it appears that the Scotch wheat-firlot exceeds the Englifh bufhel by 33 cubical inches.

FIRMAMENT, in the Ptolemaic aftronomy, the eighth heaven or fphere, with refpect to the feven fpheres of the planets which it furrounds. It is fuppofed to have two motions; a diurnal motion, given to it by the primum mobile, from eaft to weft, about the poles of the ecliptic; and another oppofite motion from weft to eaft; which laft it finifhes, according to Tycho, in 25412 years, according to Ptolemy in 36000, and according to Copernicus in 25800, in which time the fixed ftars return to the fame points in which they were at the beginning. This period is commonly called the Platonic year, or the great year.

FIRMAMENT is alfo ufed in divers places of fcripture, to denote the middle region of the air.

FIRMAN is a paffport or permit granted by the great mogul to foreign veffels, to trade within the territories of his jurifdiction.

FIRMNESS, denotes the confiftence of a body, or that ftate

ſtate wherein its ſenſible parts cohere in ſuch a manner, that the motion of one part induces a motion of the reſt.

FIRST-FRUITS, among the Hebrews, were oblations of part of the fruit of the harveſt, offered to God as an acknowledgment of his ſovereign dominion.

FIRST-FRUITS, in the church of England, are the profits of every ſpiritual benefice for the firſt year, according to the valuation thereof in the king's books.

FISC, in the civil law, the treaſury of a prince. It differs from the ærarium, which was the treaſury of the public or people: thus, when the money ariſing from the ſale of condemned perſons goods was appropriated for the uſe of the public, their goods were ſaid *publicari;* but when it was deſtined for the ſupport of the prince, they were called *confiſcari.*

FISCAL, in the civil law, ſomething relating to the pecuniary intereſt of the prince or people. The officers appointed for the management of the fiſc, were called *procuratores fiſci*, and *advocati fiſci*; and among the caſes enumerated in the conſtitutions of the empire where it was their buſineſs to plead, one is againſt thoſe who have been condemned to pay a fine to the fiſc on account of their litigiouſneſs, or frivolous appeals.

FISH, in natural hiſtory. See NATURAL HISTORY.

Breeding of FISHES may be turned to great advantage; for beſides furniſhing your table, obliging your friends, and raiſing money, your land will be thereby greatly improved, ſo as to yield more this way than by any other employment whatever.

When fiſh are fed in large pools or ponds, either malt boiled, or freſh grains, is the beſt food; thus carps may be raiſed and fed like capons, and tenches will feed as well. The care of feeding them is beſt committed to a gardener or the butler, who ſhould be always at hand. In a ſtew, any ſort of grain boiled, eſpecially peas, and malt coarſe ground; alſo the grains after brewing, while freſh and ſweet: but one buſhel of malt not brewed, will go as far as of grains. See FISH-POND, *infra.*

FISH, in a ſhip, a plank or piece of timber, faſtened to a ſhip's maſt or yard, to ſtrengthen it, which is done by nailing it on with iron ſpikes, and woulding or winding ropes hard about them.

FISHES, in heraldry, are the emblems of ſilence and watchfulneſs; and are borne either upright, imbowed, extended, endorſed reſpecting each other, ſurmounting one another, fretted, *&c.*

In blazoning fiſhes, thoſe borne feeding, ſhould be termed devouring; all fiſhes borne upright and having fins, ſhould be blazoned hauriant; and thoſe borne tranſverſe the eſcutcheon, muſt be termed naiant.

FISH-PONDS, thoſe made for the breeding or feeding of fiſh.

Fiſh-ponds are no ſmall improvement of watery and boggy lands, many of which are fit for no other uſe. In making of a pond, its head ſhould be at the loweſt part of the ground, that the trench of the flood-gate or ſluice, having a good fall, may not be too long in emptying. The beſt way of making the head ſecure, is to drive in two or three rows of ſtakes above ſix feet long, at about four feet diſtance from each other, the whole length of the pond-head, whereof the firſt row ſhould be rammed at leaſt about four feet deep. If the bottom is falſe, the foundation may be laid with quicklime; which ſlacking, will make it as hard as a ſtone. Some lay a layer of lime, and another of earth dug out of the pond, among the piles and ſtrakes; and when theſe are well covered, drive in others as they ſee occaſion, ramming in the earth as before, till the pond-head be of the height deſigned.

The dam ſhould be made ſloping on each ſide, leaving a waſte to carry off the over-abundance of water in times of floods or rains; and as to the depth of the pond, the deepeſt part need not exceed ſix feet, riſing gradually in ſhoals towards the ſides, for the fiſh to ſun themſelves, and lay their ſpawn. Gravelly and ſandy bottoms, eſpecially the latter, are beſt for breeding; and a fat ſoil with a white fat water, as the waſhings of hills, commons, ſtreets, ſinks, *&c.* is beſt for fattening all ſorts of fiſh. For ſtoring a pond, carp is to be preferred for its goodneſs, quick growth, and great increaſe, as breeding five or ſix times a-year. A pond of an acre, if it be a feeding and not breeding one, will every year feed two hundred carps of three years old, three hundred of two years old, and four hundred of a year old. Carps delight in ponds that have marl or clay bottoms, with plenty of weeds and graſs, whereon they feed in hot months.

Your pond ſhould be drained every three or four years, and your fiſh ſorted. If it is a breeding one, the ſmaller ones are to be taken out, to ſtore other ponds with; leaving a good ſtock of females, at leaſt eight or nine years old, as they never breed before that age. In feeding ponds, it is beſt to keep them pretty near of a ſize.

FISHERY, a place where great numbers of fiſh are caught.

The principal fiſheries for ſalmon, herring, mackrel, pilchards, *&c.* are along the coaſts of Scotland, England, and Ireland; for cod, on the banks of Newfoundland; for whales, about Greenland; and for pearls, in the Eaſt and Weſt-Indies.

FISHERY denotes alſo the commerce of fiſh, more particularly the catching them for ſale.

Were we to enter into a very minute and particular conſideration of fiſheries, as at preſent eſtabliſhed in this kingdom, this article would ſwell beyond its proper bounds; becauſe to do juſtice to a ſubject of that concernment to the Britiſh nation, requires a very ample and diſtinct diſcuſſion. We ſhall, however, obſerve, that ſince the Divine Providence has ſo eminently ſtored the coaſts of Great Britain and Ireland with the moſt valuable fiſh; and ſince fiſheries, if ſucceſsful, become permament nurſeries for breeding expert ſeamen: it is not only a duty we owe to the Supreme Being, not to deſpiſe the wonderful plenty he hath afforded us, by neglecting to extend this branch of commerce to the utmoſt; but it is a duty we owe to our country, for its natural ſecurity, which depends upon the ſtrength of our royal navy. No nation can have a navy, where there

there is not a fund of bufinefs to breed and employ feamen, without any expence to the public; and no trade is fo well calculated for training up thefe ufeful members of this fociety, as fifheries.

The fituation of the Britifh coafts is the moft advantageous for catching fifh in the world: the Scottifh iflands, particularly thofe to the north and weft, lie moft commodious for carrying on the fifhing trade to perfection; for no country in Europe can pretend to come up to Scotland in the abundance of the fineft fifh, with which its various creeks, bays, rivers, lakes, and coaft are replenifhed. King Charles I. was fo fenfible of the great advantage to be derived from fifheries, that he began the experiment, together with a company of merchants; but the civil wars foon occafioned that project to be fet afide. King Charles II. made a like attempt; but his preffing wants made him withdraw what money he had employed that way, whereupon the merchants that joined with him did fo too. Since the union, feveral attempts have been made to retrieve the fifheries, and a corporation fettled to that effect, entitled the Royal Britifh Fifhery.

In the year 1750, the parliament of Great Britain taking the ftate of the fifheries into confideration, an act was paffed for the encouragement of the white-herring fifhery, granting a charter, whereby a corporation is created, to continue twenty one years, by the name of the Society of the Free Britifh Fifhery, to be under the direction of a governor, prefident, viceprefident, council, *&c.* who are to continue in office the fpace of three years, with power to make bye-laws, *&c.* and to raife a capital of 500,000 l. by way of fubfcription. And any number of perfons, who, in any part of Great Britain, fhall fubfcribe 10,000 l. into the ftock of this fociety, under the name of the Fifhing Chamber, and carry on the faid fifhery on their own account of profit and lofs, fhall be entitled to the fame bounty allowed to the fociety. The bounty is 30 s. the tun, to be paid yearly, for fourteen years, befides 3 *per cent.* for the money advanced by each chamber. The act contains other proper regulations relative to the nets, marks on the herring-barrels, number of hands, and the quantity of falt that is entitled to the bounty, *&c.* It is then by the encouragement given by this act, that we now fee a laudable emulation prevailing all over the two kingdoms, and fifhing buffes fitted out from almoft every port, in order to repair to the Shetland iflands, where the herring-fifhery is carried on with an ardor becoming fo important a branch of trade. Scotland, which fuffered incredibly from the neglect of this valuable and natural produce of the feas, has not been backward to join in a fcheme that tends fo evidently to its own advantage; for the cities of Edinburgh and Glafgow, the towns of Montrofe, Dundee, Perth, Invernefs, and fome other boroughs, have raifed the proper fum, and chambers have been erected in each of them; the gentlemen of eftates adjoining to the refpective places above-mentioned, liberally contributing with merchants, towards the profecution of an undertaking fo vifibly tending to the good of their country in general.

Cod-FISHERY. There are two kinds of cod-fifh, the one green or white cod, and the other dried or cured cod; though it is all the fame fifh differently prepared; the former being fometimes falted and barrelled, then taken out for ufe; and the latter, having lain fome competent time in falt, dried in the fun or fmoke. We fhall therefore fpeak of each of thefe apart; and firft of

Green-cod FISHERY. The chief fifheries for green cod are in the bay of Canada, on the great bank of Newfoundland, and on the ifle of St Peter, and the ifle of Sable, to which places veffels refort from divers parts both of Europe and America. They are from 100 to 150 tuns burden, and will catch between thirty and forty thoufand cod each. The moft effential part of the fifhery is, to have a mafter who knows how to cut up the cod, one who is fkilled to take off the head properly, and above all a good falter, on which the preferving of them, and confequently the fuccefs of the voyage, depends. The beft feafon is from the beginning of February to the end of April; the fifh, which in the winter retire to the deepeft water, coming then on the banks, and fattening extremely. What is caught from March to June keeps well; but thofe taken in July, Auguft, and September, when it is warm on the banks, are apt to fpoil foon. Every fifher takes but one at a time: the moft expert will take from 350 to 400 in a day; but that is the moft, the weight of the fifh and the great coldnefs on the bank fatiguing very much. As foon as the cod are taken, the head is taken off; they are opened, gutted, and falted; and the falter ftows them in the bottom of the hold, head to tail, in beds a fathom or two fquare; laying layers of falt and fifh alternately, but never mixing fifh caught on different days. When they have lain thus three or four days to drain off the water, they are replaced in another part of the fhip, and falted again; where they remain till the veffel is loaded. Sometimes they are cut in thick pieces, and put up in barrels for the conveniency of carriage.

Dry-cod FISHERY. The principal fifhery for dry cod is, from Cape Rofe to the Bay des Exports, along the coaft of Placentia, in which compafs there are divers commodious ports for the fifh to be dried in. Thefe, though of the fame kind with the frefh cod, are much fmaller, and therefore fitter to keep, as the falt penetrates more eafily into them. The fifhery of both is much alike; only this latter is moft expenfive, as it takes up more time, and employs more hands, and yet fcarce half fo much falt is fpent in this as in the other. The bait is herrings, of which great quantities are taken on the coaft of Placentia. When feveral veffels meet and intend to fifh in the fame port, he whofe fhalloop firft touches ground, becomes entitled to the quality and privileges of admiral: he has the choice of his ftation, and the refufal of all the wood on the coaft at his arrival. As faft as the mafters arrive, they unrig all their veffels, leaving nothing but the fhrouds to fuftain the mafts, and in the mean time the mates provide a tent on fhore, covered with branches of trees, and fails over them, with a fcaffold of great trunks of pines, twelve, fifteen, fixteen, and often

often twenty feet high, commonly from forty to fixty feet long, and about one third as much in breadth. While the fcaffold is preparing, the crew are a fifhing; and as faft as they catch, they bring their fifh afhore; open and falt them upon moveable benches; but the main falting is performed on the fcaffold. When the fifh have taken falt, they wafh and hang them to drain on rails; when drained, they are laid on kinds of ftages, which are fmall pieces of wood laid a-crofs, and covered with branches of trees, having the leaves ftripped off for the paffage of the air. On thefe ftages, they are difpofed, a fifh thick, head againft tail, with the back uppermoft, and are turned carefully four times every twenty four hours. When they begin to dry, they are laid in heaps ten or twelve thick, in order to retain their warmth; and every day the heaps are enlarged, till they become double their firft bulk; then two heaps are joined together, which they turn every day as before; laftly, they are falted again, beginning with thofe firft falted; and being laid in huge piles, they remain in that fituation till they are carried on board the fhips, where they are laid on the branches of trees difpofed for that purpofe, upon the ballaft, and round the fhip, with mats to prevent their contracting any moifture.

There are four kinds of commodities drawn from cod, *viz.* the zounds, the tongues, the roes, and the oil extracted from the liver. The firft is falted at the fifhery, together with the fifh, and put in barrels from 6 to 700 pound. The tongues are done in like manner, and brought in barrels from 4 to 500 pounds. The roes are alfo falted in barrels, and ferve to caft into the fea to draw fifh together, and particularly pilchards. The oil comes in barrels, from 400 to 520 pounds, and is ufed in dreffing leather.—In Scotland, they catch a fmall kind of cod on the coafts of Buchan, and all along the Murray frith on both fides; as alfo in the frith of Forth, Clyde, *&c.* wich is much efteemed. They falt and dry them in the fun upon rocks, and fometimes in the chimney. They alfo cure fkait, and other fmaller fifh in the fame manner; but moft of thefe are for home-confumption.

Coral-Fishery. See Coral-*fifhery*.

Herring-Fishery. See Clupea.

Pilchard-Fishery. The chief pilchard-fifheries are along the coafts of Dalmatia on the coaft of Bretagne, and along the coafts of Cornwall and Devonfhire. That of Dalmatia is very plentiful: that on the coafts of Bretagne employs annually about 300 fhips. The pilchards caught on our coafts, though bigger, are not fo much valued as thofe on the coafts of France, owing principally to their not being fo thoroughly cured. They naturally follow the light, which contributes much to the facility of the fifhery: the feafon is from June to September. On the coafts of France they make ufe of the roes of the cod-fifh as a bait, which thrown into the fea, makes them rife from the bottom, and run into the nets. On our coafts there are perfons pofted afhore, who, fpying by the colour of the water where the fhoals are, make figns to the boats to go among them to caft their nets. When taken, they are brought on fhore to a warehoufe, where they are laid up in broad piles, fupported with backs and fides; and as they are piled, they falt them with bay-falt, in which lying to foak for thirty or forty days, they run out a deal of blood, with dirty pickle and bittern: then they wafh them clean in fea-water; and, when dry, barrel and prefs them hard down to fqueeze out the oil, which iffues out at a hole in the bottom of the cafk. The Cornifhmen obferve of the pilchard, that it is the leaft fifh in fize, moft in number, and greateft for gain, of any they take out of the fea.

Salmon-Fishery. The chief falmon fifheries in Europe are in England, Scotland, and Ireland, in the rivers, and fea-coafts adjoining to the river-mouths. The moft diftinguifhed for falmon in Scotland are, the river Tweed, the Clyde, the Tay, the Dee, the Don, the Spey, the Nefs, the Bewley, *&c.* in moft of which it is very common, about the height of fummer, efpecially if the weather happen to be very hot, to catch four or five fcore of falmon at a draught. The chief rivers in England for falmon are, the Tyne, the Trent, the Severn, and the Thames. The fifhing ufually begins about January; and in Scotland they are obliged to give over about the middle of Auguft; becaufe, as it is then fuppofed the fifh come up to fpawn, it would be quite depopulating the rivers to continue fifhing any longer. It is performed with nets, and fometimes with a kind of locks or wears made on purpofe, which in certain places have iron or wooden grates fo difpofed, in an angle, that being impelled by any force in a contrary direction to the courfe of the river, they may give way and open a little at the point of contact, and immediately fhut again, clofing the angle. The falmon, therefore, coming up into the rivers, are admitted into thefe grates, which open, and fuffer them to pafs through, but fhut again, and prevent their return. Salmon are alfo caught with a fpear, which they dart into him when they fee him fwimming near the furface of the water. It is cuftomary likewife to catch them with a candle and lanthorn, or wifp of ftraw fet on fire; for the fifh naturally following the light, are ftruck with the fpear, or taken in a net fpread for that purpofe, and lifted with a fudden jerk from the bottom. We make no mention of the method of catching falmon with a line or hook, becaufe it is much the fame with that explained under the article *Trout*-Fishing.

Curing Salmon. When the falmon are taken, they open them along the back, take out the guts and gills, and cut out the greateft part of the bones, endeavouring to make the infide as fmooth as poffible; then falt the fifh in large tubs for the purpofe, where they lie a confiderable time foaking in brine; and about October, they are packed clofe up in barrels, and fent to London, or exported up the Mediterranean. They have alfo in Scotland, a great deal of falmon falted in the common way, which after foaking in brine a competent time, is well preffed, and then dried in fmoke: this is called *kipper*, and is chiefly made for home confumption, and, if properly cured and prepared, is reckoned very delicious.

Sturgeon-

Sturgeon-Fishery. The greateſt ſturgeon-fiſhery is in the mouth of the Volga, on the Caſpian ſea, where the Muſcovites employ a great number of hands, and catch them in a kind of incloſure formed by huge ſtakes repreſenting the letter Z, repeated ſeveral times. Theſe fiſheries are open on the ſide next the ſea, and cloſe on the other; by which means the fiſh aſcending in its ſeaſon up the river, is embarraſſed in theſe narrow angular retreats, and ſo is eaſily killed with a harping-iron. Sturgeons, when freſh, eat deliciouſly; and in order to make them keep, they are ſalted or pickled in large pieces, and put up in cags from thirty to fifty pounds. But the great object of this fiſhery is the roe, of which the Muſcovites are extremely fond, and of which is made the cavear, or kavia, ſo much eſteemed by the Italians. See Cavear.

Whale-Fishery. Whales are chiefly caught in the north ſea: the largeſt ſort are found about Greenland, or Spitzbergen. At the firſt diſcovery of this country, whales not being uſed to be diſturbed, frequently came into the very bays, and were accordingly killed almoſt cloſe to the ſhore, ſo that the blubbler being cut off was immediately boiled into oil on the ſpot. The ſhips in theſe times took in nothing but the pure oil and the fins, and all the buſineſs was executed in the country, by which means a ſhip could bring home the product of many more whales than ſhe can according to the preſent method of conducting this trade. The fiſhery alſo was then ſo plentiful, that they were obliged ſometimes to ſend other ſhips to fetch off the oil they had made, the quantity being more than the fiſhing ſhips could bring away. But time and change of circumſtances have ſhifted the ſituation of this trade. The ſhips coming in ſuch numbers from Holland, Denmark, Hamburgh, and other northern countries, all intruders upon the Engliſh, who were the firſt diſcoverers of Greenland, the whales were diſturbed, and gradually, as other fiſh often do, forſaking the place, were not to be killed ſo near the ſhore as before; but are now found, and have been ſo ever ſince, in the openings and ſpace among the ice, where they have deep water, and where they go ſometimes a great many leagues from the ſhore.

The whale-fiſhery begins in May, and continues all June and July; but whether the ſhips have good or bad ſucceſs, they muſt come away, and get clear of the ice, by the end of Auguſt; ſo that in the month of September at fartheſt, they may be expected home; but a ſhip that meets with a fortunate and early fiſhery in May, may return in June or July.

The manner of taking whales at preſent is as follows. As ſoon as the fiſhermen hear the whale blow, they cry out, *Fall! fall!* and every ſhip gets out its long boat, in each of which there are ſix or ſeven men: they row till they come pretty near the whale, then the harpooner ſtrikes it with his harpoon. This requires great dexterity; for through the bone of his head there is no ſtriking, but near his ſpout there is a ſoft piece of fleſh, into which the iron ſinks with eaſe. As ſoon as he is ſtruck, they take care to give him rope enough, otherwiſe, when he goes down, as he frequently does, he would inevitably ſink the boat: this rope he draws with ſuch violence, that, if it were not well watered, it would, by its friction againſt the ſides of the boat, be ſoon ſet on fire. The line faſtened to the harpoon is ſix or ſeven fathom long, and is called the fore-runner; it is made of the fineſt and ſofteſt hemp, that it may ſlip the eaſier: to this they join a heap of lines of 90 or 100 fathoms each; and when there are not enough in one long boat, they borrow from another. The man at the helm obſerves which way the rope goes, and ſteers the boat accordingly, that it may run exactly out before; for the whale runs away with the line with ſo much rapidity, that he would overſet the boat, if it were not kept ſtreight. When the whale is ſtruck, the other long boats row before, and obſerve which way the line ſtands, and ſometimes pull it; if they feel it ſtiff, it is a ſign the whale ſtill pulls in ſtrength; but if it hangs looſe, and the boat lies equally high before and behind upon the water, they pull it in gently, but take care to coil it ſo, that the whale may have it again eaſily if he recovers ſtrength: they take care, however, not to give him too much line, becauſe he ſometimes entangles it about a rock, and pulls out the harpoon. The fat whales do not ſink as ſoon as dead, but the lean one's do, and come up ſome days afterwards. As long as they ſee whales, they loſe no time in cutting up what they have taken, but keep fiſhing for others: when they ſee no more, or have taken enough, they begin with taking off the fat and whiſkers in the following manner. The whale being laſhed along-ſide, they lay it on one ſide, and put two ropes, one at the head, and the other in the place of the tail, which, together with the fins, is ſtruck off as ſoon as he is taken, to keep thoſe extremities above water. On the off-ſide of the whale are two boats, to receive the pieces of fat, utenſils, and men, that might otherwiſe fall into the water on that ſide. Theſe precautions being taken, three or four men with irons at their feet, to prevent ſlipping, get on the whale, and begin to cut out pieces of about three feet thick, and eight long, which are hauled up at the capſtane or windlaſs. When the fat is all got off, they cut off the whiſkers of the upper jaw with an ax. Before they cut, they are all laſhed to keep them firm, which alſo facilitates the cutting, and prevents them from falling into the ſea: when on board, five or ſix of them are bundled together, and properly ſtowed; and after all is got off, the carcaſe is turned a-drift, and devoured by the bears, who are very fond of it. In proportion as the large pieces of fat are cut off, the reſt of the crew are employed in ſlicing them ſmaller, and picking out all the lean. When this is prepared, they ſtow it under the deck, where it lies till the fat of all the whales is on board; then cutting it ſtill ſmaller, they put it up in tubs in the hold, cramming them very full and cloſe. Nothing now remains but to ſail homewards, where the fat is to be boiled and melted down into train oil. See Train Oil.

It were in vain to ſpeak in this place of the advantages that may be derived to Great Britain from the whale-fiſhery. We ſhall only remark, that the legiſla-

ture think that trade of fo great importance, as to grant a very confiderable bounty for the encouragement of it; for every Britifh veffel of 200 tuns or upwards, bound to the Greenland feas on the whale-fifhery, if found to be duly qualified according to the act, obtains a licence from the commiffioners of the cuftoms to proceed on fuch voyage: and on the fhip's return, the mafter and mate making oath that they proceeded on fuch voyage and no other, and ufed all their endeavours to take whales, &c. and that all the whale fins, blubber, oil, &c. imported in their fhip, were taken by their crew in thofe feas, there fhall be allowed 40 s. for every ton according to the admeafurement of the fhip.

Befides thefe fifheries, there are feveral others both on the coafts of Great Britain and in the North Seas, which, although not much the fubject of merchandize, neverthelefs employ great numbers both of fhips and men; as, 1. The oyfter-fifhing at Colchefter, Feverfham, the Ifle of Wight, in the Swales of the Medway, and in all the creeks between Southampton and Chichefter, from whence they are carried to be fed in pits about Wevenhoe and other places. See OYSTER. 2. The lobfter-fifhing all along the Britifh Channel, the Frith of Edinburgh, on the coaft of Northumberland, and on the coaft of Norway, from whence great qantities are brought to London. And laftly, the fifhing of the pot-fifh, fin-fifh, fea-unicorn, fea horfe, and the feal, or dog-fifh; all which are found in the fame feas with the whales, and yield blubber in a certain degree; befides, the horn of the unicorn is as eftimable as ivory, and the fkins of the feals are particularly ufeful to trunkmakers.

Trout FISHING. The baits for this purpofe are either natural or artificial, as earth, worms, minnows, and fifhing flies, both natural and artificial. Whatever worms are ufed, they anfwer beft if kept fome time in an earthen pot, with mofs often changed in fummer. If you fifh for trout with hand on the ground, the hook is to be introduced into the worm a little above the middle, coming out again a little below; then draw the worm above the arming of the hook, making your firft entrance at the tail-end, that the point of the hook may come out at the head-end. When you fifh with minnows, take the whiteft and middle fized; and after putting the hook in at the mouth, and out at the gills, and drawing it through about three inches, flip it again into his mouth, fo as the point and beard may come out at the tail. This done, tie the hook and tail together with a fine white thread, and let the body of the minnow be almoft ftreight upon the hook.

FISSURE *of the bones*, in furgery, is when they are divided either tranfverfely or longitudinally, not quite through, but cracked after the manner of glafs, by any external force. See SURGERY.

FISTULA, in the ancient mufic, an inftrument of the wind-kind, refembling our flute, or flageolet.

The principal wind-inftruments of the ancients, were the tibia and fiftula. But how they were conftituted, wherein they differed, or how they were played on, does not appear.

FISTULA, in medicine and furgery. See MEDICINE and SURGERY.

FISTULA, in farriery. See FARRIERY.

FISTULAR, or FISTULOUS, appellations given by furgeons to wounds and ulcers, which degenerate into fiftulas.

FIT, in medicine. See PAROXYSM.

FITCHEE', in heraldry, a term applied to a crofs, when the lower end of it is fharpened into a point, as in Plate LXXX. fig. 6.

FITCHES, in hufbandry, a fort of pulfe, more generally known by the name of chick-pea, or cicer. See CICER.

FITZ, makes part of the furname of fome of the natural fons of the kings of England, as Fitz-roy; which is purely French, and fignifies the king's fon.

FIVE CHURCHES, a bifhop's fee of lower Hungary, 76 miles fouth of Buda.

FIVES, or VIVES, in farriery. See FARRIERY, p. 555.

FIXATION, in chemiftry, the rendering any volatile fubftance fixed, fo as not to fly off upon being expofed to a great heat; hence,

FIXED BODIES are thofe which bear a confiderable degree of heat without evaporating, or lofing any of their weight.

FLACCIDITY, among phyficians, a diforder of the folids, cured by aftringent and cardiac medicines, joined with exercife and good air.

FLAG, a general name for colours, ftandards, ancients, banners, enfigns, &c.

The fafhion of pointed or triangular flags, as now ufed, Rod. Toletan affures. came from the Mahometan Arabs, or Saracens, upon their feiznre of Spain, before which time all the enfigns of war were ftretched or extended on crofs pieces of wood, like the banners of a church. The pirates of Algiers, and throughout the coafts of Barbary, bear an hexonal flag.

FLAG is more particularly ufed at fea; for the colours, ancients, ftandards, &c. borne on the top of the mafts of veffels, to notify the perfon who commands the fhip, of what nation it is, and whether it be equipped for war or trade, fee Plate LXXXI.

The admiral in chief carries his flag on the main top, the vice-admiral on the fore-top, and the rear-admiral on the mizzen-top.

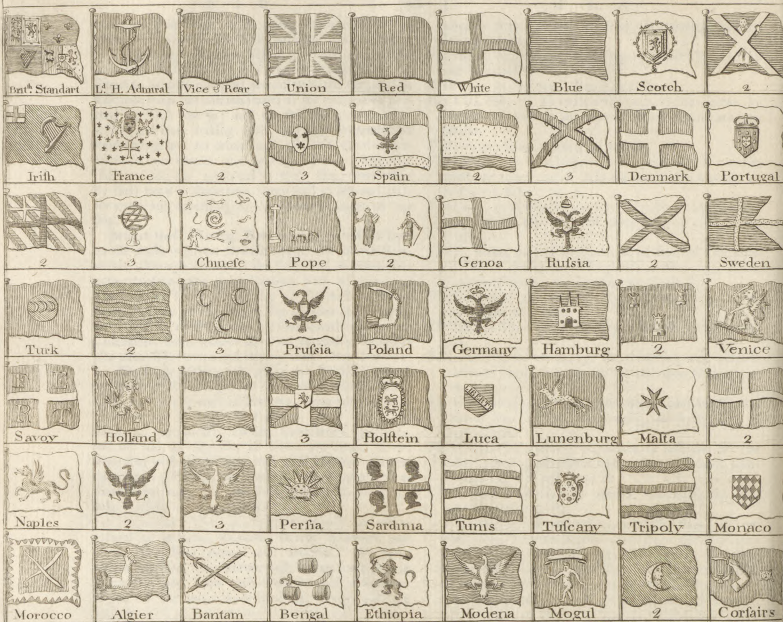
When a council of war is to be held at fea, if it be on board the admiral, they hang a flag in the main fhrouds; if in the vice-admiral, in the fore-fhrouds; and if in the rear-admiral, in the mizzen fhrouds.

Befides the national flag, merchant-fhips frequently bear leffer flags on the mizzen-maft, with the arms of the city where the mafter ordinarily refides; and on the fore-maft, with the arms of the place where the perfon who freights them lives.

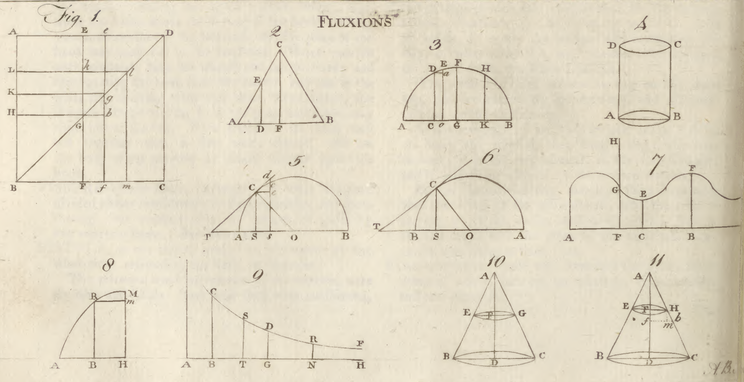
FLAG-OFFICERS, thofe who command the feveral fquadrons of a fleet, fuch are the admirals, vice-admirals, and rear-admirals.

The

FLAGS



FLUXIONS



The flag officers in our pay, are the admiral, vice-admiral, and rear-admiral of the white, red, and blue. See ADMIRAL.

FLAG-SHIP, a ſhip commanded by a general or flag-officer, who has a right to carry a flag, in contradiſtinction to the ſecondary veſſels under the command thereof.

FLAG-FLOWER, in botany. See IRIS.

Corn FLAG, in botany. See GLADIOLUS.

FLAGELLARIA, in botany, a genus of the hexandria trigynia claſs. The calix conſiſts of ſix ſegments; it has no corolla; and the berry contains but one ſeed. There is but one ſpecies, a native of the Eaſt-Indies.

FLAGEOLET, or FLAJEOLET, a little flute, uſed chiefly by ſhepherds and country people. It is made of box, or other hard wood, and ſometimes of ivory, and has ſix holes beſides that at the bottom, the mouth-piece, and that behind the neck.

FLAIL, an inſtrument for threſhing corn.

A flail conſiſts of the following parts. 1. The hand-ſtaff, or piece held in the threſher's hand. 2. The ſwiple, or that part which ſtrikes out the corn. 3. The caplins, or ſtrong double leathers, made faſt to the tops of the hand-ſtaff and ſwiple. 4. The middle-band, being the leather thong, or fiſh ſkin, that ties the cap-lins together.

FLAMBEAU, a kind of large taper, made of hempen wicks, by pouring melted wax on their top, and letting it run down to the bottom. This done, they lay them to dry; after which they roll them on a table, and join four of them together by means of a red-hot iron; and then pour on more wax, till the flambeau is brought to the ſize required.

Flambeaus are of different lengths, and made either of white or yellow wax. They ſerve to give light in the ſtreets at night, or on occaſion of illuminations.

FLAMBOROUGH-HEAD, in geography, a cape or promontory of Yorkſhire, five miles eaſt of Burlington: E. long. 20′, N. lat. 54° 15′.

FLAME, the ſmall parts of an inflammable body, that are ſet on fire, or briſkly agitated and thrown off, with a certain vibrative motion at the ſurface of that body into the open air: or, in Sir Iſaac Newton's words, the flame of a body is only the ſmoke thereof heated red hot; and the ſmoke is only the volatile part of the body ſeparated by the fire. See FIRE.

FLAMEN, in Roman antiquity, the name of an order of prieſts, inſtituted by Romulus or Numa; authors not being agreed on this head.

They were originally only three, *viz.* the flamen dialis, flamen martialis, and flamen quirinus. They were choſen by the people, and inſtalled by the ſovereign pontiff. Afterwards, their number was increaſed to fifteen; the three firſt of whom were ſenators, and called flamines majores; the other twelve, taken from among the people, being denominated flamines minores.

The flamen dialis, or prieſt of Jupiter, was a conſiderable perſon at Rome; the flamen martialis, or prieſt of Mars, was the ſecond in dignity; and the flamen quirinalis, was the next to him.

FLANDERS, a province of the Netherlands, bounded by the German ſea and the United provinces on the north; by the province of Brabant, on the eaſt; by Hainault and Artois, on the ſouth; and by another part of Artois and the German ſea, on the weſt; being about ſixty miles long, and fifty broad, and divided between the Auſtrians, the French, and the Dutch.

Flanders is a perfectly champaign country, with not a riſing ground or hill in it, and watered with many fine rivers and canals. Its chief commodities are fine lace, linen, and tapeſtry.

FLANEL, or FLANNEL, a looſe ſort of woollen ſtuff, not croſſed, and woven on a loom like bays.

FLATS, in muſic, a kind of additional notes, which, together with ſharps, ſerve to remedy the defects of muſical inſtruments, wherein temperament is required. See MUSIC.

FLATULENCY, in medicine. See MEDICINE.

FLAW, in the ſea-language, ſignifies a ſudden guſt of wind.

FLAX, in botany. See LINUM.

The following particulars with regard to the manner of raiſing flax has been for ſome years paſt warmly commended by the Truſtees for fiſheries, manufactures, and improvements in Scotland.

Of the choice of the Soil, and Preparing the Ground for FLAX. A ſkilful flax-raiſer always prefers a free open deep loam, and all grounds that produced the preceding year a good crop of turnip, cabbage, potatoes, barley, or broad clover; or has been formerly laid down rich, and kept for ſome years in paſture.

A clay ſoil, the ſecond or third crop after being limed, will anſwer well for flax; provided, if the ground be ſtill ſtiff, that it be brought to a proper mould, by tilling after harveſt, to expoſe it to the winter froſts.

All new grounds produce a ſtrong crop of flax, and pretty free of weeds. When a great many mole-heaps appear upon new ground, it anſwers the better for flax after one tilling.

Flax-ſeed ought never to be ſown on grounds that are either too wet or dry; but on ſuch as retain a natural moiſture: and ſuch grounds as are inclined to weeds ought to be avoided, unleſs prepared by a careful ſummer-fallow.

If the lintſeed be ſown early, and the flax not allowed to ſtand for ſeed, a crop of turnip may be got after the flax that very year; the ſecond year a crop of bear or barley may be taken; and the third year, graſs-ſeeds are ſometimes ſown along with the lintſeed. This is the method moſtly practiſed in and about the counties of Lincoln and Somerſet, where great quantities of flax and hemp are every year raiſed, and where theſe crops have long been capital articles. There, old ploughed grounds are never ſown with lintſeed, unleſs the ſoil be very rich and clean. A certain worm, called in Scotland the Coup-worm, abounds in new broke up grounds, which greatly hurts every crop but flax. In ſmall incloſures ſurrounded with trees or high hedges, the flax, for want of free air, is ſubject to fall before it be ripe, and the droppings of rain and

dew.

dew from the trees prevent the flax within the reach of the trees from growing to any perfection.

Of preceding crops, potatoes and hemp are the beſt preparation for flax. In the fens of Lincoln, upon proper ground of old tillage, they ſow hemp, dunging well the firſt year; the ſecond year hemp without dung; the third year flax without dung; and that ſame year a crop of turnip eat on the ground by ſheep; the fourth year hemp with a large coat of dung, and ſo on for ever.

If the ground be free and open, it ſhould be but once ploughed, and that as ſhallow as poſſible, not deeper than $2\frac{1}{2}$ inches. It ſhould be laid flat, reduced to a fine garden-mould by much harrowing, and all ſtones and ſods ſhould be carried off.

Except a little pigeon's dung for cold or ſour ground, no other dung ſhould be uſed preparatory for flax, becauſe it produces too many weeds, and throws up the flax thin and poor upon the ſtalk.

Before ſowing, the bulky clods ſhould be broken, or carried off the ground; and ſtones, quickenings, and every other thing that may hinder the growth of the flax, ſhould be removed.

Of the choice of Lintſeed. The brighter in colour, and heavier the feed is, ſo much the better: that which when bruiſed appears of a light or yellowiſh green, and freſh in the heart, oily and not dry, and ſmells and taſtes ſweet, and not fuſty, may be depended upon.

Dutch ſeed of the preceding year's growth, for the moſt part, anſwers beſt; but it ſeldom ſucceeds if kept another year. It ripens ſooner than any other foreign ſeed. Philadelphia ſeed produces fine lint and few bolls, becauſe ſown thick, and anſwers beſt in wet cold ſoils. Riga ſeed produces coarſer lint, and the greateſt quantity of ſeed. Scots ſeed, when well winned and kept, and changed from one kind of ſoil to another, ſometimes anſwers pretty well; but ſhould be ſown thick, as many of its grains are bad, and fail. It ſprings well, and its flax is ſooner ripe than any other; but its produce afterwards is generally inferior to that from foreign ſeed.

A kind has been lately imported, called memmelſeed, which looks well, is ſhort and plump, but ſeldom grows above eight inches, and on that account ought not to be ſown.

Of Sowing Lintſeed. The quantity of lintſeed ſown, ſhould be proportioned to the condition of the ſoil; for if the ground be in good heart, and the ſeed ſown thick, the crop will be in danger of falling before it is ready for pulling. From eleven to twelve pecks Linlithgow meaſure of Dutch or Riga ſeed, is generally ſufficient for one Scots acre; and about ten pecks of Philadelphia ſeed, which being the ſmalleſt grained, goes fartheſt. Riga lintſeed, and the next year's produce of it, is preferred in Lincolnſhire.

The time for ſowing lintſeed is from the middle of March to the end of April, as the ground and ſeaſon anſwers; but the earlier the ſeed is ſown, the leſs the crop interferes with the corn-harveſt.

Late ſown lintfeed may grow long, but the flax upon the ſtalk will be thin and poor.

After ſowing, the ground ought to be harrowed till the ſeed is well covered, and then (ſuppoſing the ſoil as before mentioned to be free and reduced to a fine mould) the ground ought to be rolled.

When a farmer ſows a large quantity of lintſeed, he may find it proper to ſow a part earlier and part latter, that in the future operations of weeding, pulling, watering, and graſſing, the work may be the eaſier and more conveniently gone about.

It ought always to be ſown on a dry bed.

Of Weeding Flax. It ought to be weeded when the crop is about four inches long. If longer deferred, the weeders will ſo much break and crook the ſtalks, that they will never perhaps recover their ſtraightneſs again; and when the flax grows crooked, it is more liable to be hurt in the rippling and ſwingling.

Quickening-graſs ſhould not be taken up; for, being ſtrongly rooted, the pulling of it always looſens a deal of the lint.

If there is an appearance of a ſettled drought, it is better to defer the weeding, than by that operation to expoſe the tender roots of the flax to the drought.

How ſoon the weeds are got out, they ought to be carried off the field, inſtead of being laid in the furrows, where they often take root again, and at any rate obſtruct the growth of the flax in the furrows.

Of Pulling Flax. When the crop grows ſo ſhort and branchy, as to appear more valuable for ſeed than flax, it ought not to be pulled before it be thoroughly ripe; but if it grows long and not branchy, the ſeed ſhould be diſregarded, and all the attention given to the flax. In the laſt caſe it ought to be pulled after the bloom has fallen, when the ſtalk begins to turn yellow, and before the leaves fall, and the bolls turn hard and ſharp-pointed.

When the ſtalk is ſmall, and carries few bolls, the flax is fine; but the ſtalk of coarſe flax is groſs, rank, branchy, and carries many bolls.

When flax has fallen and lies, ſuch as lies ought to be immediately pulled, whether it has grown enough or not, as otherwiſe it will rot altogether.

When parts of the ſame field grow unequally, ſo that ſome parts are ready for pulling before other parts; only what is ready ſhould be pulled, and the reſt ſhould be ſuffered to ſtand till ready.

The flax-raiſer ought to be at pains to pull, and keep by itſelf, each different kind of lint which he finds in his field; what is both long and fine, by itſelf; what is both long and coarſe, by itſelf; what is both ſhort and fine, by itſelf; what is both ſhort and coarſe, by itſelf; and in like manner every other kind by itſelf that is of the ſame ſize and quality. If the different kinds be not thus kept ſeparate, the flax muſt be much damaged in the watering, and the other ſucceeding operations.

What is commonly called under growth, may be neglected as uſeleſs.

Few perſons that have ſeen flax pulled, are ignorant of the method of laying it in handfuls acroſs other: which gives the flax ſufficient air, and keeps the handfuls ſeparate and ready for the rippler.

Of Stacking up Flax *during the winter, and Winning the*

the Seed. If the flax be more valuable than the feed, it ought by no means to be ftacked up; for its own natural juice affifts it greatly in the watering: whereas, if kept long unwatered, it lofes that juice, and the harle adheres fo much to the boon, that it requires longer time to water, and even the quality of the flax becomes thereby harfher and coarfer. Befides, the flax ftacked up over year, is in great danger from vermin and other accidents; the water in fpring is not fo foft and warm as in harveft; and near a year is thereby loft of the ufe of the lint: but if the flax be fo fhort and branchy as to appear moft valuable for feed, it ought, after pulling, to be ftooked and dried upon the field, as is done with corn, then ftacked up for winter, rippled in fpring, and after fheeling the feed fhould be well cleaned from bad feeds, *&c.*

Of Rippling FLAX. After pulling, if the flax is to be regarded more than the feed, it fhould be allowed to lie fome hours upon the ground to dry a little, and fo gain fome firmnefs, to prevent the fkin or harle, which is the flax, from rubbing off in the rippling; an operation which ought by no means to be neglected, as the bolls, if put into the water along with the flax, breed vermin there, and otherwife fpoil the water. The bolls alfo prove very inconvenient in the graffing and breaking.

In Lincolnfhire and Ireland, they think that rippling hurts the flax; and therefore, in place of rippling, they ftrike the bolls againft a ftone.

The handfuls for rippling fhould not be great, as that endangers the lint in the rippling comb.

After rippling, the flax-raifer will perceive, that he is able to affort each fize and quality of the flax by itfelf more exactly than he could before.

Of Watering FLAX. A running ftream waftes the lint, makes it white, and frequently carries it away. Lochs, by the great quantity and motion of the water, alfo wafte and whiten the flax, though not fo much as running ftreams. Both rivers and lochs water the flax quicker than canals.

But all flax ought to be watered in canals, which fhould be digged in clay ground if poffible, as that foil retains the water beft: but if a firm retentive foil cannot be got, the bottom or fides of the canal, or both the bottom and fides, may be lined with clay; or, inftead of lining the fides with clay, which might fall down, a ditch may be dug without the canal, and filled with clay, which will prevent both extraneous water from entering, and the water within from running off.

A canal of forty feet long, fix broad, and four deep, will generally water the growth of an acre of flax.

It ought to be filled with frefh foft water from a river or brook, if poffible two or three weeks before the flax is put in, and expofed all that time to the heat of the fun. The greater way the river or brook has run, the fofter, and therefore the better will the water be. Springs, or fhort runs from hills, are too cold, unlefs the water is allowed to ftand long in the canal. Water from coal or iron, is very bad for flax. A little of the powder of galls thrown into a glafs of water, will immediately difcover if it comes from minerals of that kind, by turning it into a dark colour, more or lefs tinged in proportion to the quantity of vitriol it contains.

The canal ought not to be under any fhade; which, befides keeping the fun from foftening the water, might make part of the canal cooler than other parts, and fo water the flax unequally.

The flax-raifer will obferve, when the water is brought to a proper heat, that fmall plants will be rifing quickly in it, numbers of fmall infects and reptiles will be generating there, and bubbles of air rifing on the furface. If no fuch figns appear, the water muft not be warm enough, or is otherwife unfit for flax.

Mofs-holes, when neither too deep nor too fhallow, frequently anfwer well for watering flax, when the water is proper, as before defcribed.

The proper feafon for watering flax is, from the end of July to the end of Auguft.

The adavntage of watering flax as foon as poffible, after pulling, has been already mentioned.

The flax being forted after rippling, as before mentioned, fhould next be put in beets, never larger than a man can grafp with both his hands, and tied very flack, with a band of a few ftalks. Dried rufhes anfwer exceedingly well for binding flax, as they do not rot in the water, and may be dried and kept for ufe again.

The beets fhould be put into the canals flope-ways, or half ftanding upon end, the root-end uppermoft. Upon the crop-ends, when uppermoft, there frequently breeds a deal of vermin, deftructive of the flax, which is effectually prevented by putting the crop-end downmoft.

The whole flax in the canal ought to be carefully covered from the fun with divots; the graffy fide of which fhould be next the flax, to keep it clean. If it is not thus covered, the fun will difcolour the flax, though quite covered with water. If the divots are not weighty enough to keep the flax entirely under water, a few ftones may be laid above them. But the flax fhould not be preffed to the bottom.

When the flax is fufficiently watered, it feels foft to the grip, and the *harle* parts eafily with the *boon* or *fhow*, which laft is then become brittle, and looks whitifh. When thefe figns are found, the flax fhould be taken out of the water, beet after beet; each gently rinfed in the water, to cleanfe it of the naftinefs which has gathered about it in the canal; and as the lint is then very tender, and the beet flackly tied, it muft be carefully and gently handled.

Great care ought to be taken that no part is overdone; and as the coarfeft waters fooneft, if different kinds be mixed together, a part will be rotted, when the reft is not fufficiently watered.

When lint taken out of the canal is not found fufficiently watered, it may be laid in a heap, for twelve, eighteen, or twenty-four hours, which will have an effect like more watering; but this operation is nice, and may prove dangerous in unfkilful hands.

After the flax is taken out of the canal, frefh lint fhould not be put a fecond time into it, until the former water be run off, and the canal cleaned, and fupplied with frefh water.

Of graffing FLAX. Short heath is the beft field for graffing flax, as, when wet, it faftens to the heath, and is thereby prevented from being blown away by the wind. The heath alfo keeps it a little above the earth,

earth, and ſo expoſes it the more equally to the weather. When ſuch heath is not to be got, links, or clean old lea-ground is the next beſt. Long graſs-grounds ſhould be avoided, as the graſs growing thro' the lint frequently ſpots, tenders, or rots it; and grounds expoſed to violent winds ſhould alſo be avoided.

The flax, when taken out of the water, muſt be ſpread very thin upon the ground; and being then very tender, it muſt be gently handled. The thinner it is ſpread the better, as it is then the more equally expoſed to the weather. But it ought never to be ſpread during a heavy ſhower, as that would waſh and waſte the harle too much, which is then exceſſively tender, but ſoon after becomes firm enough to bear the rains, which, with the open air and ſunſhine, cleans, ſoftens, and purifies the harle to the degree wanted, and makes it bliſter from the boon. In ſhort, after the flax has got a little firmneſs by being a few hours ſpread in dry weather, the more rain and ſunſhine it gets the better.

If there be little danger of high winds carrying off the flax, it will be much the better of being turned about once a-week. If it is not to be turned, it ought to be very thin ſpread. The ſpreading of flax and hemp requires a deal of ground, and enriches it greatly.

The ſkilful flax-raiſer ſpreads his firſt row of flax at the end of the field oppoſite to the point from from whence the moſt violent wind commonly comes, placing the root-ends foremoſt; he makes the root-ends of every other row overlap the crop-ends of the former row three or four inches, and binds down the laſt row with a rope; by which means the wind does not eaſily get below the lint to blow it away: and as the crop-ends are ſeldom ſo fully watered as the root-ends, the aforeſaid overlapping has an effect like giving the crop-ends more watering. Experience only can fully teach a perſon the ſigns of flax being ſufficiently graſſed: then it is of a clearer colour than formerly; the harle is bliſtered up, and eaſily parts with the boon, which is then become very brittle. The whole ſhould be ſufficiently graſſed before any of it is lifted; for if a part be lifted ſooner than the reſt, that which remains is in great danger from the winds.

A dry day ought to be taken for taking up the flax; and if there is no appearance of high wind, it ſhould be looſed from the heath or graſs, and left looſe for ſome hours, to make it thoroughly dry.

As a great quantity of flax can ſcarcely be all equally watered and graſſed, and as the different qualities will beſt appear at lifting the flax off the graſs; therefore at that time each different kind ſhould be gathered together, and kept by itſelf; that is, all of the ſame colour, length, and quality.

The ſmaller the beets lint is made up in, the better for drying, and the more convenient for ſtacking, houſing, *&c.* and in making up theſe beets, as in every other operation upon flax, it is of great conſequence that the lint be laid together as it grew, the root-ends together, and the crop-ends together.

Of keeping FLAX *after it is graſſed.* Nothing needs be ſaid here, but that if the flax is to be ſtacked, it ſhould be ſet in an airy place, upon a dry foundation, ſuch as pob-middings, or the like, and well covered from the weather; and if houſed, the floor muſt be dry, and the houſe well aired, and water-tight.

Follows an Eſtimate of the Expence, Produce, and Profit of a Scots acre of FLAX,—*ſuppoſing the ſeaſon favourable, that no accidental loſſes happen, and that the farmer is neither unſkilful nor negligent.*

	A medium crop.	*A great crop.*	*An extraordinary crop.*
Ground-rent, labouring the ground, and leading the flax	L. 2 10 0	L. 3 10 0	L. 5 0 0
Lintſeed from L. 2 to L. 4 *per* hogſhead, the medium 3 s. 4 d. *per* peck — — —	1 16 8 for 11 pecks.	1 10 0 for 9 pecks.	1 6 8 for 8 pecks.
Clodding and ſowing — — —	0 2 0	0 2 0	0 2 0
Weeding — — — — —	0 12 0	0 8 0	nothing.
Pulling, rippling, putting in, and covering in the water	0 14 0	0 15 0	1 0 0
Taking out of the water, graſſing, and ſtacking	0 8 0	0 12 0	0 18 0
Breaking, and ſcutching, at 2 s. *per* ſtone —	3 0 0 for 30 ſtones.	4 0 0 for 40 ſtones.	6 0 0 for 60 ſtones.
Total expence	L. 9 2 8	L. 10 17 0	L. 14 6 8
Produce at 10 s. *per* ſtone — — —	L. 15 0 0 for 30 ſtones.	L. 20 0 0 for 40 ſtones.	L. 30 0 0 for 60 ſtones.
Lintſeed ſold for oil at 1 s. *per* peck — —	0 16 0	0 18 0	1 0 0
The chaff of the bolls is well worth the expence of drying the ſeed; as it is good food, boiled and mixed with beer, for horſes.			
Total produce	L. 15 16 0	L. 20 18 0	L. 31 0 0
Ballance for profit — — —	L. 6 14 4	L. 10 1 0	L. 16 13 4

There-

There is nothing ftated here as expence of the canal in which the flax is watered; becaufe that varies much according to the conveniencies people have for making it: and a canal once made requires for after-years only to be repaired and cleanfed.

It is a certain fact, that the greater the crop is, the better is the quality of the fame kind of flax.

The advantage of having both a crop of flax and a crop of turnip the fame year—or of fowing grafs-feeds along with the lintfeed—and of reducing the ground to a fine garden mould, free of weeds, ought to be attended to.

For Cambrick and fine Lawn. The ground muft be a rich light foil, rather fandy, but cannot be too rich.

It ought to be ploughed in September, or the beginning of October, firft putting a little hot rotten dung upon it.

Second ploughing in January after a hard froft; and when you intend to fow it, plough it a third time, or rather hoe it, reducing the clods very fine; but make no furrows: the land muft be made level like a garden; but never work the land when wet.

The feed fhould be fown the beginning of April, and about double the quantity that is generally fown by our farmers; if the land be very rich, it will require rather more than double.

As foon as fown (if the weather be dry) it will be neceffary to roll the ground.

The lint muft be weeded very clean when about three inches high; directly after which you muft fet forked fticks, of about one and half inch thick (which ought to be prepared before) every four or five feet, according to the length of the poles you are to lay upon them; they fhould be well fixed in the ground, the forked part to receive the poles about fix or feven inches above the lint; each row of poles fhould be two, three, or four feet afunder, according to the length of the brufhwood you are to lay upon them.

The poles ought to be from ten to fifteen feet long, and ftrong enough to fupport the brufh acrofs the poles; take the longeft brufhwood you can get, the more branchy the better, very thick, filling up the vacancies with fmaller brufh, and any of the branches that rife higher than eighteen or twenty inches ought to be lopt off to make the brufh lie as level as poffible: any fort of brufh will do except oak, as that tinges the lint.

Your lint muft be pulled as foon as the feed is fully formed, which is a few days after it is out of the bloom before the lint turn yellow.

It muft be pulled above the brufhwood, and every handful laid upon it as foon as poffible: if it is fine weather, leave it four or five hours in that manner; then carry it to a fcreen near a barn, to put it under cover in cafe of rain; there it muft be fpread four or five days, and always put in the barn at night, or when it appears to rain: the bundles muft be opened in the barn, or made hollow, to prevent it from heating.

Thefe operations muft be performed until the lint is perfectly dry, and out of danger of heating; taking care all the time to keep the roots as even as poffible, and if poffible, keep it from rain or wet: if you cannot prevent it from being wet, it will be better to leave it on the grafs till dry; becaufe when once wet, the putting it under cover before dry will make it turn black; a thing which muft be prevented at all events.

If any of the lint upon the border, or through the piece of ground, be coarfer than another, it muft be feparated from the reft.

The utmoft care muft be taken to preferve the lint entire, or unbroke; for this reafon they beat off the feed with a round mell or bittle.

The moft proper ground is fummer fallow, or after potatoes, or lea; if poffible near a wood, to prevent the expence of carrying brufh.

As foon as the feed is off, if you intend to water it that feafon, it muft be tied in bundles about as large as you can grafp with your two hands.

The water proper for it, is a very fmall rivulet or foft fpring free of any metallic ore, and taking care that no flood or foul water enters your pit; which muft be at leaft five feet deep, about nine or ten broad at the top, and feven or eight at the bottom, the length will depend on the quantity of flax you have to water. A very fmall ftripe of water, when clear, fhould always be running in and off from your pit when the lint is in it.

The pit ought to be made three or four months before it be ufed.

You muft drive poles about four inches thick, with a hook inclining downwards, in this form 7, all along the fides of the pit, about five feet afunder. The hooks muft be level, or rather under the furface of the water. A long pole, the whole length of the pit, muft be fixed into thefe hooks on each fide; and crofs poles put under that, to keep the lint under water; but, the crofs poles are not ufed till the lint is put in. You muft order it fo, that all the lint fhould be three or four inches under water. You next bring your lint to the fides of the pit; then put your fheaves head to head, caufing each overlap the other about one third, and take as many of thefe as make a bundle of two or two and a half feet broad, laying the one above the other, till it is about four or four and a half feet high; then you tie them together in the middle, and at each root-end: after this, you wrap your bundle in ftraw, and lay it in the water, putting the thin or broad fide undermoft, taking care that none of your lint touch the earth; after it is fully preffed under water, put in your crofs poles to keep it under. The bundles ought to lie in the pit a foot feparate from each other. This renders it eafy to take out; for, if the bundles entangle, they will be too heavy to raife.

The time of watering depends fo much upon the weather, and foftnefs or hardnefs of the water, that it is impoffible to fix any certain time. This muft be left to the fkill of the farmer. If the flax be intended for fpinning yarn foft and fit for cambrick, it ought to be fpread upon fhort grafs for four or five days before you put it into the water; but if for lawns, lace, or thread, it is beft to dry it outright. In either cafe, avoid as much as poffible to let it get rain; as much rain blanches and wafhes

washes out the oil, which is neceſſary to preſerve the ſtrength.

The great property of this flax is to be fine and long. Thick ſowing raiſes all plants fine and ſlender, and when the ground is very rich, it forces them to a great length. Pulling green prevents that coarſe hardneſs which flax has when let ſtand till it be full ripe, and gives it the fine ſilky property. The bruſhwood, when the flax ſprings up, catches it by the middle, prevents it from lying down and rotting; infallible conſequences of ſowing thick upon rich ground. It likewiſe keeps it ſtraight, moiſt, and ſoft at the roots; and by keeping it warm, and ſhaded from the ſun, greatly promotes its length. The keeping it from rain, heating, taking proper care of your water, preſerves the colour, and prevents theſe bars in cloth ſo much complained off by bleachers.

FLAX-DRESSING. *The different methods of that operation.*

For many ages it was the practice to ſeparate the boon or core from the flax, which is the bark of the plant, by the following ſimple *hand-methods*. Firſt, for breaking the boon; the ſtalks in ſmall parcels were beat with a mallet; or, more dexterouſly, the *break* (Plate LXXXII. fig. 1. and 2.) was uſed thus: The flax being held in the left-hand a-croſs the three *under-teeth* or *ſwords* of the break (A, fig. 1. and *a*, fig. 2.), the *upper-teeth* (B, fig. 1. and *b*, fig. 2.) were with the right-hand quickly and often forced down upon the flax, which was artfully ſhifted and turned with the left-hand. Next, for clearing the flax of the broken boon; the workman with his left-hand held the flax over the *ſtock* (fig. 3. and 4.) while with his right-hand he ſtruck or threſhed the flax with the *ſcutcher* (fig. 5.).

Theſe methods of breaking and ſcutching the flax being flow and very laborious, a *water-mill* was invented in Scotland about forty years ago, which, with ſome late improvements, makes great diſpatch, and in ſkilful and careful hands gives ſatisfaction. It has been generally conſtructed to break the boon by three dented rollers, placed one above the other. The middle one of which being forced quickly round takes the other two along with it, and one end of handfuls of the flax being by the workman directed in between the upper and middle rollers, the flax is immediately drawn in by the rollers; a curved board or plate of tin behind the rollers directs the flax to return again between the middle and undermoſt rollers;—and thus the operation is repeated until the boon be ſufficiently broke. Great weights of timber or ſtone at the ends of levers, preſs the upper and under-rollers towards the middle one.

The ſcutching is next carried on by the mill in the following manner: Four arms, ſomething like the hand-ſcutchers before deſcribed, project from a perpendicular axle; a box around the axle incloſes theſe projecting ſcutchers; and this box is divided among the workmen, each having ſufficient room to ſtand and handle his flax, which, through ſlits in the upper-part and ſides of the box, they hold in to the ſtroke of the ſcutchers; which, moving round horizontally, ſtrike the flax a-croſs or at right angles, and ſo threſh out or clear it of the boon.

The breaking of the flax by *rollers* is ſcarcely ſubject to any objection, but that it is dangerous to workmen not ſufficiently on their guard, who ſometimes allow the rollers to take hold of their fingers, and thereby their whole arm is inſtantly drawn in: thus many have loſt their arms. To avoid this danger, a break upon the general principles of the hand-break before deſcribed, has been lately adapted to water-machinery, and uſed in place of rollers. The horizontal ſtroke of the ſcutchers was long thought too ſevere, and waſteful of the flax; but very careful experiments have diſcovered that the waſte complained of muſt be charged to the unſkilfulneſs or negligence of the workmen, as in good hands the mill carries away nothing but what, if not ſo ſcutched off, muſt be taken off in the heckling with more loſs both of time and flax. But to obviate this objection of the violence of the *horizontal ſcutchers*, an imitation of hand-ſcutching has lately been applied to water. The ſcutchers then project from an horizontal axle, and move like the arms of a check-reel, ſtriking the flax neither acroſs nor perpendicularly down, but ſloping in upon the parcel exactly as the flax is ſtruck by the hand-ſcutcher. This ſloping ſtroke is got by raiſing the ſcutching ſtock ſome inches higher than the centre of the axle; and by raiſing or lowering the ſtock, over which the flax is held, or ſcrewing it nearer to or farther from the ſcutchers, the workman can temper or humour the ſtroke almoſt as he pleaſes.

A lint-mill with horizontal ſcutchers upon a perpendicular axle, requires a houſe of two ſtories, the rollers or break being placed in the ground ſtory, and the ſcutchers in the loft above; but a mill with vertical ſcutchers on an horizontal axle, requires but one ground ſtory for all the machinery.

Another method of breaking and ſcutching flax, more expeditious than the old hand-methods, and more gentle than water-mills, has alſo been lately invented in Scotland. It is much like the break and ſcutcher giving the ſloping ſtroke laſt deſcribed, moved by the foot. The treddle is remarkably long, and the ſcutchers are fixed upon the rim of a fly-wheel. The foot-break is alſo aſſiſted in its motion by a fly. Theſe foot-machines are very uſeful where there are no water-mills, but they are far inferior to the mills in point of expedition.—[*See plans of the* water-mills, *and* foot-machine, *on the unnumbered plates betwixt the* LXXXII. *and* LXXXIII.]

The next operation that flax undergoes after ſcutching, is heckling. The *heckle* (fig. 6. Plate LXXXII.) is firmly fixed to a bench before the workman, who ſtrikes the flax upon the teeth of the heckle and draws it thro' the teeth. To perſons unacquainted with that kind of work this may ſeem a very ſimple operation; but, in fact, it requires as much practice to acquire the ſlight of heckling well, and without waſting the flax, as any other operation in the whole manufacture of linen. They uſe coarſer and wider teethed heckles, or finer, accord-

Fig. 1. Flax hand break

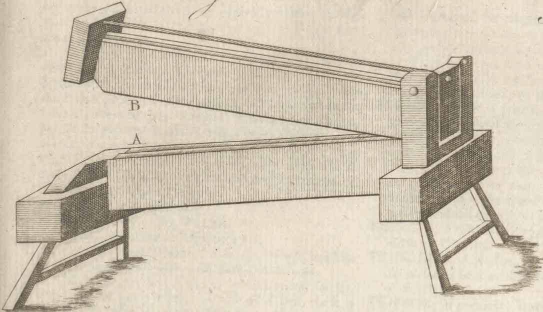


Fig. 2.
Section of the Break

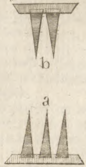


Fig. 5.
Hand Skutcher

Skutching Stock

Fig. 3.
Side view

Fig. 4
Front view

Fig. 6.
Heckle

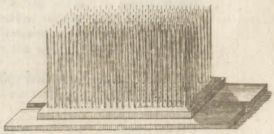
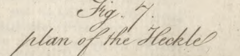


Fig. 7.
plan of the Heckle



A. Bell Sct.

ing to the quality of the flax; generally putting the flax thro' two heckles, a coarser one first, and next thro' a fine heckle.

Flax for cambrick and fine lawn, thread and lace, is dressed in a manner somewhat different. It is not skutched so thoroughly as common flax; which from the skutch proceeds to the heckle, and from that to the spinner: whereas this fine flax, after a rough skutching, is scraped and cleansed with a blunt knife upon the workman's-knee covered with his leather apron; from the knife it proceeds to the spinner, who, with a brush made for the purpose, straights and dresses each parcel just before she begins to spin it.

Toad-FLAX. See LINARIA.

FLEA, in zoology. See PULEX.

FLEA-BANE, in botany. See CONYZA.

FLEA-BITTEN, that colour of a horse, which is white or grey, spotted all over with dark redish spots.

FLEAM, in surgery and farriery, an instrument for letting a man or horse blood. A case of fleams, as it is called by farriers, comprehends six sorts of instruments; two hooked ones, called drawers, and used for cleaning wounds; a pen-knife; a sharp pointed lancet, for making incisions; and two fleams, one sharp and the other broad pointed. These last are somewhat like the point of a lancet, fixed in a flat handle, only no longer than is just necessary to open the vein.

FLECHE, a town of France, under the meridian of London, twenty miles north-east of Angers.

FLEECE, the covering of wool, shorn off the bodies of sheep. See WOOL.

Order of the Golden FLEECE, an order of knighthood instituted by Philip II. duke of Burgundy. These knights at first were twenty-four, besides the duke himself, who reserved the nomination of six more: but Charles V. increased them to fifty. He gave the guardianship of this order to his son Philip king of Spain, since which the Spanish monarchs are chiefs of the order. The knights had three different mantles ordained them at the grand solemnity, the collar and fleece.

FLEET, commonly implies a company of ships of war, belonging to any prince or state: but sometimes it denotes any number of trading ships, employed in a particular branch of commerce.

In sailing, a fleet of men of war is usually divided into three squadrons: the admiral's, the vice admiral's, and the rear-admiral's squadron, all which, being distinguished by their flags and pendants, are to put themselves, and, as near as may be, to keep themselves in their customary places, *viz.* The admiral, with his squadron, to sail in the van, that so he may lead the way to all the rest in the day-time, by the sight of his flag in the main top-mast head; and in the night time, by his lights or lanterns. The vice-admiral and his squadron, is to sail in the centre or middle of the fleet. The rear-admiral, and the ships of his squadron, is to bring up the rear. But sometimes other divisions are made; and those composed of the lighter ships and the best sailors, are placed as wings to the van, centre, and rear.

FLEET is also a noted prison in London, where persons are committed for contempt of the king and his laws, particularly of his courts of justice: or for debt, where any person will not, or is unable to pay his creditors.

There are large rules and a warden belonging to the fleet prison, which had its name from the float or fleet of the river or ditch, on the side whereof it stands.

FLENSBURGH, a port town subject to Denmark, sixteen miles north of the city of Sleswick.

FLESH, in anatomy, a similar, fibrous part of an animal body, soft and bloody, being that whereof most of the other parts are composed, and whereby they are connected together: or more properly, it is such parts of the body where the blood-vessels are so small, as only to retain blood enough to preserve their colour red.

FLEURY, a town of Burgundy, in France, thirty miles north of Chalons.

FLEXIBLE, in physics, a term applied to bodies capable of being bent or diverted from their natural figure or direction.

FLEXOR, in anatomy, a name applied to several muscles, which are so called from their office, which is to bend the part to which they belong; in opposition to the extensors, which open or stretch them. See ANATOMY, part II.

FLINT, in natural history, a semipellucid stone, composed of crystal debased with earth, of one uniform substance, and free from veins; but of different degrees of colour, according to the quantity of earth it contains, and naturally surrounded with a whitish crust.

Flint is a stone of an extremely fine, compact, and firm texture, and very various, both in size and figure. It is of all the degrees of grey, from nearly quite black, to almost quite white. It breaks with a fine, even, glossy surface; and is moderately transparent, very hard, and capable of a fine polish. It readily strikes fire with steel, and makes not the least effervescence with aquafortis, and burns to a whiteness. Its uses in glass making, *&c.* are too well known to need a particular recital.

FLOATAGES, all things floating on the top of the sea or any water, a word much used in the commissions of water bailiffs.

FLOOD. See DELUGE.

FLORENCE, an archbishop's see and city of Italy, situated on the river Arno, in Tuscany, forty-five miles east of Leghorn: E. long. 12° 15′, and N. lat. 43° 30′. Florence is one of the most elegant towns in Italy, has an university, and is six miles in circumference. The statues, paintings, and curiosities in the grand duke's palace are the admiration of travellers.

FLORENTINE, a town of Champaign in France, twenty-eight miles south-west of Troyes.

FLORES, in geography, one of the Azores islands, subject to Portugal.

FLORID STYLE, is that too much enriched with figures and flowers of rhetoric.

FLORIDA, in geography, a name first given by the Spaniards to all that part of North America which lies north of the gulph of Mexico. However, all that retains the name Florida at present, is the peninsula between the British colony of Georgia and cape Florida,

viz. between 25° and 30° of N. latitude, and between 81° and 85° W. longitude.

FLORIN, is ſometimes uſed for a coin, and ſometimes for a money of account.

Florin, as a coin, is of different values, according to the different metals and different countries where it is ſtruck. The gold florins are moſt of them of a very coarſe alloy, ſome of them not exceeding thirteen or fourteen carrats, and none of them ſeventeen and a half. As to ſilver florins, thoſe of Holland are worth about 1 s. 8 d. thoſe of Genoa were worth $8\frac{1}{4}$ Sterling.

Florin, as a money of account, is uſed by the Italian, Dutch, and German merchants and bankers, but admits of different diviſions in different places. In Holland, it is on the footing of the coin of that name, containing 20 ſtivers At Frankfort and Nuremberg it is equivalent to 3s. Sterling, and is divided into creutzers, and pfinnings. At Liege, it is equivalent to 2s 3d. At Straſburg, to 1s. 8d. In Savoy, to 11d. At Genoa, to $8\frac{1}{4}$d. And at Geneva, to $6\frac{1}{2}$ d. See Coin.

FLORIST, a perſon well ſkilled in flowers, their kinds and cultivation.

FLORY, Flowry, or Fleury, in heraldry, a croſs that has the flowers at the end circumflex and turning down, differing from the potence, inaſmuch as the latter ſtretches out more like that which is called patee.

The croſs flory is repreſented in Plate LXXX. fig. 7

FLOS, Flower, in botany. See Flower.

Flos, in chemiſtry, the moſt ſubſtile part of bodies ſeparated from the more groſs parts by ſublimation, in a dry form. See Chemistry.

FLOTSON, or Flotsom, goods that by ſhipwreck are loſt, and floating upon the ſea; which, with jetſon and lagan, are generally given to the lord admiral: but this is the caſe only where the owners of ſuch goods are not known. And here it is to be obſerved, that jetſon ſignifies any thing that is caſt out of a ſhip when in danger, and afterwards is beat on the ſhore by the water, notwithſtanding which the ſhip periſhes Lagan is where heavy goods are thrown overboard, before the wreck of the ſhip, and ſink to the bottom of the ſea.

FLOUNDER, the Engliſh name of a ſpecies of pleuronectes. See Pleuronectes.

FLOUR, the meal of wheat-corn, finely ground and ſifted. See Meal.

FLOWER, among botaniſts and gardeners, the moſt beautiful part of trees and plants, containing the organs or parts of fructification. See Botany.

External Flower. See Xeranthemum.

Everlaſting Flower. See Gnaphalium.

Flower Fence. See Poinciana.

Flower de luce. See Iris.

Sultan-Flower. See Cyanus.

Sun-Flower. See Helianthus.

Trumpet Flower. See Bignonia.

Wind-Flower. See Anemone

Flower de lis, or Flower de luce, in heraldry, a bearing repreſenting the lily, called the queen of flowers, and the true hieroglyphic of royal majeſty; but of late it is become more common, being borne in ſome coats one, in others three, in others five, and in ſome ſemee, or ſpread all over the eſcutcheon in great numbers.

The arms of France are, three flower de lis or, in a field azure.

FLUDDER. See Colymbus.

FLUID, an appellation given to all bodies whoſe particles eaſily yield to the leaſt partial preſſure, or force impreſſed.

Laws and properties of Fluids. See Hydraulics and Hydrostatics.

FLUOR, in phyſics, a fluid; or, more properly, the ſtate of a body that was before hard or ſolid, but is now reduced by fuſion, or fire, into a ſtate of fluidity.

Fluor, in mineralogy, implies a ſort of mineral concretion, frequently found amongſt ores and ſtones, in mines and quarries.

Fluor albus, or Whites. See Medicine.

FLUSHING, or Vlissengen, a port town of Zealand in Holland, five miles ſouth of Middleburgh: E. long. 3° 25′, N. lat. 51° 30′. It is a town of great foreign trade, and has a good ſecure harbour.

FLUTE, an inſtrument of muſic, the ſimpleſt of all thoſe of the wind kind. It is played on by blowing it with the mouth, and the tones or notes are changed by ſtopping and opening the holes diſpoſed for that purpoſe along its ſide.

German Flute, is an inſtrument entirely different from the common flute. It is not, like that, put into the mouth to be played, but the end is ſtopt with a tampion or plug; and the lower lip is applied to a hole about two inches and a half, or three inches, diſtant from the end This inſtrument is uſually about a foot and a half long; rather bigger at the upper end than the lower; and perforated with holes, beſides that for the mouth, the loweſt of which is ſtopt and opened by the little finger's preſſing on a braſs or ſometimes a ſilver key, like thoſe in hautboys, baſſoons, &c. Its ſound is exceeding ſweet and agreeable; and ſerves as a treble in a concert.

Coarſe flutes, on importation, pay the gros, containing twelve dozen, 3 s. $10\frac{20}{100}$ d. and on exportation draw back 3s. $4\frac{50}{100}$ d.

Flutes, or Flutings. See Architecture.

FLUVIALIS, in botany. See Najas.

FLUX, in medicine, an extraordinary iſſue, or evacuation of ſome humours of the body. See Medicine.

Flux, in metallurgy, whatever can cauſe a body otherwiſe not at all, or hardly, fuſible by fire, to melt. See Chemistry.

FLUXIONS.

F L U X I O N S.

FLUXIONS, a method of calculation which greatly facilitates computations in the higher parts of mathematics. Sir Iſaac Newton and Mr Leibnitz contended for the honour of inventing it. It is probable they had both made progreſs in the ſame diſcovery unknown to each other, before there was any publication on the ſubject.

In this branch of mathematics magnitudes of every kind are ſuppoſed generated by motion: a line by the motion of a point, a ſurface by the motion of a line, and a ſolid by the motion of a ſurface. And ſome part of a figure is ſuppoſed generated by an uniform motion; in conſequence of which the other parts may increaſe uniformly or with an accelerated or retarded motion, or may decreaſe in any of theſe ways; and the computations are made by tracing the comparative velocities with which the parts flow.

Fig. 1. If the parallelogram ABCD be generated by an uniform motion of the line AB toward CD while it moves from FE towards *fe*, while the line BF receives the increment F*f*, and the figure will be increaſed by the parallelogram F*e*; the line FE in this caſe undergoes no variation.

The fluxion of any magnitude at any point is the increment that it would receive in any given time, ſuppoſing it to increaſe uniformly from that point; and as the meaſures will be the ſame, whatever the time be, we are at liberty to ſuppoſe it leſs than any aſſigned time.

The firſt letters in the alphabet are uſed to repreſent invariable quantities; the letters x, y, z variable quantities; and the ſame letters with points over them $\dot{x}$, $\dot{y}$, $\dot{z}$, repreſent their fluxions.

Therefore if AB$=a$, and BF$=x$; F*f*, the fluxion of BF, will be $=\dot{x}$, and F*e*, the fluxion of AF, $=a\dot{x}$.

If the rectangle be ſuppoſed generated by the uniform motion of FG towards CD, at the ſame time HG moves uniformly towards AD, the point G keeping always on the diagonal, the lines FG HG will flow uniformly; for while B*f* receives the increment F*f* and HB, the increment HK, FG will receive the increment *hg* and HG the increment *hg*, and they will receive equal increments in equal ſucceſſive times. But the parallelogram will flow with an accelerated motion; for while F flows to *f* and H to K, it is increaſed by the gnomon KG*f*; but while F and H flow through the equal ſpaces *fm* KL, it is increaſed by the gnomen L*gm* greater than KG*f*; conſequently when fluxions of the ſides of a parallelogram are uniform, the fluxion of the parallelogram increaſes continually.

The fluxion of the parallelogram BHGF is the two parallelograms KG and G*f*; for though the parameter receives an increment of the gnomen KG*f*, while its ſides flow to *f* and K, the part *g*G is owing to the additional velocity wherewith the parallelogram flows during that time; and therefore is no part of the meaſure of the fluxion, which muſt be computed by ſuppoſing the parameter to flow uniformly as it did at the beginning, without any acceleration.

Therefore if the ſides of a parallelogram be x and y, their fluxions will be $\dot{x}$ $\dot{y}$; and the fluxion of the parallelogram $x\dot{y}+y\dot{x}$; and if $x=y$, that is, if the figure be a ſquare, the fluxion of x^2 will be $2x\dot{x}$.

Fig. 2. Let the triangle ABC be deſcribed by the uniform motion of DE from A towards B, the point E moving in the line DF, ſo as always to touch the lines AC, CB; while D moves from A to F, DE is uniformly increaſed, and the increaſe of the triangle is uniformly accelerated. When DE is in the poſition FC, it is a maximum. As D moves from F to B, the line FC decreaſes, and the triangle increaſes, but with a motion uniformly retarded.

Fig. 3. If the ſemicircle AFB be generated by the uniform motion of CD from A towards B, while C moves from A to G, the line CD will increaſe, but with a retarded motion; the circumference alſo increaſes with a retarded motion, and the circular ſpace increaſes with an accelerated motion, but not uniformly, the degrees of acceleration growing leſs as CD approaches to the poſition GF. When C moves from G to B, it decreaſes with a motion continually accelerated, the circumference increaſes with a motion continually accelerated, and the area increaſes with a motion continually retarded, and more quickly retarded as CD approaches to B.

The fluxion of a quantity which decreaſes is to be conſidered as negative.

When a quantity does not flow uniformly, its fluxion may be repreſented by a variable quantity, or a line of a variable length; the fluxion of ſuch a line is called the ſecond fluxion of the quantity whoſe fluxion that line is: and if it be variable, a third fluxion may be deduced from it, and higher orders from theſe in the ſame manner: the ſecond fluxion is repreſented by two points, as $\ddot{x}$.

The increment a quantity receives by flowing for any given time, contains meaſures of all the different orders of fluxions; for if it increaſes uniformly, the whole increment is the firſt fluxion; and it has no ſecond fluxion. If it increaſes with a motion uniformly accelerated, the part of the increment occaſioned by the firſt motion meaſures the firſt fluxion, and the part occaſioned by the acceleration meaſures the ſecond fluxion. If the motion be not only accelerated, but the degree of acceleration continually increaſed, the two firſt fluxions are meaſured as before; and the part of the increment occaſioned by the additional degree of acceleration meaſures the third; and ſo on. Theſe meaſures require to be corrected, and are only mentioned here to illuſtrate the ſubject.

DIRECT METHOD.

Any flowing quantity being given, to find its fluxion.

Rule I. To find the fluxion of any power of a quantity

tity, multiply the fluxion of the root by the exponent of the power, and the product by a power of the same root less by unity than the given exponent.

The fluxion of x^3 is $3x^2\dot{x}$, of x^n $nx^{n-1}\dot{x}$; for the root of x^n is x, whose fluxion is $\dot{x}$; which multiplied by the exponent n, and by a power of x less by unity than n, gives the above fluxion.

If x receive the increment $\dot{x}$, it becomes $x+\dot{x}$; raise both to the power of n, and x^n becomes $x^n+nx^{n-1}\dot{x}+\frac{n.\overline{n-1}}{2}x^{n-2}\dot{x}^2+$, &c.; but all the parts of the increment, except the first term, are owing to the accelerated increase of x^n, and form measures of the higher fluxions. The first term only measures the first fluxion; the fluxion of $\overline{a^2+z^2}^{\frac{3}{2}}$ is $\frac{3}{2}\times 2z\dot{z}\times\overline{a^2+z^2}^{\frac{1}{2}}$; for put $x=a^2+z^2$, we have $\dot{x}=2z\dot{z}$, and the fluxion of $x^{\frac{3}{2}}$, which is equal to the proposed fluent, is $\frac{3}{2}x^{\frac{1}{2}}\dot{x}$, for which substituting the values of x and $\dot{x}$, we have the above fluxion.

Rule II. To find the fluxion of the product of several variable quantities multiplied together, multiply the fluxion of each by the product of the rest of the quantities, and the sum of the products thus arising will be the fluxion sought.

Thus the fluxion of xy, is $\dot{x}y+\dot{y}x$; that of xyz, is $xy\dot{z}+xz\dot{y}+yz\dot{x}$; and that of $xyzu$, is $xyz\dot{u}+xyu\dot{z}+xzu\dot{y}+yzu\dot{x}$.

Rule III. To find the fluxion of a fraction.—From the fluxion of the numerator multiplied by the denominator, subtract the fluxion of the denominator multiplied by the numerator, and divide the remainder by the square of the denominator.

Thus, the fluxion of $\frac{x}{y}$ is $\frac{y\dot{x}-x\dot{y}}{y^2}$; that of $\frac{x}{x+y}$, is $\frac{\dot{x}\times\overline{x+y}-\overline{\dot{x}+\dot{y}}\times x}{\overline{x+y}|^2}=\frac{y\dot{x}-x\dot{y}}{\overline{x+y})^2}$.

Rule IV. In complex cases, let the particulars be collected from the simple rules and combined together.

The fluxion of $\frac{x^2y^2}{z}$ is $\frac{\overline{2x^2y\dot{y}+2y^2x\dot{x}}\times z-x^2y^2\dot{z}}{z^2}$; for the fluxion of x^2 is $2x\dot{x}$, and of y^2 is $2y\dot{y}$, by Rule I. and therefore the fluxion of x^2y^2 (by Rule II.) $2x^2y\dot{y}+2y^2x\dot{x}$; from which, multiplied by z, (by Rule III.) and subtracting from it the fluxion of the denominator z, multiplied by the numerator, and dividing the whole by the square of the denominator, gives the above fluxion.

Rule IV. The second fluxion is derived from the first, in the same manner as the first from the flowing quantity.

Thus the fluxion of x^3, $3x^2\dot{x}$; its second, $6x\dot{x}^2+3x^2\ddot{x}$ (by Rule II.); and so on: but if $\dot{x}$ be invariable, $\ddot{x}=0$, and the second fluxion of $x^3=6x\dot{x}^2$.

Prob. 1. *To determine maxima and minima.*

When a quantity increases, its fluxion is positive; when it decreases, it is negative; therefore when it is just betwixt increasing and decreasing, its fluxion is $=0$.

Rule. Find the fluxion, make it $=0$, whence an equation will result that will give an answer to the question.

Fig. 4. Examp. To determine the dimensions of a cylindric measure ABCD, open at the top, which shall contain a given quantity (of liquor, grain, &c.) under the least internal superficies possible.

Let the diameter $AB=x$, and the altitude $AD=y$; moreover, let p (3,14159, &c.) denote the periphery of the circle whose diameter is unity, and let c be the given content of the cylinder. Then it will be $1:p::x:(px)$ the circumference of the base; which, multiplied by the altitude y, gives pxy for the concave superficies of the cylinder. In like manner, the area of the base, by multiplying the same expression into $\frac{1}{4}$ of the diameter x, will be found $=\frac{px^2}{4}$; which drawn into the altitude y, gives $\frac{px^2y}{4}$ for the solid content of the cylinder; which being made $=c$, the concave surface pxy will be found $=\frac{4c}{x}$, and consequently the whole surface $=\frac{4c}{x}+\frac{px^2}{4}$: Whereof the fluxion, which is $-\frac{4c\dot{x}}{x^2}+\frac{px\dot{x}}{2}$ being put $=0$, we shall get $-8c+px^3=0$; and therefore $x=2\sqrt[3]{\frac{c}{p}}$: further, because $px^3=8c$, and $px^2y=4c$, it follows, that $x=2y$; whence y is also known, and from which it appears, that the diameter of the base must be just the double of the altitude.

Fig. 7. To find the longest and shortest ordinates of any curve, DEF, whose equation or the relation which the ordinates bear to the abscissas is known.

Make AC the abscissa x, and CE the ordinate $=y$; take a value y in terms of x, and find its fluxion; which making $=0$, an equation will result whose roots give the value of x when y is a maximum or minimum.

To determine when it is a maximum and when a minimum, take the value of y, when x is a little more than the root of the equation so found, and it may be perceived whether it increases or decreases.

If the equation has an even number of equal roots, y will be neither a maximum nor minimum when its fluxion is $=0$.

Prob. 2. *To draw a tangent to any curve.*

Fig. 5. When the abscissa CS of a curve moves uniformly from A to B, the motion of the curve will be retarded if it be concave, and accelerated if convex towards AB; for a straight line TC is described by an uniform motion, and the fluxion of the curve at any point is the same as the fluxion of the tangent, because it would describe the tangent if it continued to move equally from that point. Now if Ss or Ce be the fluxion of the base, Cd will be the fluxion of the tangent, and *de* of the ordinate. And because the triangles TSC, *ced*, are equiangular, $de:ce::CS:ST$, wherefore

Rule. Find a fourth proportional to the fluxion of the

the ordinate valued in terms of the abſciſſa, the fluxion of the abſciſſa, and the ordinate, and it determines the line ST, which is called the ſemi-tangent, and TC joined is a tangent to the curve.

Fig. 6. EXAMP. To draw a right line CT, to touch a given circle BCA in a given point C.

Let CS be perpendicular to the diameter AB, and put AB$=a$, BS$=x$, and SC$=y$: Then, by the property of the circle, y^2 (CS²) =BS×AS $(=x\times\overline{a-x})=ax-x^2$; whereof the fluxion being taken, in order to determine the ratio of $\dot{x}$ and $\dot{y}$, we get $2y\dot{y}=a\dot{x}-2x\dot{x}$; conſequently $\frac{\dot{x}}{\dot{y}}=\frac{2y}{a-2x}=\frac{y}{\frac{1}{2}a-x}$; which multiplied by y, gives $\frac{y\dot{x}}{\dot{y}}=\frac{y^2}{\frac{1}{2}a-x}=$ the ſubtangent ST. Whence (O being ſuppoſed the centre) we have OS $(\frac{1}{2}a-x)$: CS (y) :: CS (y) : ST; which we alſo know from other principles.

PROB. 3. *To determine points of contrary flexure in curves.*

FIG. 7. Suppoſing C to move uniformly from A to B, the curve DEF will be convex towards AB when the celerity of E increaſes, and concave when it decreaſes; therefore at the point where it ceaſes to be convex and begins to be concave, or the oppoſite way, the celerity of E will be uniform, that is, CE will have no ſecond fluxion. Therefore,

RULE. Find the ſecond fluxion of the ordinate in terms of the abſciſſa, and make it $=0$; and from the equation that ariſes you get a value of the abſciſſa, which determines the point of contrary flexure.

Ex. Let the nature of the curve ARS be defined by the equation $ay=a^{\frac{3}{2}}x^{\frac{1}{2}}+xx$, (the abſciſſa AF and the ordinate FG being, as uſual, repreſented by x and y reſpectively). Then $\dot{y}$, expreſſing the celerity of the point r, in the line FH, will be equal to $\frac{\frac{1}{2}a^{\frac{3}{2}}x^{-\frac{1}{2}}\dot{x}+2x\dot{x}}{a}$: Whoſe fluxion, or that of $\frac{1}{2}a^{\frac{3}{2}}x^{-\frac{1}{2}}+2x$ (becauſe a and $\dot{x}$ are conſtant) muſt be equal to nothing; that is, $-\frac{1}{4}a^{\frac{3}{2}}x^{-\frac{3}{2}}\dot{x}+2\dot{x}=0$: Whence $a^{\frac{3}{2}}x^{-\frac{3}{2}}=8$, $a^{\frac{3}{2}}=8x^{\frac{3}{2}}$, $64x^3=a^3$, and $x=\frac{1}{4}a=$AF; therefore FG $\left(=\frac{a^{\frac{3}{2}}x^{\frac{1}{2}}+xx}{a}\right)=\frac{9}{16}a$: From which the poſition of the point G is given.

PROB. 4. *To find the radii of curvature.*

The curvature of a circle is uniform in every point, that of every other curve continually varying; and it is meaſured at any point by that of a circle whoſe radius is of ſuch a length as to coincide with it in curvature in that point.

All curves that have the ſame tangent have the ſame firſt fluxion, becauſe the fluxion of a curve and its tangent are the ſame. If it moved uniformly on from the point of contact, it would deſcribe the tangent. And the deflection from the tangent is owing to the acceleration or retardation of its motion, which is meaſured by its ſecond fluxion; and conſequently two curves which have not only the ſame tangent, but the ſame curvature at the point of contact, will have both their firſt and ſecond fluxions equal. It is eaſily proven from thence, that the radius of curvature is $=\frac{\dot{z}^3}{-\dot{x}\ddot{y}}$, where x, y, and z repreſent the abſciſſa, ordinate, and curve reſpectively.

EXAMP. Let the given curve be the common parabola, whoſe equation is $y=a^{\frac{1}{2}}x^{\frac{1}{2}}$: Then will $\dot{y}=\frac{1}{2}a^{\frac{1}{2}}x\dot{x}^{-\frac{1}{2}}=\frac{a^{\frac{1}{2}}\dot{x}}{2x^{\frac{1}{2}}}$, and (making $\dot{x}$ conſtant) $\ddot{y}=-\frac{1}{2}\times\frac{1}{2}a^{\frac{1}{2}}\dot{x}^2x^{-\frac{3}{2}}=\frac{-a^{\frac{1}{2}}\dot{x}^2}{4x^{\frac{3}{2}}}$: Whence $\dot{z}\left(\sqrt{\dot{x}^2+\dot{y}^2}\right)=\frac{\dot{x}}{2}\sqrt{\frac{4x+a}{x}}$, and the radius of curvature $\left(\frac{\dot{z}^3}{-\dot{x}\ddot{y}}\right)=\frac{\overline{a+4x}^{\frac{3}{2}}}{2\sqrt{a}}$: Which at the vertex, where $x=0$, will be $=\frac{1}{2}a$.

INVERSE METHOD.

From a given fluxion to find a fluent.

This is done by tracing back the ſteps of the direct method. The fluxion of x is $\dot{x}$; and therefore the fluent of $\dot{x}$ is x: but as there is no direct method of finding fluents, this branch of the art is imperfect. We can aſſign the fluxion of every fluent, but we cannot aſſign the fluent of a fluxion, unleſs it be ſuch a one as may be produced by ſome rule in the direct method from a known fluent.

GENERAL RULE. Divide by the fluxion of the root, add unity to the exponent of the power, and divide by the exponent ſo increaſed.

For, dividing the fluxion $nx^{n-1}\dot{x}$ by $\dot{x}$ (the fluxion of the root x) it becomes nx^{n-1}; and, adding 1 to the exponent $(n-1)$ we have nx^n; which, divided by n, gives x^n, the true fluent of $nx^{n-1}\dot{x}$.

Hence (by the ſame rule) the

Fluent of $3x^2\dot{x}$ will be $=x^3$;

That of $8x^2\dot{x}=\frac{8x^3}{3}$;

That of $2x^5\dot{x}=\frac{x^6}{3}$;

That of $y^{\frac{1}{2}}\dot{y}=\frac{2}{3}y^{\frac{3}{2}}$.

Sometimes the fluent ſo found requires to be corrected. The fluxion of x is $\dot{x}$, and the fluxion of $a+x$ is alſo $\dot{x}$, becauſe a is invariable, and has therefore no fluxion.

Now when the fluent of $\dot{x}$ is required, it muſt be determined, from the nature of the problem, whether any invariable part, as a, muſt be added to the variable part x.

When fluents cannot be exactly found, they can be approximated by infinite ſeries.

Ex. Let it be required to approximate the fluent of

$$\frac{\overline{a^2-x^2}^{\frac{1}{2}}\times x^n\dot{x}}{\overline{c^2-x^2}^{\frac{1}{2}}}$$ in an infinite ſeries.

The

The value of $\dfrac{\overline{a^2-x^2}|^{\frac{1}{2}}}{\overline{c^2-x^2}|^{\frac{1}{2}}}$, expreſſed in a ſeries, is $\dfrac{a}{c}+\overline{\dfrac{a}{2c^3}-\dfrac{1}{2ac}}\times x^2+\overline{\dfrac{3a}{8c^5}-\dfrac{1}{4ac^3}-\dfrac{1}{8a^3c}}\times x^4+\overline{\dfrac{5a}{16c^7}-\dfrac{3}{16ac}-\dfrac{1}{16a^3c^3}-\dfrac{1}{16a^5c}}\times x^6+$ &c. Which value being therefore multiplied by $x^n\dot{x}$, and the fluent taken (by the common method) we get $\dfrac{ax^{n+1}}{\overline{n+1}\times c}+\overline{\dfrac{a}{2c^3}-\dfrac{1}{2ac}}\times\dfrac{x^{n+3}}{n+3}+\overline{\dfrac{3a}{8c^5}-\dfrac{1}{4ac^3}-\dfrac{1}{8a^3c}}\times\dfrac{x^{n+5}}{n+5}+\overline{\dfrac{5a}{16c^7}-\dfrac{3}{16ac^5}-\dfrac{1}{16a^3c^3}-\dfrac{1}{16a^5c}}\times\dfrac{x^{n+7}}{n+7}+$ &c.

PROB. 1. *To find the area of any curve.*

RULE. Multiply the ordinate by the fluxion of the abſciſſa, and the product gives the fluxion of the figure, whoſe fluent is the area of the figure.

EXAMP. 1. Fig. 8. Let the curve ARMH, whoſe area you will find, be the common parabola. Let u repreſent the area, and $\dot{u}$ its fluxion.

In which caſe the relation of AB (x) and BR (y) being expreſſed by $y^2=ax$ (where a is the parameter) we thence get $y=a^{\frac{1}{2}}x^{\frac{1}{2}}$; and therefore $\dot{u}=$ RmHB $(=y\dot{x})$ $=a^{\frac{1}{2}}x^{\frac{1}{2}}\dot{x}$: whence $u=\frac{2}{3}\times a^{\frac{1}{2}}x^{\frac{3}{2}}=\frac{2}{3}a^{\frac{1}{2}}x^{\frac{1}{2}}\times x=\frac{2}{3}yx$ (becauſe $a^{\frac{1}{2}}x^{\frac{1}{2}}=y$) $=\frac{2}{3}\times$ AB $\times$ BR: hence a parabola is $\frac{2}{3}$ of a rectangle of the ſame baſe and altitude.

EXAMP. 2. Let the propoſed curve CSDR (fig. 9.) be of ſuch a nature, that (ſuppoſing AB unity) the ſum of the areas CSTBC and CDGBC anſwering to any two propoſed abſciſſas AT and AG, ſhall be equal to the area CRNBC, whoſe correſponding abſciſſa AN is equal to AT×AG, the product of the meaſures of the two former abſciſſas.

Firſt, in order to determine the equation of the curve, (which muſt be known before the area can be found) let the ordinates GD and NR move parallel to themſelves towards HF; and then having put GD$=y$, NR$=z$, AT$=a$, AG$=s$, and AN$=u$, the fluxion of the area CDGB will be repreſented by $y\dot{s}$, and that of the area CRNB by $z\dot{u}$: which two expreſſions muſt, by the nature of the problem, be equal to each other; becauſe the latter area CRNB exceeds the former CDGB by the area CSTB, which is here conſidered as a conſtant quantity: and it is evident, that two expreſſions, that differ only by a conſtant quantity, muſt always have equal fluxions.

Since, therefore, $y\dot{s}$ is $=z\dot{u}$, and $u=as$, by hypotheſis, it follows, that $\dot{u}=a\dot{s}$, and that the firſt equation (by ſubſtituting for $\dot{u}$) will become $y\dot{s}=az\dot{s}$, or $y=az$, or laſtly $ys=zas$, that is, GD×AG=NR×AN: therefore, GD : NR :: AN : AG; whence it appears, that every ordinate of the curve is reciprocally as its correſponding abſciſſa.

Now, to find the area of the curve ſo determined, put AB$=1$, BC$=b$, and BG$=x$: then, ſince AG ($1+x$) : AB (1) :: BC (b) : GD (y) we have $y=\dfrac{b}{1+x}$, and conſequently $\dot{u}\ (=y\dot{x})=\dfrac{b\dot{x}}{1+x}=b\times\overline{\dot{x}-x\dot{x}+x^2\dot{x}-x^3\dot{x}+x^4\dot{x}-\text{\&c.}}$ Whence, BGDC, the area itſelf will be $=b\times x-\dfrac{x^2}{2}+\dfrac{x^3}{3}-\dfrac{x^4}{4}+\dfrac{x^5}{5}$, &c. which was to be found.

Hence it appears, that as theſe areas have the ſame properties as logarithms, this ſeries gives an eaſy method of computing logarithms; and the fluent may be found by means of a table of logarithms, without the trouble of an infinite ſeries: and every fluxion whoſe fluent agrees with any known logarithmic expreſſion, may be found the ſame way. Hence the fluents of fluxions of the following forms are deduced.

The fluent of $\dfrac{\dot{x}}{\sqrt{x^2\pm a^2}}=$ hyp. log. of $x+\sqrt{x^2\pm a^2}$;

of $\dfrac{\dot{x}}{\sqrt{2ax+xx}}=$ hyp. log. $a\times x+\sqrt{2ax+x^2}$;

of $\dfrac{2a\dot{x}}{a^2-x^2}$ hyp. log. of $\dfrac{a+x}{a-x}$;

and of $\dfrac{2a\dot{x}}{x\sqrt{a^2\pm x^2}}=$ hyp. log. $\dfrac{a-\sqrt{a^2\pm x^2}}{a+\sqrt{a^2\pm x^2}}$.

PROB. 2. *To determine the length of curves.*

Fig. 5. Becauſe Cde is a right-angled triangle, Cd^2 $=$Ce^2+de^2; wherefore the fluxions of the abſciſſa and ordinate being taken in the ſame terms and ſquared, their ſum gives the ſquare of the fluxion of the curve; whoſe root being extracted, and the fluent taken, gives the length of the curve.

EXAMP To find the length of a circle from its tangent. Make the radius AO (fig. 5.) $=a$, the tangent of AC $=t$, and its ſecant $=s$, the curve $=z$, and its fluxion $=\dot{z}$; becauſe the triangles OTC, OCS, are ſimilar, OT : OC :: OC :: OS; whence OS $=\dfrac{a^2}{s}$, and SA $=a-\dfrac{a^2}{s}=a-\dfrac{a^2}{\sqrt{a^2+t^2}}$; whoſe fluxion is $\dfrac{a^2t\dot{t}}{\overline{a^2+t^2}|^{\frac{3}{2}}}$; and becauſe the triangles OTC, dCe are ſimilar, TC ($=t$): TO ($=\sqrt{a^2+t^2}$) :: Ce $=\left(\dfrac{a^2t\dot{t}}{\overline{a^2+t^2}|^{\frac{3}{2}}}\right)$: Cd $=\dfrac{a^2\dot{t}}{a^2+t^2}=$ fluxion of the curve.

Now by converting this into an infinite ſeries, we have the fluxion of the curve $=\dot{t}-\dfrac{t^2\dot{t}}{a^2}+\dfrac{t^4\dot{t}}{a^4}-\dfrac{t^6\dot{t}}{a^6}$, &c. and conſequently $z=t-\dfrac{t^3}{3a^2}+\dfrac{t^5}{5a^4}-\dfrac{t^7}{7a^6}+\dfrac{t^9}{9a^8}$, &c. $=$ AR.

Where, if (for example' ſake) AR be ſuppoſed an arch of 30 degrees, and AO (to render the operation more eaſy) be put $=$ unity, we ſhall have $t=\sqrt{\frac{1}{3}}=.5773502$ (becauſe O$b\sqrt{\frac{3}{4}}$: bR $(\frac{1}{2})$ :: OA (1) : AT (t) $=\sqrt{\frac{1}{3}}$) Whence,

$t^3\quad(=t\times t^2=t\times\frac{1}{3})=.1924500$

$t^5\quad\left(=t^3\times t^2=\dfrac{t^3}{3}\right)=.0641500$

t^7

$$t^{7}\ \left(=t^5\times t^2=\frac{t^5}{3}\right)=.0213833$$

$$t^{9}\ \left(=t^7\times t^2=\frac{t^7}{3}\right)=.0071277$$

$$t^{11}\ \left(=t^9\times t^2=\frac{t^9}{3}\right)=.0023759$$

$$t^{13}\ \left(=t^{11}\times t^2=\frac{t^{11}}{3}\right)=.0007919$$

$$t^{15}\ \left(=t^{13}\times t^2=\frac{t^{13}}{3}\right)=.0002639$$

&c.

And therefore $AR = .5773502 - \frac{.1934500}{3} + \frac{.0641500}{5} - \frac{.0213833}{7} \times \frac{0091277}{9} - \frac{.0023759}{11} + \frac{.0007919}{13} - \frac{.0002639}{15} + \frac{.0000879}{17} - \frac{.0000293}{19} + \frac{.0000097}{21} - \frac{.0000032}{23} = .5235987$: for the length of an arch of 30 degrees, which multiplied by 6 gives 3.141592 + for the length of the femi periphery of the circle whofe radius is unity.

Other feries may be deduced from the verfed fine, fine and fecant; and thefe are of ufe for finding fluents which cannot be expreffed in finite terms. For,

$$\text{the fluent of}\left\{\begin{array}{l} \dfrac{\dot{w}}{\sqrt{2aw-w^2}} \\[2ex] \dfrac{\dot{w}}{\sqrt{a^2-w^2}} \\[2ex] \dfrac{a\dot{w}}{a^2+w^2} \\[2ex] \dfrac{a\dot{w}}{w\sqrt{w^2-a^2}} \end{array}\right\}\text{is equal to the arch whofe}\left\{\begin{array}{l} \text{Verfed-fine} \\[2ex] \text{Right-fine} \\[2ex] \text{Tangent} \\[2ex] \text{Secant} \end{array}\right\}\text{is } \frac{w}{a}\text{, and Radius Unity.}$$

Prob. 3. *To find the contents of a folid.*

Let the furface of the generating plane be multiplied by the fpace it paffes through in any time, the product will give a folid which is the fluxion of the folid required: the furface muft therefore be computed in terms of x, which reprefents the line or axis on which it moves, and by its motion on which the fluxion is to be meafured, and the fluent found will give the contents of the folid.

Examp. Let it be propofed to find the content of a cone ABC, fig. 10.

Put the given altitude (AD) of the cone $=a$, and the femi-diameter (BD) of its bafe $=b$, the folid $=s$, its fluxion $=\dot{s}$, and the area of a circle, whofe radius is unity, $=p$: then the diftance (AF) of the circle EG, from the vertex A, being denoted by x, &c. we have, by fimilar triangles, as $a : b :: x : \text{EF}\ (y) = \frac{bx}{a}$. Whence in this cafe, $\dot{s}\ (=py^2\dot{x}) = \frac{pb^2x^2\dot{x}}{a^2}$; and confequently $s = \frac{pb^2x^3}{3a^2}$; which, when $x=a$ (=AD) gives $\frac{pb^2a}{3}$ ($=p\times \text{BD}^2\times \frac{1}{3}\text{AD}$) for the content of the whole cone ABC: which appears from hence to be juft $\frac{1}{3}$ of a cylinder of the fame bafe and altitude.

Prob. 4. *To compute the furface of any folid body.*

The fluxion of the furface of the folid is equal to the periphery of the furface, by whofe motion the folid is generated, multiplied by its velocity on the edge of the folid, and the computation is made as in the foregoing.

Examp. Fig. 11. Let it be propofed to determine the convex fuperficies of a cone ABC.

Then, the femi-diameter of the bafe (BD, or CD) being put $=b$, the flanting line, or hypothenufe AC$=c$, and FH (parallel to DC) $=y$, AG $=z$, the furface $=w$, its fluxion $=\dot{w}$, and $p=$ the periphery of a circle whofe diameter is unity, we fhall, from the fimilarity of the triangles ADC and Hmh, have $b : c :: \dot{y}\ (mh : \dot{z}\ (\text{H}h) = \frac{c\dot{y}}{b}$: whence $\dot{w}\ (2py\dot{z}) = \frac{2pcy\dot{y}}{b}$; and confequently $w = \frac{pcy^2}{b}$. This, when $y=b$, becomes $=pcb=p\times\text{DC}\times\text{AC}=$ the convex fuperficies of the whole cone ABC: which therefore is equal to a rectangle under half the circumference of the bafe and the flanting line.

The method of fluxions is alfo applied to find the centres of gravities, and ofcillation of different bodies; to determine the paths defcribed by projectiles and bodies acted on by central forces, with the laws of centrepetal force in different curves; the retardates given to motions performed in refifting medici; the attractions of bodies under different forms; the direction of wind, which has the greateft effect on an engine; and to folve many other curious and ufeful problems.

FLY

FLY in zoology. See Natural History.

Fly, in mechanics, a crofs with leaden weights at its ends; or rather a heavy wheel at right angles to the axis of a windlafs, jack, or the like; by means of which the force of the power, whatever it be, is not only preferved, but equally diftributed in all parts of the revolution of the machine. See Mechanics.

FLYING, the progreffive motion of a bird, or other winged animal, in the air.

The parts of birds chiefly concerned in flying are the wings, by which they are fuftained or wafted along. The tail, Meffrs Willughby, Ray, and many others, imagine to be principally employed in fteering and turning the body in the air, as a rudder: but Borelli has put it beyond all doubt, that this is the leaft ufe of it, which is chiefly to affift the bird in its afcent and defcent in the air; and to obviate the vacillations of the body and wings: for, as to turning to this or that fides, it is performed by the wings and inclinations of the body, and but very little by the help of the tail. The flying

flying of a bird, in effect, is quite a different thing from the rowing of a veffel. Birds do not vibrate their wings towards the tail, as oars are ftruck towards the ftern, but waft them downwards; nor does the tail of the bird cut the air at right angles, as the rudder does the water; but is difpofed horizontally, and preferves the fame fituation what way foever the bird turns.

In effect, as a veffel is turned about on its centre of gravity to the right, by a brifk application of the oars to the left, fo a bird in beating the air with its right wing alone, towards the tail, will turn its fore part to the left. Thus pigeons changing their courfe to the left, would labour it with their right wing, keeping the other almoft at reft. Birds of a long neck alter their courfe by the inclinations of their head and neck, which altering the courfe of gravity, the bird will proceed in a new direction.

The manner of FLYING is thus: the bird firft bends his legs, and fprings with a violent leap from the ground; then opens and expands the joints of his wings, fo as to make a right line perpendicular to the fides of his body: thus the wings with all the feathers therein, conftitute one continued lamina. Being now raifed a little above the horizon, and vibrating the wings with great force and velocity perpendicularly againft the fubject air, that fluid refifts thofe fucceffions, both from its natural inactivity and elafticity, by means of which the whole body of the bird is protruded. The refiftance the air makes to the withdrawing of the wings, and confequently the progrefs of the bird, will be fo much the greater, as the waft or ftroke of the fan of the wing is longer: but as the force of the wing is continually diminifhed by this refiftance, when the two forces continue to be in equilibrio, the bird will remain fufpended in the fame place; for the bird only afcends fo long as the arch of air the wing defcribes makes a refiftance equal to the excefs of the fpecific gravity of the bird above the air. If the air, therefore, be fo rare as to give way with the fame velocity as it is ftruck withal, there will be no refiftance, and confequently the bird can never mount. Birds never fly upwards in a perpendicular line, but always in a parabola. In a direct afcent, the natural and artificial tendency would oppofe and deftroy each other, fo that the progrefs would be very flow. In a direct defcent they would aid one another, fo that the fall would be too precipitate.

FLYING FISH, a name given by the Englifh writers to feveral fpecies of fifh, which, by means of their long fins, have a method of keeping themfelves out of water a long time. See EXOCOETUS.

FLYING PINION, is part of a clock, having a fly, or fan, whereby to gather air, and fo bridle the rapidity of the clock's motion, when the weight defcends in the ftriking part.

FOAL, or COLT, the young of the horfe kind. The word colt, among dealers, is underftood of the male kind. See EQUUS and HORSEMANSHIP.

FOCHEN, a town of China, capital of the province of Fokein: E. long. 118°, N. lat. 26° 20′.

FOCUS, in geometry and conic fections, is applied to certain points in the parabola, ellipfis and hyperbola, where the rays reflected from all parts of thefe curves concur and meet. See CONIC SECTIONS.

FOCUS, in optics, is the point wherein rays are collected after they have undergone reflection or refraction. See OPTICS.

FOENUGREEK, in botany. See TRIGONELLA.

FOETOR, in medicine, ftinking or fœtid effluvia, arifing from the body, or any part thereof.

FOETUS, denotes the child while it is contained in the mother's womb, but particularly after it is formed, till which time it is more properly called embryo. See MIDWIFERY.

FOG, or MIST, a meteor, confifting of grofs vapours, floating near the furface of the earth.

FOIL, among glafs-grinders, a fheet of tin, with quickfilver or the like, laid on the backfide of a lookingglafs, to make it reflect.

FOIL, among jewellers, a thin leaf of metal placed under a precious ftone, in order to make it look tranfparent, and give it an agreeable different colour, either deep or pale: thus, if you want a ftone to be of a pale colour, put a foil of that colour under it; or if you would have it deep, lay a dark one under it.

FOLIA, among botanifts, particularly fignify the leaves of plants; thofe of flowers being expreffed by the word petal. See BOTANY.

FOLIACEUM EXPANSUM, in anatomy, a term applied to the extreme part of the Fallopian tube, next the ovary, which is expanded like the mouth of a trumpet, and furrounded with a fort of fringe.

FOLIAGE, a clufter or affemblage of flowers, leaves, branches *&c.*

FOLIAGE is particularly ufed for the reprefentations of fuch flowers, leaves, branches, rinds, *&c.* whether natural or artificial, as are ufed for enrichments on capitals, friezes, pediments, *&c.*

FOLIO, in merchants books, denotes a page, or rather both the right and left hand pages, thefe being expreffed by the fame figure, and correfponding to each other. See BOOK-KEEPING.

FOLIO, among printers and bookfellers, the largeft form of books, when each fheet is fo printed, that it may be bound up in two leaves only.

FOLKSTONE, a market town of Kent, fix miles weft of Dover.

FOMAHANT, in aftronomy, a ftar of the firft magnitude, in the conftellation aquarius.

FOMENTATION, in medicine, the bathing any part of the body with a convenient liquor; which is ufually a decoction of herbs, water, wine, or milk; and the applying of bags ftuffed with herbs and other ingredients, which is commonly called dry fomentation.

FONDI, a city and bifhop's fee of Naples, in the province of Lavoro, about thirty-five miles north-weft of Capua: E. long. 14° 20′, and N. lat. 41° 55′.

FONT, among ecclefiaftical writers, a large bafon, in which water is kept for the baptizing of infants, or other perfons.

FON-

FONTAINE, a town of Hainalt, fifteen miles eaſt of Mons.

FONTAINEBLEAU, a village of the iſle of France, about thirty miles ſouth-eaſt of Paris; remarkable for an elegant royal palace.

FONTANELLA, in anatomy, the quadrangular aperture, between the os frontis and oſſa ſincipitis, in infants juſt born.

FONTARABIA, a port-town of Spain, in the province of Biſcay, twenty miles weſt of Bayonne: W. long. 1° 35′; and N. lat. 43° 20′.

FONTENAYLE, a town of Orleanois, in France, about forty-ſix miles weſt of Poictiers.

FONTENOY, a town of Hainalt, ſituated three miles ſouth eaſt of Tournay.

FONTEVRAUD, or *Order of* FONTEVRAUD, a religious order inſtituted about the latter end of the XIth century. By the rules of this order the nuns were to keep ſilence for ever, and their faces to be always covered with their veils; and the monks wore a leathern girdle, at which hung a knife and ſheath.

FONTICULUS, or FONTANELLA, in ſurgery, an iſſue, ſeton, or ſmall ulcer made in various parts of the body, in order to eliminate the latent corruption out of it.

FONTINALIS, in botany, a genus of the cryptogamia muſci claſs. The anthera is operculated, and the calyptra is ſeſſile. There are four ſpecies, all natives of Britain, *viz.* the antipyretica, or greater water-moſs; the minor, or leſſer water moſs; the ſquamoſa, or ſcaly water-moſs; and the pennata, or feathered water-moſs.

FOOD implies whatever aliments are taken into the body, to nouriſh it. See MEDICINE.

FOOL, according to Mr Locke, is a perſon who makes falſe concluſions from right principles; whereas a madman, on the contrary, draws right concluſions from wrong principles.

FOOL'S STONES, in botany. See ORCHIS.

FOOT, a part of the body of moſt animals whereon they ſtand, walk, *&c.* See NATURAL HISTORY.

FOOT, in anatomy. See ANATOMY, part I.

FOOT, in the Latin and Greek poetry, a metre or meaſure, compoſed of a certain number of long and ſhort ſyllables.

Theſe feet are commonly reckoned twenty eight, of which ſome are ſimple, as conſiſting of two or three ſyllables, and therefore called diſſyllabic or triſyllabic feet; others are compound, conſiſting of four ſyllables, and are therefore called tetraſyllabic feet.

The diſſylabic feet are four in number, *viz.* the pyrrhichius, ſpondeus, iambus, and trocheus. See PYRRHICHIUS, *&c.*

The triſyllabic feet are eight in number, *viz.* the dactylus, anapæſtus, tribrachys, moloſſus, amphybrachys, amphimacer, bacchius, and antibacchius. See DACTYL, *&c.*

The tetraſyllabic are in number ſixteen, *viz.* the procleuſmaticus, diſpondeus, choriambus, antiſpaſtus, diiambus, dichoreus, ionicus a majore, ionicus a minore, epitritus primus, epitritus ſecundus, epitritus tertius, epitritus quartus, pæon primus, pæon ſecundus, pæon tertius, and pæon quartus. See PROCLEUSMATICUS, *&c.*

FOOT is alſo a long meaſure, conſiſting of 12 inches.

Geometricians divide the foot into 10 digits, and the digit into 10 lines.

FOOT *ſquare*, is the ſame meaſure both in breadth and length, containing 144 ſquare or ſuperficial inches.

Cubic or *Solid* FOOT, is the ſame meaſure in all the three dimenſions, length, breadth, and depth or thickneſs, containing 1728 cubic inches.

FOOT *of a horſe*, in the menage, the extremity of the leg, from the coronet to the lower part of the hoof.

FOOT LEVEL, among artificers, an inſtrument that ſerves as a foot-rule, a ſquare, and a level. See LEVEL, RULE, and SQUARE.

FORAMEN, in anatomy, a name given to ſeveral apertures or perforations in divers parts of the body; as, 1. The external and internal foramina of the cranium or ſkull. 2. The foramina, in the upper and lower jaw. 3. Foramen lachrymale. 4. Foramen membranæ tympani. See ANATOMY.

FORCALQUIER, a town of Provence, in France, thirty miles north of Aix.

FORCE, in mechanics, denotes the cauſe of the change in the ſtate of a body when being at reſt it begins to move, or has a motion which is either not uniform or not direct. See MECHANICS.

Central FORCES. See MECHANICS.

FORCE, in law, ſignifies any unlawful violence offered to things or perſons.

FORCEPS, in ſurgery, *&c.* a pair of ſciſſars for cutting off, or dividing, the fleſhy membraneous parts of the body, as occaſion requires. See SURGERY.

FORE-CASTLE OF A SHIP, that part where the foremaſt ſtands. It is divided from the reſt by a bulkhead.

FOREIGN, ſome thing extraneous, or that comes from abroad.

FOREIGNER, the natural born ſubject to ſome foreign prince.

Foreigners, tho' made denizens, or naturalized, are diſabled to bear any office in the goverment, to be of the privy-council, or members of parliament, *&c.* This is by the acts of the ſettlement of the crown. Such perſons as are not freemen of a city, or corporation, are alſo called foreigners, to diſtinguiſh them from the members of the ſame.

FORELOCKS, in the ſea language, little flat wedges made with iron, uſed at the ends of bolts, to keep them from flying out of their holes.

FORELORN-HOPE, in the military art, ſignifies men detached from ſeveral regiments, or otherwiſe appointed, to make the firſt attack in day of battle; or, at a ſiege, to ſtorm the counterſcarpe, mount the breach, or the like.

They are ſo called from the great danger they are unavoidably expoſed to; but the word is old, and begins to be obſolete.

FORE-MAST OF A SHIP, a large round piece of timber, placed in her fore-part, or fore-castle, and carrying the fore-sail and fore top-sail yards. Its length is usually $\frac{8}{9}$ of the main-mast, and the fore top-gallant mast is $\frac{1}{2}$ the length of the fore-top.

FOREMAST-MEN, are those on board a ship that take in the top-sails, sling the yards, furl the sails, bowse, trice, and take their turn at the helm, *&c.*

FOREST, in general, a great wood, or a large extent of ground covered with trees.

FOREST, in law, is defined by Manwood, a certain territory of woody grounds, and fruitful pastures, privileged for wild beasts and fowls of forest, chace and warren, to rest and abide under the protection of the king, for his princely delight, bounded with unremoveable marks, and meres, either known by matter of record or prescription; replenished with wild beasts of venery, or chase, with great coverts of vert for the said beasts; for preservation and continuance whereof, with the vert and venison, there are certain particular laws, privileges, and officers.

Forests are of that antiquity in England, that, excepting the new forest in Hampshire erected by William the Conqueror, and Hampton Court erected by Henry VIII. it is said that there is no record or history which makes any certain mention of their erection, though they are mentioned by several writers, and in divers of our laws and statutes.

There are sixty-nine forests in England, thirteen chases, and 800 parks. The four principal forests are New Forest, Sherwood Forest, Dean Forest, and Windsor Forest.

FOREST-TOWNS, in geography, certain towns of Swabia, in Germany, lying along the Rhine and the confines of Switzerland, and subject to the house of Austria. Their names are Rhinefield, Seckingen, Laufenburg, and Waldshut.

FORE-STAFF, or CROSS-STAFF, an instrument used at sea for taking the altitude of the sun, moon or stars.

FORESTALLER, a person who is guilty of forestalling. See the next article.

FORESTALLING, in law, buying or bargaining for any corn, cattle, victuals, or merchandize, in the way as they come to fairs or markets to be sold, before they get thither, with an intent to sell the same again at a higher price.

The punishment for this offence, upon conviction at the quarter sessions, by two or more witnesses, is, for the first time, two months imprisonment and the loss of the goods, or the value; for the second offence, the offender shall be imprisoned six months, and lose double the value of the goods; for the third offence, he shall suffer imprisonment during the king's pleasure, forfeit all his goods and chattels, and stand on the pillory: but the statute does not extend to maltsters buying barley, or to badgers licensed.

FORESTER, a sworn officer of the forest, appointed by the king's letters-patent, to walk the forest at all hours, watch over the vert and venison; also to make attachments and true presentments of all trespasses committed within the forest.

FORETHOUGHT FELONY, in Scots law, signifies premeditated murder.

FORFAR, the capital of the county of Angus, in Scotland: W. long. 2° 32′, and N. lat. 56° 25′.

It is a parliament-town, classed with Perth, Dundee, Coupar, and St Andrews, which all together send one member.

FORFEITURE, properly signifies the effect of transgressing some penal law, and extends to lands or goods.

FORFICULA, the EAR-WIG, in zoology, a genus of insects belonging to the order of coleoptera. The antennæ are bristly; the elytra are dimidiated; the wings are covered; and the tail is forked. There are two species, *viz.* the auriculata, or common ear-wig, with the tops of the elytra white; and the minor, with testaceous and unspotted elytra.

FORGE, properly signifies a little furnace, wherein smiths and other artificers of iron or steel, *&c.* heat their metals red-hot, in order to soften them and render them more malleable and manageable on the anvil.

FORGE is also used for a large furnace, wherein iron-ore, taken out of the mine, is melted down: or it is more properly applied to another kind of furnace, wherein the iron-ore, melted down and separated in a former furnace, and then cast into sows and pigs, is heated and fused over again, and beaten afterwards with large hammers, and thus rendered more soft, pure, ductile, and fit for use.

FORGER, in law, one guilty of forgery. See the next article.

FORGERY, in a legal sense, is where a person fraudulently makes and publishes false writings to another's prejudice: or, it signifies the writ that lies against him who offends that way.

FORISFAMILIATION, in law, when a child, upon receiving a portion from his father, or otherwise renounces his legal title to any further share of his father's succession, he is said to be *forisfamiliated*. See SCOTS LAW, title 28

FORLI, a town of Romania, in the pope's territories, fifteen miles south-west of Ravenna.

FORM, in physics, the essential or distinguishing modification of the matter whereof a natural body is composed, so as thereby to give it such a particular manner of existence; being that which constitutes it such a particular body, and distinguishes it from every other body.

FORM is also used, in a moral sense, for the manner of being or doing a thing according to rules: thus we say, a form of government, a form of argument, *&c.*

FORM, in law, the rules established and requisite to be observed in legal proceedings.

FORM, in carpentry, is used to denote the long seats or benches in the choirs of churches or in schools, for the priests, prebends, religious, or scholars to sit on. At schools, the word form is frequently applied to what is otherwise termed a class. See CLASS.

FORM also denotes the external appearance or surface of a body, or the disposition of its parts, as to the length, breadth, and thickness.

Form is alſo uſed, among mechanics, for a ſort of mould whereon any thing is faſhioned or wrought: as the hatter's form, the paper-maker's form, *&c.*

Printer's Form, an aſſemblage of letters, words, and lines, ranged in order, and ſo diſpoſed into pages by the compoſitor; from which, by means of ink and a preſs, the printed ſheets are drawn.

Every form is incloſed in an iron-chaſe, wherein it is firmly locked by a number of pieces of wood; ſome long and narrow, and others of the form of wedges. There are two forms required for every ſheet, one for each ſide; and each form conſiſts of more or fewer pages, according to the ſize of the book.

FORMAL, ſomething belonging to, or conſtituting the form of a thing. See Form.

FORMICA, or the Ant, in zoology, a genus of inſects belonging to the order of hymenoptera, the characters of which are theſe: There is a ſmall ſcale betwixt the breaſt and belly, and the joint is ſo deep that the animal appears as if it were almoſt cut through the body. The females, and the neuters or working ants which have no ſexual characteriſtics, are furniſhed with a hidden ſting; and both the males and females have wings, but the neuters have none. There are eighteen ſpecies, moſt of them diſtinguiſhed by their colours.

Theſe inſects keep together in companies like the bees, and maintain a ſort of republic. Their neſt is not exactly ſquare, but longer one way than the other; and in it there are a ſort of paths, which lead to different magazines. Some of the ants are employed in making the ground firm, by mixing it with a ſort of glue, for fear it ſhould crumble, and fall down upon their heads. They may be ſometimes ſeen to gather ſeveral twigs, which ſerve them for rafters, which they place over the paths, to ſupport the covering; they lay others acroſs them, and upon them ruſhes, weeds, and dried graſs, which they heap up into a double declivity, which ſerves to turn off the water from their magazines. Some of theſe ſerve to lay up their proviſions in, and in others they lay their eggs.

As for the proviſions, they lay up every thing that is fit for them to eat; and you may often ſee one loaded with pippin, or grain of fruit, another with a dead flie, and ſeveral together with the carcaſe of a may-bug, or other inſect. If they meet with any they cannot bring away, they eat it upon the ſpot, or at leaſt ſo much of it, as may reduce it to a bulk ſmall enough for them to carry. They do not run about where they pleaſe, at all adventures: for ſome of them are ſent abroad to make diſcoveries; and if they bring back news they have met with a pear, or a ſugar-loaf, or a pot of ſweatmeats, they will run from the bottom of the garden, as high as the third ſtory of a houſe, to come at it. They all follow each other in the ſame path, without wandering to the right or the left; but in the fields they are more at their liberty, and are allowed to run about in ſearch of game. There is a ſort of green fly, that does a great deal of miſchief among the flowers, and which curl up the leaves of peach and pear trees; and theſe are ſurrounded with a ſort of glue, or honey, which the ants hunt after very greedily; for they touch neither the plant nor the flies themſelves.

Next to this, their greateſt paſſion is to lay up hoards of wheat, and other corn; and for fear the corn ſhould ſprout by the moiſture of the ſubterraneous cells, they gnaw off the end which would produce the blade. The ants are often ſeen puſhing along grains of wheat, or barley, much larger than themſelves.

In Africa, and particularly in Guiney, the ants are exceeding troubleſome, and do a great deal of miſchief. They make their neſts of earth in the fields, twice as high as a man; beſides which they build large neſts in high trees, from which places they advance in ſuch prodigious ſwarms to the houſes, that they frequently oblige the inhabitants to quit their beds in the night-time. They will ſometimes attack a living ſheep, which in a night's time they will reduce to a perfect ſkeleton, leaving not the leaſt thing except the bones. It is common for them to ſerve domeſtic fowls in the ſame manner, and even the rats themſelves cannot eſcape them. If you place a worm or a beetle where only one or two ants are, they will immediately depart, and bring with them above an hundred; after which they ſeize their prey, and march off with it in good order. Theſe ants are of various ſorts, ſome great, others ſmall, ſome black, and others red; the ſting of this laſt is very painful, and cauſes an inflammation; the white are as tranſparent as cryſtal, and have ſuch ſtrong teeth, that in a night's time they will eat their way through a thick wooden cheſt, and make it as full of holes as if it had been penetrated by hail-ſhot.

There are alſo ſeveral ſorts of ants in the Eaſt Indies, whoſe numbers are prodigious: ſome of them are exceeding large, and of a ruddy colour, inclining to black; and ſome have wings, but others have none. They are very pernicious to the fruits of the earth, and do a great deal of miſchief in houſes, unleſs great care is taken to prevent them. It is remarkable, that if one ant meets another that is loaden, it always gives way to let it paſs freely.

The ant lays eggs in the manner of the common flies, and from theſe eggs are hatched a ſort of ſmall maggots or worms without legs: theſe are ſharp at one end and blunt at the other; and are white, but ſo tranſparent, that the inteſtines are ſeen through the ſkin. Theſe, after a ſhort time, change into large white aureliæ, which are what are uſually called ants eggs. That end which is to be the tail is the largeſt, and that which is the head is ſomewhat tranſparent.

The ants move theſe about at pleaſure with their forceps. It is well known, that when a neſt of theſe creatures is diſturbed and the aureliæ ſcattered about, the ants are at infinite pains to get together all that are unhurt, and make a neſt for them again: nay, any ants will do this, and thoſe of one neſt will often take care of the aureliæ of another.

The affection of the ant for its offſpring is amazing. They carry the young worms about in their mouths, that nothing may injure them; and when the earth

earth of the neſt is dry, they carry them down to a greater depth, but when wet they bring them to the ſurface, that they may not be injured by the damps.

The common ant builds only with ſmall ſmall pieces of dry earth, and there is always found a vaſt quantity either of eggs, worms, or aureliæ, at the bottom of the neſt. The aureliæ are covered only with a thin ſkin; and when carefully opened, they ſhew the worm perfect, and in its ſeveral ſtages of perfection.

The forecaſt of ants in providing againſt the winter is a miſtake. They are ſuppoſed not to eat in the winter, but to ſpend that ſeaſon, like dormice and many other ſorts of animals, in a ſtate of ſleep. What confirms this is, that they have been obſerved, as the cold draws on in the autumn, to move very heavily, and in the vintage-time they can hardly ſtir at all; ſo that the proviſion they make ſeems intended not for themſelves, but for their young.

The care theſe creatures take of their offspring is remarkable. Whenever a hill is diſturbed, all the ants are found buſied in conſulting the ſafety, not of themſelves, but of the eggs or theſe larger bodies encloſing the maggot or young ant; they carry theſe down any way ſo as to get them out of ſight, and will do this over and over as often as they are diſturbed.

They carry away the eggs and vermicles together in their confuſion; but as ſoon as the danger is over, they carefully ſeparate them, and place each ſort in parcels by themſelves under ſhelter of different kinds, and at various depths, according to the different degrees of warmth and coverture the different ſtates require.

In the warm ſeaſon of the year, they every morning bring up the eggs, as they are uſually called, to the ſurface, or nearly ſo; and from ten in the forenoon to five in the afternoon or thereabouts, all theſe will be found juſt under the ſurface; and if the hills be examined toward eight in the evening, they will be found to have carried them all down; and if rainy weather be coming on, it will be neceſſary to dig a foot deep or more, in order to find them.

Theſe little creatures are very troubleſome in gardens, and in paſture-lands; as well by feeding on the fruit, as by making up hills for their habitation. In the hotter countries, as Italy, Spain, and the Weſt Indies, ants are the great peſt of the fields. Trees may be preſerved from them by encompaſſing the ſtem, for four fingers breadth, with a roll of wool, newly pulled from the ſheep's belly; or by laying ſaw-duſt all round the ſtump of it. Some anoint the tree with tar, which has the ſame effect.

The large, black, winged ants of America, to avoid the great rains which fall there at particular ſeaſons, make to themſelves large neſts on trees, with a covered way for them to go up and down on the leeſide of the tree. Theſe neſts are roundiſh on the outſide, made of light brown earth, plaiſtered ſmooth. They are larger than a buſhel; and in the inſide are many ſinous caverns or lodgings communicating with one another. See Plate LXXX. fig. 1. A, The ants neſt; B, The tubular paſſage, made of the ſame materials.

FORMICA, in medicine, a callous ſort of wart.

FORMICA-LEO, the ANT-LION, or ANT-EATER, in zoology, an inſect ſo called from its devouring great numbers of ants. It is the caterpillar or worm of a fly much reſembling the libellæ or dragon-flies.

The addreſs of this inſect in catching the ant is admirable; it makes a hole of a conical or funnel ſhape, in the looſe ſand; and is ſure to catch all the ants that come within the verge of this hole, by throwing up ſand on them, whereby they are forcibly carried into the power of the enemy at the bottom of the hole.

FORMOSA, an iſland in the pacific ocean, between 119° and 122° of E. long. and between 22° and 25′ N. lat. about 100 miles eaſt of Canton in China. It is ſubject to the Chineſe.

FORMULA, or FORMULARY, a rule or model, or certain terms preſcribed or decreed by authority, for the form and manner of an act, inſtrument, proceeding, or the like.

FORMULA, in church-hiſtory and theology, ſignifies a profeſſion of faith.

FORMULA, in medicine, imports the conſtitution of medicines, either ſimple or compound, both with reſpect to their preſcription and conſiſtence.

FORMULARY, a writing containing the form of an oath, declaration, atteſtation, abjuration, *&c.* to be made on certain occaſions.

FORNACALIA, or FORNICALIA, in Roman antiquity, a feſtival inſtituted by Numa in honour of Fornax, the goddeſs of ovens; wherein certain cakes were made, and offered in ſacrifice before the ovens.

FORNICATION, the act of incontinency between ſingle perſons; for when either of the parties is married, ſuch act is adultery. See ADULTERY.

FORNIX, in anatomy. See ANATOMY, p. 285.

FORRAGE, in the military art, denotes hay, oats, barley, wheat, graſs, clover, *&c.* brought into the camp by the troopers, for the ſuſtenance of their horſes.

It is the buſineſs of the quarter-maſter-general to appoint the method of forrage, and poſt proper guards for the ſecurity of the forragers.

FORRES, a parliament-town of Scotland in the county of Murray, about thirteen miles weſt of Elgin: W. long. 3° 20′, and N. lat. 57° 40′.

It is claſſed with Inverneſs, Fortroſe, and Nairn.

FORT, in the military art, a ſmall fortified place, environed on all ſides with a moat, rampart, and parapet. Its uſe is to ſecure ſome high ground or the paſſage of a river, to make good an advantageous poſt, to defend the lines and quarters of a ſiege, *&c.*

FORTALICE, in Scots law, ſignified anciently a ſmall place of ſtrength, originally built for the defence of the country; and which on that account was formerly reckoned *inter regalia*, and did not go along with the lands upon which it was ſituated without a ſpecial grant from the crown. Now, fortalices are carried by a general grant of the lands; and the word is become ſynonymous with manor-place, meſſuage, *&c.*

FORTIFCATION.

Plate LXX

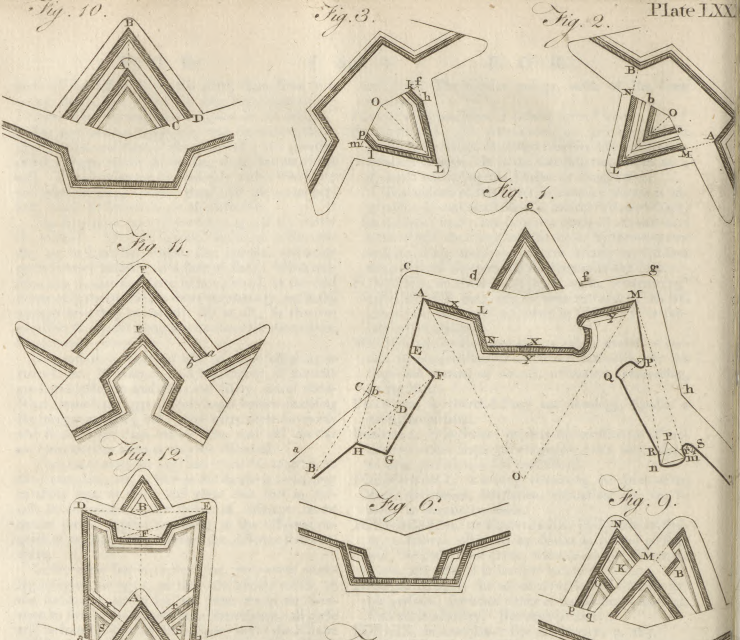


Fig. 10.
Fig. 3.
Fig. 2.
Fig. 1.
Fig. 11.
Fig. 12.
Fig. 6.
Fig. 9.
Fig. 7.
Fig. 8.
Fig. 13.
Fig. 4.
Fig. 5.
A. Bell

FORTIFICATION.

FORTIFCATION, the art of fortifying a town, or other place; or of putting them in ſuch a poſture of defence, that every one of its parts defends, and is defended by ſome other parts, by means of ramparts, parapets, moats, and other bulwarks; to the end, that a ſmall number of men within, may be able to defend themſelves for a conſiderable time againſt the aſſaults of a numerous army without; ſo that the enemy in attacking them, muſt of neceſſity ſuffer great loſs.

Fortification is either ancient or modern, regular or irregular. Ancient fortification, at firſt, conſiſted of walls or defences made of trunks and other branches of trees mixed with earth, to ſecure them againſt the attacks of the enemy. This was afterwards altered to ſtone walls, on which were raiſed breaſt-works, behind which they made uſe of their darts and arrows in ſecurity. Modern fortification is that which is flanked and defended by baſtions and out works, the ramparts of which are ſo ſolid, that they cannot be beat down but by the continual fire of ſeveral batteries of cannon. Regular fortification, is that built in a regular polygon, the ſides and angles of which are all equal, being commonly about a muſket-ſhot from each other. Irregular fortification, on the contrary, is that where the ſides and angles are not uniform, equidiſtant, or equal; which is owing to the irregularity of the ground, valleys, rivers, hills, and the like.

SECTION I. *Of Regular Fortification.*

THE art of regular fortification may be diſtinguiſhed into two parts, *viz.* the elementary or theoretical, and practical.

The elementary part conſiſts in tracing the plans and profiles of a fortification on paper, with ſcales and compaſſes; and to examine the ſyſtems propoſed by different authors, in order to diſcover their advantages and diſadvantages.

And the practical part conſiſts in forming a project of a fortification, according to the nature of the ground and other neceſſary circumſtances, to trace it on the ground, and to execute the project, together with all the military buildings, ſuch as magazines, ſtore-houſes, bridges, *&c.*

Notwithſtanding all the improvements which have been made in the art of fortifying ſince the invention of gunpowder, that of attacking is ſtill ſuperior to it: engineers have tried in vain to render the advantages of a fortification equal to thoſe of the attack; the ſuperiority of the beſiegers fire, together with the greater number of men, obliges generally, ſooner or later, the beſieged to ſubmit.

The greateſt improvement made in the art of attacking happened in the year 1697, when M. Vauban made firſt uſe of ricochet firing at the ſiege of Ath, whereby the beſieged placed behind the parapets were as much expoſed to the fire of the beſiegers as if there had been none; whereas before, they had been ſecure as long as the parapet was not demoliſhed: and the worſt is, that there can be no remedy found to prevent this enfilading without falling into inconveniencies almoſt as bad as thoſe which we endeavour to avoid.

Although authors agree as to the general form in the preſent manner of fortifying, yet they moſtly differ in particular conſtructions of the parts. As it would be both needleſs and ſuperfluous to treat of all the different methods hitherto propoſed, we ſhall content ourſelves with explaining thoſe only, which are moſt eſteemed by the beſt judges, and have been moſtly put in practice.

Conſtruction of M. VAUBAN'*s Method.*

This method is divided into little, mean, and great; the little is chiefly uſed in the conſtruction of citadels, the mean in that of all ſorts of towns, and the great in particular caſes only.

We ſhall give the conſtruction of the mean, as being moſt uſeful, and refer the reader to the table hereafter, for thoſe dimenſions which are different in theſe ſeveral fortifications.

[Plate LXXXIII. fig. 1.] Incribe in a circle a polygon of as many ſides as the fortification is deſigned to have fronts; let AB be one of the ſides of half an exagon, which biſect by the perpendicular CD: divide half AC of it into nine equal parts, and one of theſe into ten others; then theſe diviſions will ſerve as a ſcale to conſtruct all the parts of the fortification, and each of them is ſuppoſed to be a toiſe or fathom, that is ſix French feet; and therefore the whole ſide AB is ſuppoſed to be 180 toiſes.

As the dividing a line into ſo many equal parts, is troubleſome and tedious; it is more convenient to have a ſcale of equal parts by which the works may be conſtructed.

If therefore, in this caſe, the radius is taken equal to 180 toiſes; and the circle deſcribed with that radius being divided into ſix equal parts, or the radius being carried ſix times round, you will have an exagon inſcribed; AB being biſected by the perpendicular CD as before, ſet off 30 toiſes from C to D, and draw the indefinite lines ADG, BDF, in which take the parts AE, BH, each equal to 50 toiſes; from the centre E deſcribe an arc through the point H, meeting AD in G, and from the centre H deſcribe an arc through the point E, meeting BD in F; or which is the ſame, make each of the lines EG HF equal to the diſtance EH; then the lines joining the points A,E,F,G,H,B, will be the principal or outline of the front.

If the fame conftruction be performed on the other fides of the polygon, you will have the principal or outline of the whole fortification.

If, with a radius of 20 toifes, there be defcribed circular arcs, from the angular points B,A,M,T, and lines are drawn from the oppofite angles E, H, *&c.* fo as to touch thefe arcs, their parts a b, b, c, *&c.* together with thefe arcs will reprefent the outline of the ditch.

DEFINITIONS.

1. The part FEALN, is called the baftion.
2. AE, AL, the faces of the baftion.
3. EF, LN, the flanks.
4. FG, the curtain.
5. FN, the gorge of the baftion.
6. AG, BF, the lines of defence.
7. AB, the exterior fide of the polygon.
8. CD, the perpendicular.
9. Any line which divides a work into two equal parts, is called the capital of that work.
10. abc, the counterfcarp of the ditch.
11. A,M, the flanked angles.
12. H,E,L, the angles of the fhoulder, or fhoulder only.
13. G,F,N, the angles of the flank.
14. Any angle whofe point turns from the place is called a faliant angle, fuch as A, M; and any angle whofe point turns towards the place, re-entering angle, fuch as b, F, N.
15. If there be drawn two lines parallel to the principal or outline, the one at 3 toifes diftance, and the other at 8 from it; then the fpace yx included between the principal one and that fartheft diftant, is called the rampart.

And the fpace xx, contained by the principal line, and that next to it, and which is generally ftained black, is called the parapet.

16. There is a fine line drawn within four feet of the parapet, which expreffes a ftep called banquette.

N. B. All works have a parapet of three toifes thick, and a rampert of 8 to 10, befides their flopes. The rampart is elevated more or lefs above the level of the place, from 10 to 20 feet, according to the nature of the ground and the particular conftructions of engineers.

The parapet is a part of the rampart elevated from 6 to $7\frac{1}{2}$ feet above the reft, in order to cover the troops which are drawn up there from the fire of the enemy in a fiege; and the banquette is two or three feet higher than the rampart, or about four feet lower than the parapet; fo that when the troops ftand upon it, they may juft be able to fire over the parapet.

17. The body of the place, is all that which is contained within this firft rampart; for which reafon, it is often faid to conftruct the body of the place; which means properly, the conftruction of the baftions and curtains.

18. All the works which are conftructed beyond the ditch before the body of the place are called outworks.

TABLE.

	Forts.						Little Fortif.				Mean		Great.	
Side of Polyg.	80	90	100	110	120	130	140	150	160	170	180	190	200	260
Perpendicul.	10	11	$12\frac{1}{2}$	14	15	16	20	21	23	25	30	31	25	22
Faces baft.	22	25	28	30	33	35	40	42	45	47	50	53	55	60
Cap. of ravel.	25	28	30	35	38	40	45	50	50	52	55	55	60	50

In the firft vertical column are the numbers expreffing the lengths of the exterior fides from 80 to 260.

In the fecond, the perpendiculars anfwering to thefe fides.

In the third, the lengths of the faces of baftions; and in the fourth, the lengths of the capitals of the ravelins.

The forts are moftly, if not always, fquares; for which reafon, the perpendiculars are made one eighth of the exterior fides; becaufe if they were more, the gorges of the baftions would become too narrow.

The little fortification is chiefly defigned for citadels, and are commonly pentagons; the perpendiculars are made one feventh of the exterior fide; the mean is ufed in all kinds of fortifications from an exagon upwards to any number of fides: and the great is feldom ufed but in an irregular fortification, where there are fome fides that cannot be made lefs without much expence: or in a town which lies near a great river, where the fide next the river is made from 200 to 260 toifes; and as that fide is lefs expofed to be attacked than any other, the perpendicular is made fhorter, which faves much expence.

The faces of the baftions are all $\frac{2}{7}$ths of the exterior fides, or nearly fo, becaufe the fractions are neglected.

It may be obferved in general, that in all fquares the perpendicular is $\frac{1}{8}$th of the exterior fide, and all pentagons $\frac{1}{7}$th, and in all the reft upwards $\frac{1}{6}$th.

1. *Conftruction of Orillons and retired Flanks.*

Defcribe the front MPQRST as before, and divide the flank into three equal parts, of which fuppofe Sr to be one: from the oppofite flanked angle M draw a line Mr, in which take the part mr of 5 toifes; take likewife Rn in the line of defence MR, produced, equal to 5 toifes, and join nm, upon which as a bafe defcribe the equilateral triangle npm, and from the angle p, oppofite to the bafe as centre, is defcribed the circular flank nm.

And if Sr be bifected by the perpendicular 1, 2, and another be erected upon the face ST, at S; the interfection 2 of thefe two perpendiculars, will be the centre of the arc which forms the orillon.

The orillons are very ufeful in covering the retired flanks, which cannot be feen but directly in the front; and as thefe orillons are round, they cannot be fo eafily deftroyed as they would be, if they were of any other figure.

2. *Con-*

2. *Construction of Ravelins or Half-moons.*

Fig. 2. Set off 50 toises, from the re-entering angle O of the counterscarp, on the capital OL of the ravelin, or on the perpendicular produced, and from the point L draw lines to the shoulders A B; whose parts LM, LN, terminated by the counterscarp, will be the faces MO, ON, the semi-gorges of the ravelin required.

This is Mr Vauban's method of constructing ravelins, according to some authors; and others will have the faces of the ravelin to terminate on those of the bastions within 3 toises of the shoulders; which seems to be the best way, for the ravelins cover the flanks much better than the others.

The ditch before the ravelin is 12 toises, its counterscarp parallel to the faces of the ravelins, and is made in a circular arc, before the saliant angle; as likewise all ditches are in general.

When the ravelins are made with flanks, as in fig. 3. the faces should terminate off those of the bastions, at least 5 toises from the shoulders.

The flanks are made by setting off 10 toises from the extremities of the faces, from f to h, and from m to l, fig. 3. and from the points h, l, the flanks hk, lp, are drawn parallel to the capital LO of the ravelin.

There are sometimes redoubts made in the ravelin, such as in fig. 2. which is done by setting off 16 toises from the extremities of the faces on the semi-gorges from N to b, and from M to a; and from the points b, a, the faces are drawn parallel to those of the ravelin: the ditch before this redoubt is 6 toises, and its counterscarp parallel to the faces.

3. *Construction of Tenailles.*

A tenaille is a work made in the ditch before the curtains, the parapet of which is only 2 or 3 feet higher than the level ground of the ravelin. There are three different sorts: the first are those as in fig. 4. which are made in the direction of the lines of defence, leaving a passage of 3 toises between their extremities and the flanks of the bastions, as likewise another of 2 in the middle for a bridge of communication to the ravelin.

The second sort, are those as in fig. 5. Their faces are in the lines of defence, and 16 toises long, besides the passage of 3 toises between them and the flanks of the bastions; their flanks are found by describing arcs from one shoulder of the tenaille as centre thro' the other, on which are set off 10 toises for the flanks desired.

And the third sort, are those as in fig. 6. Their faces are 16 toises, as in the second sort, and the flanks are parallel to those of the bastions.

The use in general of tenailles, is to defend the bottom of the ditch by a grazing fire, as likewise the level ground of the ravelin, and especially the ditch before the redoubt within the ravelin, which can be defended from no where else so well as from them.

The first sort do not defend the ditch so well as the others, as being too oblique a defence; but as they are not subject to be enfiladed, M. Vauban has generally preferred them in the fortifying of places, as may be seen in the citadel of Lille, at Landau, New-Brisac, and in a great many other places.

The second sort defend the ditch much better than the first, and add a low flank to those of the bastions; but as these flanks are liable to be enfiladed, they have not been much put in practice. This defect might however be remedied, by making them so as to be covered by the extremities of the parapets of the opposite ravelins, or by some other work.

As to the third sort, they have the same advantage as the second, and are likewise liable to the same objections; for which reason they may be used with the same precautions which have been mentioned in the second.

Tenailles are esteemed so necessary, that there is hardly any place fortified without them; and it is not without reason; for when the ditch is dry, the part behind the tenailles serves as a place of arms, from which the troops may sally, destroy the works of the enemy in the ditch, oppose their descent, and retire with safety; and the communication from the body of the place to the ravelin becomes easy and secure; which is a great advantage; for by that means the ravelin may make a much better defence, as it can be supplied with troops and necessaries at any time. And if the ditch is wet, they serve as harbours for boats, which may carry out armed men to oppose the passage over the ditch whenever they please; and the communication from the tenailles to the ravelin, becomes likewise much easier than it would be without them.

4. *Construction of Lunettes.*

Fig. 7. Lunettes are placed on both sides of the ravelin, such as B, to increase the strength of a place: they are constructed, by bisecting the faces of the ravelin with the perpendicular LN; on which is set off 30 toises from the counterscarp of the ditch, for one of its faces; the other face PN, is found by making the semi-gorge TP of 25 toises; the ditch before the lunettes is 12 toises, the parapet 3, and the rampart 8; as in the ravelin.

There is sometimes another work made to cover the saliant angle of the ravelin; such as A, called *Bonnet*, whose faces are parallel to those of the ravelin, and when produced bisect those of the lunettes; the ditch before it is 10 toises.

There are likewise lunettes, such as D, in fig. 8, whose faces are drawn perpendicular to those of the ravelin, within a third part from the saliant angle; and their semi-gorges are only 20 toises.

These kind of works may make a good defence, and are no very great expence; for as they are so near the ravelin, the communication with it is very easy, and one cannot well be maintained till they are all three taken.

5. *Construction of Tenaillons.*

Fig. 9. Produce the faces of the ravelin beyond the counterscarp of the ditch, at a distance MN of 30 toises, and take on the counterscarp of the great ditch 15 toises from the re-entering angle p to q, and draw Nq; then qNMp will be the tenaillon required; its ditch is 12 toises, that is, the same as that of the ravelin. Sometimes there is made a retired battery in the front of the tenaillons, as in fig. B; this battery is 10 toises from the front to which it is parallel, and 15 toises long.

There are commonly retrenchments made in the tenaillons, such as O; their parapets are parallel to the fronts

fronts MN, or rather perpendicular to the ſide Nq, and biſect the ſide qN; the ditch before this retrenchment is 3 toiſes, and there is a banquette before the parapet next to the ditch of about 8 feet, called *Berm;* it ſerves to prevent the earth of the parapet (which ſeldom has any revetement) from falling into the ditch.

It is to be obſerved, that the ravelin, before which tenaillons are conſtructed, muſt have its ſaliant angle much greater than the former conſtruction makes them; otherwiſe the ſaliant angles of the tenaillons become too acute; for which reaſon we made the capital of this ravelin 45 toiſes, and the faces terminate within 3 toiſes of the ſhoulders.

6. *Conſtruction of Counterguards.*

Fig. 10. 11. When the counterguard is placed before the ravelin, ſet off 40 toiſes on the capital of the ravelin from the ſaliant angle A, to the ſaliant angle B, of the counterguard; and 10 from C to D, on the counterſcarp of the ditch.

When the counterguard is before the baſtion, ſuch as in fig. 2, its ſaliant angle F is 50 toiſes from the ſaliant angle E of the baſtion, and the breadth near the ditch of the ravelin is 10 toiſes as before.

The ditch before the counterguards is 12 toiſes, and its counterſcarp parallel to the faces.

Counterguards are made before the ravelin in ſome particular occaſions only, but are frequently conſtructed before the baſtions, as covering the flanks wonderfully well. Some authors, as Blondel, and Mr Coehorn, will have them much narrower than they are here.

7. *Conſtruction of Hornworks.*

Fig. 12. Produce the capital of the ravelin beyond the ſaliant angle A, at a diſtance AB of about 80 toiſes; draw DBE at right angles to AB; in which take BD, BE, each equal to 55 toiſes; and on the exterior ſide DE, trace a front of a polygon in the ſame manner as that of the body of the place, making the perpendicular BF 18 toiſes, and the faces 30.

The branches Da Eb of the hornwork, when produced, terminate on the faces of the baſtions, within 5 toiſes of the ſhoulders. The ditch of the hornwork is 12 toiſes, and its counterſcarp parallel to the branches; and in the front terminates at the ſhoulders, in the ſame manner as the great ditch before the baſtións.

The capital of the ravelin before the front of the hornwork is 35 toiſes, and the faces terminate on the ſhoulders, or rather 2 or 3 toiſes beyond them: and the ditch before the ravelin is 8 toiſes.

There are ſometimes retrenchments made within the hornwork, ſuch as S, S; which are conſtructed by erecting perpendiculars to the faces of the ravelins, within 25 toiſes of their extremities. This retrenchment, like all others, has a parapet turfed only with a berm of 8 feet before it; as likewiſe, a ditch from 3 to 5 toiſes broad.

Fig. 13. When a hornwork is made before the baſtion, the diſtance DL of the front from the ſaliant angle of the baſtion is 100 toiſes, and the branches terminate on the faces of the adjacent ravelins within 5 toiſes from their extremities; all the reſt is the ſame as before.

8. *Conſtruction of Crownworks.*

Plate LXXXIV. fig. 1. From the ſaliant angle of the ravelin, as a centre, deſcribe an arc of a circle with a radius of about 120 toiſes, cutting the capital of the ravelin produced at C; from the point C, ſet off the cords CB, CF, each of them equal to 110 toiſes; and on each of which, as an exterior ſide, conſtruct a front of a polygon of the ſame dimenſions as in the hornwork; that is, the perpendicular ſhould be 18 toiſes, the faces 30, and the branches terminate on the faces of the baſtions, within 25 toiſes of the ſhoulders.

The ditch is 12 toiſes, the capital of the ravelin 35, and its ditch 8; that is, the ſame as in the hornwork.

Sometimes the crownwork is made before the baſtion, as in fig. 2. the arc is deſcribed from the ſaliant angle A of the baſtion, with a radius of 120 toiſes, as before, and the branches terminate on the faces of the adjacent ravelins within 25 toiſes of their extremities; the reſt of the dimenſions and conſtructions are the ſame as before.

Hornworks, as well as crownworks, are never made but when a large ſpot of ground falls beyond the fortification, which might be advantageous to an enemy in a ſiege, or to cover ſome gate or entrance into a town;

9. *Conſtruction of Covert-ways and Glacis.*

Although we have not hitherto mentioned the covert-way, neverthelefs all fortifications whatſoever have one; for they are eſteemed to be one of the moſt eſſential parts of a modern fortification; and it is certain, the taking the covert-way, when it is in a good condition and well defended, is generally the moſt bloody action of the ſiege.

After having conſtructed the body of the place, and all the outworks which are thought neceſſary, lines are drawn parallel to the outmoſt counterſcarps of the ditches, at 6 toiſes diſtant from it; and the ſpace mnmn, included between that line and the counterſcarp, will be the covert-way required.

Fig. 3. There is in every re-entering angle of the counterſcarp a place of arms, m; which is found by ſetting off 20 toiſes from the re-entering angle a, on both ſides from a to b, and from a to c; and from the points b, c, as centres, arcs are deſcribed with a radius of 25 toiſes, ſo as to interſect each other in d; then the lines drawn from this interſection to the points b, c, will be the faces of the places of arms.

If lines are drawn, parallel to the lines which terminate the covert way, and the places of arms, at 20 toiſes diſtant from them, the ſpace x, x, x, between theſe lines and thoſe which terminate the covert-way, will be the glacis.

At the extremities of the places of arms, are traverſes made, ſuch as v, v, which ſerves to incloſe them; theſe traverſes are 3 toiſes thick, and as long as the covert-way is broad; and a paſſage is cut in the glacis round them, of about 6 or 8 feet, in order to have a free communication with the reſt of the covert-way.

There are alſo traverſes of the ſame dimenſions before every ſaliant angle of the baſtion and outworks, and are in the ſame direction of the faces of thoſe works produced; and the thickneſs lies at the ſame ſide as the parapets.

The paſſages round theſe laſt traverſes are likewiſe from 6 to 8 feet wide.

In

Fig. 1.

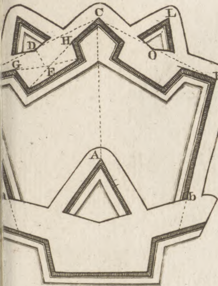


Fig. 3.

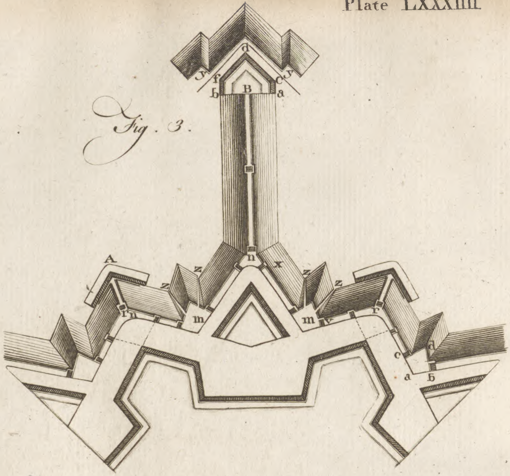
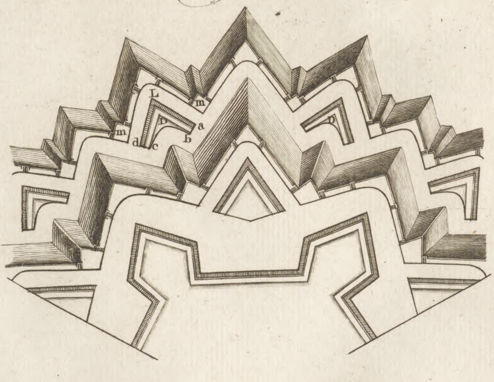


Fig. 2.

Fig. 4.



A. Bell Sculp.t

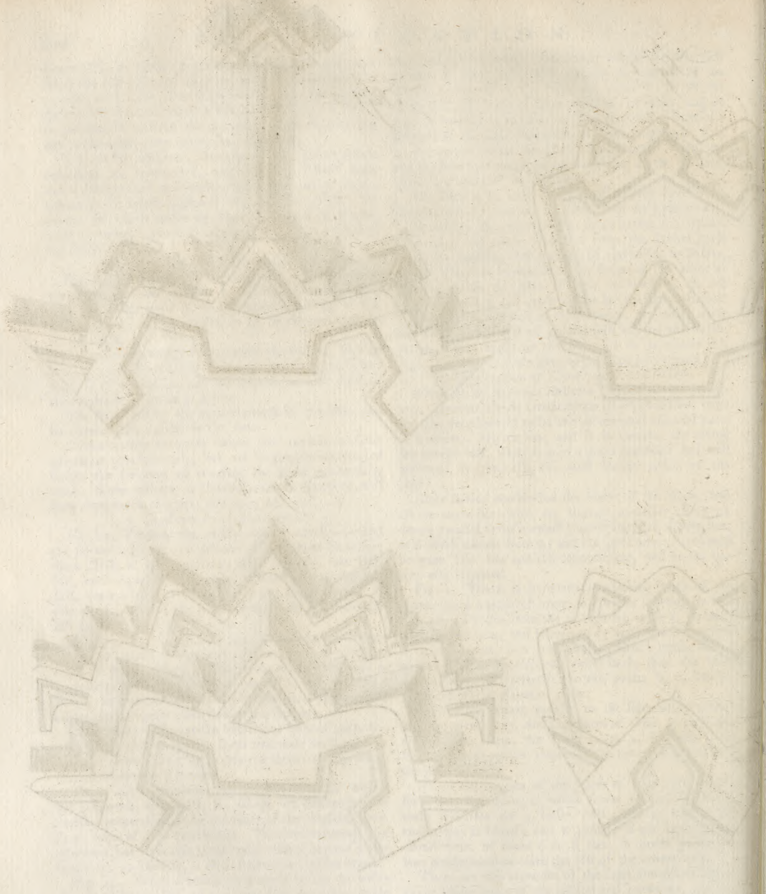
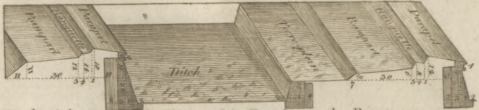


Fig. 1.



Profil of the Body of the Place and the Ravelin with Revetement

Profil of the Body of the Place and the Ravelin with demi-Revetement

Fig. 2.

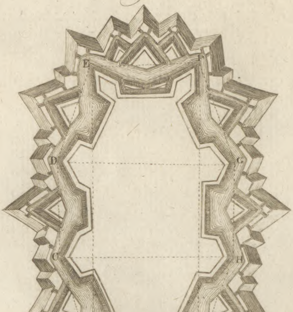


Fig. 3.

A. Bell Sc.

In each place of arms are two fally ports z. z, which are 10 or 12 feet wide, for the troops to fally out; in time of a fiege they are fhut up, with barriers or gates.

10. *Conftruction of Arrows and Detached Redoubts.*

An arrow is a work made before the faliant angles of the glacis, fuch as A, fig. 3.; it is compofed of a parapet of 3 toifes thick, and 40 long; and the ditch before it 5 toifes, terminating in a flope at both ends. The communication from the covert way into thefe arrows is 4 or 5 toifes wide, and there is a traverfe r at the entrance of 3 toifes thick, with a paffage of 6 or 8 feet round it.

A detatched redoubt is a kind of work much like a ravelin, with the flanks placed beyond the glacis; fuch as fig. B: they are made in order to occupy fome fpot of ground which might be advantageous to the befiegers; likewife to oblige the enemy to open their trenches farther off than they would do otherwife.

Their diftance from the covert-way ought not to exceed 120 toifes, that it may be defended by mufket fhot from thence.

The gorge ab is 40 toifes, the flanks ac, bf, which are perpendicular to the gorge 10, and the faces cd, fd 30; the ditch before it is 6 toifes, ending in flopes at both ends; the covert way 4; the branches of the covert-way are 42 toifes long, or thereabouts; the faces of the places of arms y, y, which are perpendicular to the branches, 10; and the other, which is parallel to them, 14.

The communication from the covert-way into the redoubt, is 5 or 6 toifes wide; and there is a traverfe made juft at the entrance; and another in the middle when it is pretty long. The parapets of this communication terminate in a flope or glacis.

If thefe redoubts are above 50 toifes diftant from the covert-way, the befiegers carry their trenches round, and enter through the gorge; by which the troops that are in them are made prifoners of war, if they do not retire betimes; to prevent this, fome other outworks fhould be made to fupport them.

11. *Conftruction of Second Ditches, and Covert-ways.*

Fig. 4. When the ground is low, and water to be found, there is often a ditch of about 10 or 12 toifes made round the glacis; and oppofite to the places of arms are conftructed lunettes, beyond the ditch; fuch as D, whofe breadth on the counterfcarp of the ditch is 10 toifes, from b to a, and from c to d; and the faces aL, dL, are parallel to thofe of the places of arms; the ditch before them is from 8 to ten toifes wide.

The fecond covert-way is 4 toifes, the femi-gorges of the places of arms, m, about 15, and the faces perpendicular to the counterfcarp; the fecond glacis is from 15 to 18 toifes broad.

This fecond covert-way has traverfes every where, in the fame manner as the firft.

12. *Conftruction of Profiles.*

Plate LXXXV. fig. 1. A profile is the reprefentation of a vertical fection of a work; it ferves to fhew thofe dimenfions which cannot be reprefented in plans, and are neceffary in the building of a fortification; they are generally conftructed upon a fcale of 30 feet to an inch. It would be needlefs to defcribe all their particular dimenfions, fince they are marked in the fchemes; we fhall therefore lay down the principal rules only, given by M. Vauban, on this fubject.

1. Every work ought to be at leaft 6 feet higher than that before it, fo that it may command thofe before it; that is, that the garrifon may fire from all the works at the fame time, with great and fmall arms, at the befiegers in their approaches: notwithftanding this fpecious pretence, there are feveral authors, who object againft it: For they fay, if you can difcover the enemy from all the works, they can difcover, by the fame reafon, all the works from their batteries; fo that they may deftroy them without being obliged to change their fituation, and thereby difmount all the guns of the place before they come near it.

But if all the works were of the fame height, thofe within cannot be deftroyed, till fuch time as thofe before them are taken; guns might be placed in the covert-way and outworks to obftruct the enemy's approach, and when they come near the place, they might be tranfported into the inner-works; and as the body of the place would be much lower, the expence would be confiderably diminifhed.

But when works are low, they are eafily enfiladed by the ricochet batteries, which is a kind of firing with a fmall quantity of powder, by giving the gun an elevation of 10 or 12 degrees: this might however be partly prevented, by making the parapets near the faliant angles, for the fpace of 8 toifes on each fide, 5 or 6 feet higher than the reft of the works.

2. The covert-way fhould be lower than the level-ground, otherwife the body of the place muft be raifed very high, efpecially when there are feveral outworks; this is to be underftood only when the works exceed each other in height, otherwife it need not be below the level.

3. The bafes of all inward flopes of earth fhould be at leaft equal to the height, if not more.

4. The bafes of all outward flopes of earth, two thirds of their heights.

5. The flopes of all walls or revetements fhould be one fifth of their height; but one fixth would be fufficient in our opinion: the height of a wall is eftimated from the bottom of the ditch, and not from the beginning of its foundation.

6. The flopes of all parapets and traverfes are one fixth of their breadth; that is, 3 feet towards the field, or the infide, where the banquettes fhould be, 3 feet higher than the outfide.

7. When the revetement of a rampart goes quite up to the top, 4 feet of the upper-part is a vertical wall of 3 feet thick, with a fquare ftone at the top of it, projecting 6 inches, and a circular one below, or where the flope begins, of 8 or 10 inches diameter; they go quite round the rampart, and the circular projection is called the *cordon*.

Where the ftraight part of the wall ends and the flope begins, the wall is always made 5 feet thick; and the counterforts or buttreffes reach no higher than that place.

7. When the rampart is partly walled, and partly turfed,

ed, then one fifth of the height which is turfed muſt be added to 5 feet, to get the thickneſs of the wall above.

And having the thickneſs of any wall above, by adding one fifth of its height from the bottom of the ditch, the ſum will be the thickneſs of the wall at the bottom; but if a ſixth part is only taken for the ſlope, then a ſixth part muſt be added.

For inſtance, ſuppoſe a rampart of 30 feet high from the bottom of the ditch, and that 10 of which are to be turfed; then the fifth part of 10, which is 2, added to 5, gives 7 for the wall above; and as this wall is 20 feet high, the fifth of which is 4, and 4 added to the thickneſs 7 above, gives 11 for the thickneſs near the foundation.

Plate LXXXV. fig. 1. Repreſents, in military perſpective, the profiles of the body of a place, the ravelin and covert-way; which gives a clear idea of what is meant by a profile, and from which thoſe of all other works may be eaſily conceived.

SECT. II. *Of Irregular Fortification.*

THE moſt eſſential principle in fortification, conſiſts in making all the fronts of a place equally ſtrong, ſo that the enemy may find no advantage in attacking either of the ſides; this can happen no otherwiſe but in a regular fortification ſituated in a plain or even ground; but as there are but few places which are not irregular, either in their works or ſituations, and the nature of the ground may be ſuch as makes it impracticable to build them regular, without too great expence; it is ſo much the more neceſſary to ſhew in what conſiſts the ſtrength or weakneſs of a town irregularly fortified, ſo that the weakeſt part may be made ſtronger by additional outworks; as likewiſe if ſuch a place is to be attacked, to know which is the ſtrongeſt or weakeſt.

1. *Conſtruction of an irregular place ſituated in an open country.*

If the place to be fortified is an old town incloſed by a wall or rampart, as it moſt frequently happens, the engineer is to conſider well all the different circumſtances of the figure, ſituation, and nature of the ground, to regulate his plan accordingly, ſo as to avoid the diſadvantages, and gain all the advantages poſſible; he ſhould examine, whether by cutting off ſome parts of the old wall or rampart, and taking in ſome ground, the place cannot be reduced into a regular figure, or nearly ſo; for, if that can be done without increaſing the expence conſiderably, it ſhould by no means be omitted; old towns have often towers placed from diſtance to diſtance, as Douay, Tournay, and many other places, which are generally made uſe of, and mended when it may be done; if there is a rampart without baſtions or towers, it muſt be well conſidered, whether baſtions may not be added, or if it is not better to make only ſome outworks; if the ditch about this rampart is not too wide and deep, it would be advantageous to make detached baſtions, otherwiſe ravelins and counterguards muſt be conſtructed; ſpecial care muſt be taken, to make all ſides of the polygon as nearly equal as poſſible, and that the length of the lines of defence do not exceed the reach of muſket-ſhot; but if that cannot be done, thoſe ſides which are on the narroweſt part ſhould be made the longeſt.

If it ſhould happen, that ſome of the ſides are inacceſſible or of very difficult approach, either on account of ſome precipice, marſhy ground, or inundation, they may be made much longer than the others, which are of eaſy acceſs, and the flanks need not be ſo large as the reſt; by doing ſo, there will be ſome expences ſaved, which may be uſed in making the other ſides ſtronger by adding more outworks.

There are few ſituations, but what are more advantageous in ſome parts than in others; it is therefore the buſineſs of an engineer to diſtinguiſh them, and to render thoſe ſides ſtrong by art, which are not ſo by nature.

If the ſituation is low and watery, lunettes or tenaillons, and ſuch other ſmall outworks ſhould be conſtructed, becauſe they are not of any great expence, and may make a very good defence; but if one ſide of the place is only low, and running water is to be had, a ſecond ditch and covert-way with lunettes may be made, by obſerving, that if the firſt glacis is made to ſlope, ſo as to become even with the level of the water in the ſecond ditch; or if the water can be ſwelled, by means of dykes or ſluices, ſo as to overflow the beſt part of the firſt glacis, it ſhould be done; for by ſo doing, theſe works will be able to make a very good defence, ſince the beſiegers will find it a difficult matter to lodge themſelves upon this glacis, which cannot be done but within a few toiſes of the firſt covert way, where the beſieged are ready to receive them, and to deſtroy their works with great advantage; whereas the enemy cannot ſupport their workmen but from the ſecond covert-way, which is too far off to be of any great ſervice to them.

But if the ſituation is of a dry nature, without any water about it, caponiers ſhould be made in the great ditch, from the curtains to the ravelin, and batteries raiſed in the entrance of the ditch before the ravelin, whoſe parapet muſt ſlope off into a glacis, ſo as to afford no cover for the enemy behind them; arrows, and detached redoubts are likewiſe very proper to be uſed in ſuch a caſe, and ſometimes horn or crown-works, if it ſhould be thought convenient; but theſe works ſhould never be conſtructed, without an abſolute neceſſity, either to occupy a ſpot of ground which might be advantageous to the enemy, or to cover ſome gate or entrance into the town, for they are of ſo great expence, that their defence ſeems not to be anſwerable to it.

Moſt of the places in Flanders are fortified with hornworks, ſuch as Ipres, Tournay, Lille, and others.

If the place to be fortified is new, and the ſituation will not admit of a regular conſtruction; particular care muſt be taken in chuſing ſuch a ſpot of ground as is moſt advantageous, and leaſt liable to any diſadvantages, either in the building or in the maintaining of it: all hills or riſing grounds ſhould be avoided, which might command any part of the works; marſhy grounds, becauſe ſuch ſituations are unwholeſome; or lakes and ſtanding waters, for the ſame reaſon, excepting a lake is, or may be made navigable: good water ſhould be had either within the place or near it, for it is abſolutely neceſſary for men and cattle;

cattle; the air ſhould be wholeſome, otherwiſe the continual ſickneſs that may reign in ſuch a place might prevent people to come and live in it, and the garriſon would not be in a condition to defend themſelves as they ought to do; in ſhort, all the different circumſtances attending ſuch an undertaking ſhould be maturely conſidered, before a reſolution is taken to fortify any place.

When a ſituation is pitched upon, the next thing to be conſidered is, the bigneſs of the town and the number of its outworks, which muſt abſolutely depend upon the conſequence ſuch a place is of to a nation; if it is only to guard a paſs, or entrance into a country, it need not be ſo large; but if it is to be a place either to promote or to protect trade, it ſhould be large and commodious; the ſtreets ſhould be wide, and the buildings regular and convenient: as to what regards the fortification, its conſtruction ſhould depend on the nature of the ſituation, and the number of the works on the funds or expence a prince or a nation will be at; which however ought to be according to the benefit ariſing from ſuch a place: for, as ſuch undertakings are of very great expence, an engineer cannot be too ſparing in his works; on the contrary, the greateſt œconomy ſhould be uſed, both in regard to the number of works, and to their conſtruction. The body of the place may have * revetements quite up to the top, or only in part, and the reſt turfed; but as to the outworks, they ſhould have half revetements, or they may be made with turf only; as being not ſo neceſſary to prevent the place from being ſurpriſed, and may nevertheleſs make a good defence.

On Plate LXXXV. fig. 2. is the plan of an octagon, one half of which is ſimilar and equal to the other half; it being ſuppoſed, that the ſituation would not admit of fortification quite regular; and the exterior ſides are each 180 toiſes, and the works are conſtructed according to our method; but becauſe the ſides AB, EF, are weaker than the reſt, as has been proved before, we have added tenailles, redoubts in the ravelins, and lunettes, to render them nearly equal in ſtrength with the others; and if counter guards were made before the baſtions A and B, it would effectually ſecure that front. Inſtead of lunettes, any other works may be made, as it may be thought convenient and according to the nature of the ground. If it ſhould be judged neceſſary to add other outworks to the ravelins all round the place, care muſt be taken to add likewiſe more to the fronts AB, EF, in order to render the advantages and diſadvantages of attacking on either ſide equal.

2. *Conſtruction of an irregular place, ſituated on a hill or rock.*

In the conſtruction of ſuch places, care muſt be taken that no neighbouring hill commands any part of the works; the town ſhould always be built on the higheſt part; but if it ſhould be thought more convenient to place it lower, then the upper part muſt be fortified with a fort; the ſituation ſhould be made level as near as poſſible, by removing the earth from ſome places to fill up others; and if it cannot well be levelled without extraordinary expence, works muſt be made on the higheſt part, ſo as to command and protect the lower; the works ought to occupy all the upper part of the hill, but if it ſhould be too extenſive to be all incloſed, or ſo irregular as not to be fortified without great inconvenience, the parts which fall without ſhould be fortified with ſome detached works, and a communication with the place muſt be made either above or under ground. There ſhould be no cavity or hollow roads, within cannon-ſhot, round about the place, where the enemy might be able to approach under cover; if there ſhould happen to be a ſpring, near the top of the hill, it ſhould be incloſed in the fortification, or if that cannot be done, by ſome work or other; for there is nothing more neceſſary, and at the ſame time ſcarcer in ſuch ſituations than water, for which reaſon there cannot be too much care taken in providing it; ſeveral ciſterns are to be made to receive the rain-water, and to preſerve it; wells ſhould be dug likewiſe, though ever ſo deep, the water of which will ſerve for common uſe.

Places built on hills or rocks, ſhould never be large, for their uſe is generally to guard paſſes or inlets into a country, and are ſeldom uſeful in traffic, and it is a difficult matter to provide for a large garriſon in ſuch ſituations, neither ſhould any ſuch place be built without ſome very material reaſons; but when it is abſolutely neceſſary, great care and precautions ſhould be taken to render the works as perfect as the ſituation will admit of, and at the ſame time to be as frugal in the expence as poſſible.

3. *Conſtruction of irregular fortifications, ſituated near rivers, lakes, or the ſea.*

As the intent of building theſe kind of places is chiefly to facilitate and protect trade, it is of much more importance than any other kind, eſpecially in maritime countries, where the principal ſtrength and power depends on it; for which reaſon, we ſhall treat of it more largely than any other part.

The firſt thing to be conſidered is their ſituations, which ought to be ſuch as to afford a good harbour for ſhipping, or a ſafe and eaſy entrance in ſtormy weather; but as it is hardly poſſible to find any, where ſhips may go in and lie ſecure with all winds, care ſhould be taken to make them ſafe to enter with thoſe winds which are moſt dangerous: but it is not ſufficient that the harbour is ſafe againſt ſtormy weather, they ſhould likewiſe be ſo againſt an enemy, both by land and water; for it often happens, that ſhips are deſtroyed where it was imagined they were ſecure, which is of too great a conſequence not to be provided againſt; for which reaſon, forts or batteries muſt be built in the moſt convenient places, to prevent the enemy's ſhips from coming too near, ſo as to be able to cannonade thoſe in the harbour, or fling ſhells amongſt them: and if there is any danger of an enemy's approach by land, high ramparts and edifices muſt be built, ſo as to cover them.

When a river is pretty large, and it is not convenient for

* Revetements are chiefly made to prevent a place from being ſurpriſed; outworks do not want to be made ſo, the taking them by ſurpriſe is of no great conſequence, except in a ſiege, when other cautions are uſed to prevent it.

for making a harbour without great expence, the ſhips may ride along the ſhore, which, for that reaſon, muſt be made acceſſible for ſhips of burden; this may be done by advancing the quay into the river, if the water is too ſhallow, or by digging the river ſufficiently deep for that purpoſe.

And to prevent any enemy from coming up the river, forts muſt be built on both ſides, eſpecially when there are any turnings or windings. Antwerp is ſuch a place; for the Scheld is ſufficiently deep to carry ſhips of great burden, which may come quite near the town-wall; and ſeveral ſorts are built below it on both ſides, ſo that it would not be an eaſy matter for an enemy to come up the river.

When the river is but ſmall, ſo that no ſhips of burden can come through it; it is ſufficient to make it run through ſome of the works, where proper landing places are contrived, from whence the goods may be carried into the place; as at Sarrelouis, where a horn-work is built beyond the Sarre, in the gorge of which the goods are landed.

If the breadth of the river does not exceed 200 yards, it commonly paſſes through the middle of the town, and proper quays are made on each ſide; in ſuch a caſe, the fortification is ſo contrived as that the river paſſes through the curtain, in order to have a baſtion on each ſide to defend the coming in and going out.

When M. Vauban fortified near rivers, he made always the exterior ſide near the water much longer than any of the others; ſuch is Hunningen on the Rhine, and Sarrelouis on the Sarre; but for what reaſon he fortified theſe places in that manner, has not been told by any author.

But it is plain, that the ſides which terminate at the river, are the weakeſt; becauſe the beſiegers trenches being ſecured by the river, they may draw moſt of their troops off, and act therefore with more vigour and ſtrength on the other ſide: beſides, as the ſtrength of a ſide increaſes in proportion as the angle of the polygon is greater, by making the ſide next the river longer, the angles at its extremities become wider, and conſequently the adjacent ſides ſtronger.

There are other advantages, beſides theſe mentioned already, which ariſe from the lengthening that ſide; for if the river is pretty deep ſo as not to be fordable, that ſide is not liable to be attacked; and by increaſing its length, the capacity of the place increaſes much more in proportion to the expence, than if more ſides were made; the centre of the place will be likewiſe nearer the river, which makes it more convenient for tranſporting the goods from the water-ſide to any part of the town.

Plate LXXXV. fig. 3. To illuſtrate this method of M. Vauban's we ſhall give the plan of Hunningen; this place was built for the ſake of having a bridge over the Rhine, for which reaſon he made it only a pentagon; the ſide AB next to the river is 200 toiſes, and each of the others but 180.

About the ſpace *a b c*, which lies before the front AB, is a ſtone-wall, and the paſſages *x*, *x*, are ſhut up with ſluices, to retain the water in the ditches in dry ſeaſons, and to prevent an enemy from deſtroying the ſluice near the point c, whereby the water would run out and leave the ditches dry; the redout y was built in the little iſland hard by, in order to cover that ſluice; without this precaution the place might be inſulted from the river-ſide, where the water is ſhallow in dry ſeaſons.

The hornwork K beyond the Rhine was built to cover the bridge; but as this work cannot be well defended croſs the river, the hornwork H was made to ſupport the other.

Before we finiſh the deſcription of this plan, we ſhall ſhew how to find the long ſide AB, as being uſeful in the following work.

After having inſcribed the two ſides GE, GF, in a circle, draw the diameter CD, ſo as to be equally diſtant from the line joining the points E, F, that is parallel to it; on this diameter ſet off 100 toiſes on each ſide of the centre, from theſe points draw two indefinite perpendiculars to the diameter; then if from the points E, F, as centres, two arcs are deſcribed with a radius of 180 toiſes, their interſections A and B, with the ſaid perpendiculars, will determine the long ſide AB, as likewiſe the other two FB and EA. In like manner may be found the long or ſhort ſide of any polygon whatſoever.

When a place near a river is to be fortified, for the ſafety of commerce, particular care ſhould be taken in leaving a good ſpace between the houſes and the water-ſide, to have a key or landing place for goods brought by water; it ſhould alſo be contrived to have proper places for ſhips and boats to lie ſecure in ſtormy weather, and in time of a ſiege; and as water-carriage is very advantageous for tranſporting goods from one place to another, as likewiſe for bringing the neceſſary materials, not only for building the fortification, but alſo the place itſelf, the expences will be leſſened conſiderably, when this convenience can be had; for which reaſon, places ſhould never be built any where elſe but near rivers, lakes, or near the ſea; excepting in extraordinary caſes, where it cannot be avoided.

FORTISSIMO, in muſic, ſometimes denoted by FFF, or *fff*, ſignifies to ſing or play very loud or ſtrong.

FORT-LEWIS, a fortreſs of Alſace, in Germany, ſituated on the weſtern ſhore of the Rhine, ſubject to France: E. long. 8°, and N. lat. 48° 46′.

FORTUNATE-ISLANDS in ancient geography, certain iſlands, concerning the ſituation of which authors are not agreed, famous for the golden apples of the Heſperides. See HESPERIDES.

The common opinion is, that they are the ſame with the Canary iſlands.

FORTUNE, a goddeſs worſhipped with great devotion by the ancient Greeks and Romans, who believed her to preſide over human affairs, and to diſtribute wealth and honour at her pleaſure.

FORUM, in Roman antiquity, a public ſtanding place within the city of Rome, where cauſes were judicially tried, and orations delivered to the people.

Forum, was alſo uſed for a place of traffic, anſwering to our market-place: of theſe there were vaſt numbers, as the *forum piſcarium, olitorium*, &c. Theſe were generally called *fora venalia*, in contradiſtinction to the former, which were called *fora civilia*.

Forum, is alſo uſed, among caſuiſts, *&c.* for juriſdiction; thus they ſay, *In foro legis*, &c.

FOSS, or Fossa, in anatomy, a kind of cavity in a bone, with a large aperture, but no exit or perforation.

Foss-way, one of the four principal highways of England, that anciently led through the kingdom; ſuppoſed to be made by the Romans, having a ditch upon one ſide thereof.

FOSSIL, in natural hiſtory, denotes, in general, every thing dug out of the earth, whether they be natives thereof, as metals, ſtones, ſalts, earths, and other minerals; or extraneous, repoſited in the bowels of the earth by ſome extraordinary means. See Natural History.

FOSSOMBRONE, a city and biſhop's ſee of Italy, ten miles ſouth-eaſt of Urbino.

FOUMART, in zoology. See Mustela.

FOUNDATION, in architecture, is that part of a building which is under ground. See Building.

The foundation is properly ſo much of the maſonry as reaches as high as the ſurface of the ground, and ought always to be proportioned to the load or weight of the building that it is to bear. Sometimes the foundation is maſſive, and continued under the whole building, as in the antique arches and aqueducts, and ſome amphitheatres; but it is more uſually in ſpaces or intervals, either to avoid expence, or becauſe the vacuities are at too great a diſtance, in which latter caſe they make uſe of inſulated pillars bound together by arches.

Palladio allows a ſixth part of the height of the whole building for the hollowing or under-digging; unleſs there be cellars under ground, in which caſe he would have it ſomewhat lower; and as to thickneſs, double the width of the wall is no bad rule.

Foundation *of Bridges*, is laid after different manners. The firſt is by incloſing all round the ſpace of ground you would build upon, by dams made with piles ſet deep in the ground in double rows, well ſtrengthened and bound together with croſs pieces and cords, and filling the vacant ſpaces between them with chalk or other earthy matter. This being done, the water muſt be emptied out, and the foundation dug according to the quality of the ground, driving down piles, if it be neceſſary, upon which the walls of the foundation muſt be laid. But this method is only practicable in building on ſuch rivers, where the water is neither very rapid, nor very deep. The ſecond is done by laying the foundation on grate-work, rafts of ſtout oak well bound together, and made faſt at the ſurface of the water with cables or machines, and building upon them large quarters of ſtone, cramped together, and joined with good mortar, or cement, and afterwards letting them deſcend ſoftly by theſe cables and machines perpendicularly to the bottom of the water. This was the method practiſed in laying the foundation of Weſtminſter Bridge, the grating being made of the bottom of a frame called by the French Caiſſon, the ſides of which were ſo contrived, that they might be taken off, after a pier was finiſhed. The third is by drawing off all, or the greateſt part of the water of the river into ſome other place.

FOUNDER, in a general ſenſe, the perſon who lays a foundation, or endows a church, ſchool, religious-houſe, or other charitable inſtitution.

Founder alſo implies an artiſt who caſts metals, in various forms, for different uſes, as guns, bells, ſtatues, printing characters, candleſticks, buckles, *&c.* whence they are denominated gun-founders, bell-founders, figure-founders, letter-founders, founders of ſmall works, *&c.* See Foundery.

Founder, in the ſea language: A ſhip is ſaid to founder, when by an extraordinary leak, or by a great ſea breaking in upon her, ſhe is ſo filled with water, that ſhe cannot be freed of it; ſo that ſhe can neither veer nor ſteer, but lie like a log; and not being able to ſwim long, will at laſt ſink.

FOUNDERY, or Foundry, the art of caſting all ſorts of metals into different forms. It likewiſe ſignifies the work-houſe or ſmelting-hut wherein theſe operations are performed.

Foundery *of ſmall-works, or caſting in ſand.* The ſand uſed for caſting ſmall works, is, at firſt, of a pretty ſoft, yellowiſh, and clammy nature: but it being neceſſary to ſtrew charcoal duſt in the mould, it at length becomes of a quite black colour. This ſand is worked over and over, on a board, with a roller, and a ſort of knife; being placed over a trough to receive it, after it is by theſe means ſufficiently prepared.

This done, they take a wooden board of a length and breadth proportional to the things to be caſt, and putting a ledge round it, they fill it with ſand, a little moiſtened, to make it duly cohere. Then they take either wood or metal models of what they intend to caſt, and apply them ſo to the mould, and preſs them into the ſand, as to leave their impreſſion there. Along the middle of the mould is laid half a ſmall braſs cylinder, as the chief canal for the metal to run through, when melted, into the models or patterns; and from this chief canal are placed ſeveral others, which extend to each model or pattern placed in the frame. After this frame is finiſhed, they take out the patterns, by firſt looſening them all round, that the ſand may not give way.

Then they proceed to work the other half of the mould with the ſame patterns in juſt ſuch another frame, only that it has pins, which, entering into holes that correſpond to it in the other, make the two cavities of the pattern fall exactly on each other.

The frame thus moulded, is carried to the melter, who, after extending the chief canal of the counterpart, and adding the croſs canals to the ſeveral models in both, and ſtrewing mill-duſt over them, dries them in a kind of oven for that purpoſe.

 Both

Both parts of the mould being dry, they are joined together by means of the pins; and to prevent their giving way, by reafon of the melted metal paffing through the chief cylindrical canal, they are fcrewed or wedged up like a kind of a prefs.

While the moulds are thus preparing, the metal is fufing in a crucible of a fize proportionate to the quantity of metal intended to be caft.

When the moulds are coolifh, the frames are unfcrewed, or unwedged, and the caft work taken out of the fand, which fand is worked over again for other caftings.

FOUNDERY *of ftatues*. The cafting of ftatues depends on the due preparation of the pit, the core, the wax, the outer mould, the inferior furnace to melt off the wax, and the upper to fufe the metal. The pit is a hole dug in a dry place fomething deeper than the intended figure, and made according to the prominence of certain parts thereof. The infide of the pit is commonly lined with ftone, or brick; or when the figure is very large, they fometimes work on the ground, and raife a proper fence to refift the impulfion of the melted metal.

The inner mould, or core, is a rude mafs to which is given the intended attitude and contours. It is raifed on an iron grate, ftrong enough to fuftain it, and is ftrengthened within by feveral bars of iron. It is generally made either of potter's clay, mixed with hair, and horfe dung; or of plafter of Paris mixed with brick-duft. The ufe of the core is to fupport the wax, the fhell, and leffen the weight of the metal. The iron bars and the core are taken out of the brafs figure through an aperture left in it for that purpofe, which is foldered up afterwards. It is neceffary to leave fome of the iron bars of the core, that contribute to the fteadinefs of the projecting part, within the brafs figure.

The wax is a reprefentation of the intended ftatue. If it be a piece of fculpture, the wax fhould be all of the fculptor's own hand, who ufually forms it on the core; though it may be wrought feparately in cavities, moulded on a model, and afterwards arranged on the ribs of iron over the grate; filling the vacant fpace in the middle with liquid plafter and brick duft, whereby the inner core is proportioned as the fculptor carries on the wax.

When the wax, which is the intended thicknefs of the metal, is finifhed, they fill fmall waxen tubes perpendicular to it from top to bottom, to ferve both as canals for the conveyance of the metal to all parts of the work; and as vent-holes, to give paffage to the air, which would otherwife occafion great diforder, when the hot metal came to encompafs it.

The work being brought thus far, muft be covered with its fhell, which is a kind of cruft laid over the wax, and which being of a foft matter, eafily receives the impreffion of every part, which is afterwards communicated to the metal upon its taking the place of the wax, between the fhell and the mould. The matter of this outer mould is varied according as different layers are applied. The firft is generally a compofition of clay, and old white crucibles well ground and fifted, and mixed up with water, to the confiftence of a colour fit for painting: accordingly they apply it with a pencil, laying it feven or eight times over, and letting it dry between whiles. For the fecond impreffion, they add horfe dung, and natural earth to the former compofition. The third impreffion is only horfe-dung and earth. Laftly, the fhell is finifhed by laying on feveral more impreffions of this laft matter, made very thick with the hand.

The fhell, thus finifhed, is fecured by feveral iron girts, bound round it, at about half a foot diftance from each other, and faftened at the bottom to the grate under the ftatue, and at top to a circle of iron where they all terminate.

If the ftatue be fo big that it would not be eafy to move the moulds with fafety, they muft be wrought on the fpot where it is to be caft. This is performed two ways: in the firft, a fquare hole is dug under ground, much bigger than the mould to be made therein, and its infide lined with walls of free-ftone, or brick. At the bottom is made a hole of the fame materials with a kind of furnace, having its aperture outwards: in this is a fire made to dry the mould, and afterwards melt the wax. Over this furnace is placed the grate, and upon this the mould, *&c.* formed as above. Laftly, at one of the edges of the fquare pit, is made another large furnace to melt the metal. In the other way, it is fufficient to work the mould above ground, but with the like precaution of a furnace and grate underneath. When finifhed, four walls are to be run around it, and by the fide thereof a maffive made for a melting-furnace. For the reft, the method is the fame in both. The mould being finifhed, and inclofed as defcribed, whether under ground or above it, a moderate fire is lighted in the furnace under it, and the whole covered with planks, that the wax may melt gently down, and run out at pipes contrived for that purpofe, at the foot of the mould, which are afterwards exactly clofed with earth, fo foon as the wax is carried off. This done, the hole is filled up with bricks thrown in at random, and the fire in the furnace augmented, till fuch time as both the bricks and mould become red hot. After this, the fire being extinguifhed, and every thing cold again, they take out the bricks and fill up their place with earth moiftened, and a little beaten to the top of the mould, in order to make it the more firm and fteady. Thefe preparatory meafures being duly taken, there remains nothing but to melt the metal, and run it into the mould. This is the office of the furnace above defcribed, which is commonly made in the form of an oven with three apertures, one to put in the wood, another for a vent, and a third to run the metal out at. From this laft aperture, which is kept very clofe, while the metal is in fufion, a fmall tube is laid, whereby the melted metal is conveyed into a large earthen bafon, over the mould, into the bottom of which all the big branches of the jets, or cafts, which are to convey the metal into all the parts of the mould, are inferted.

Thefe cafts, or jets, are all terminated with a kind of plugs, which are kept clofe, that, upon opening the furnace, the brafs, which gufhes out with violence, may

may not enter any of them, till the bason be full enough of matter to run into them all at once. Upon which occasion they pull out the plugs, which are long iron rods with a head at one end, capable of filling the whole diameter of each tube. The whole of the furnace is opened with a long piece of iron fitted at the end of each pole, and the mould filled in an instant. This completes the work in relation to the casting part; the rest being the sculptor's or carver's business, who, taking the figure out of the mould and earth wherewith it is encompassed, saws off the jets with which it appears covered over, and repairs it with chissels, gravers, puncheons, *&c.*

Foundery *of bells*. The metal, it is to be observed, is different for bells, from what it is for statues; there being no tin in the statue-metal: but there is a fifth, and sometimes more, in the bell-metal.

The dimensions of the core and the wax for bells, if a ring of bells especially, are not left to chance, but must be measured on a scale, or diapason, which gives the height, aperture, and thickness necessary for the several tones required. See Diapason.

It is on the wax that the several mouldings and other ornaments are formed to be represented in relievo, on the outside of the bell.

The business of bell-foundery is reducible to three particulars. 1. The proportion of a bell. 2. The forming of the mould; and, 3. The melting of the metal.

The proportions of our bells differ much from those of the Chinese: in ours, the modern proportions are, to make the diameter fifteen times the thickness of the brim, and twelve times the height.

There are two kinds of preparations, *viz.* the simple and the relative: the former are those proportions only that are between the several parts of a bell, to render it sonorous; the relative proportions establish a requisite harmony between several bells.

The particulars necessary for making the mould of a bell are, 1. The earth; the most cohesive is the best: it must be well ground and sifted, to prevent any chinks. 2. Brick-stone; which must be used for the mine, mould, or core, and for the furnace. 3. Horse dung, hair, and hemp, mixed with the earth, to render the cement more binding. 4. The wax for inscriptions, coats of arms, *&c.* 5. The tallow equally mixed with the wax, in order to put a slight lay of it upon the outer mould, before any letters are applied to it. 6. The coals to dry the mould.

For making the mould, they have a scaffold consisting of four boards, ranged upon tressels. Upon this they carry the earth, grossly diluted, to mix it with horse-dung, beating the whole with a large spatula.

The compasses of construction is the chief instrument for making the mould, which consist of two different legs joined by a third piece. And last of all, the founders shelves, on which are the ingravings of the letters, cartridges, coats of arms, *&c.*

They first dig a hole of a sufficient depth to contain the mould of the bell, together with the case, or cannon, under ground; and about six inches lower than the terreplain, where the work is performed. The hole must be wide enough for a free passage between the mould and walls of the hole, or between one mould and another, when several bells are to be cast. At the centre of the hole is a stake erected, that is strongly fastened in the ground. This supports an iron peg, on which the pivot of the second branch of the compasses turns. The stake is encompassed with a solid brick-work, perfectly round, about half a foot high, and of the proposed bell's diameter. This they call a mill-stone. The parts of the mould are, the core, the model of the bell, and the shell. When the outer surface of the core is formed, they begin to raise the core, which is made of bricks that are laid in courses of equal height upon a lay of plain earth. At the laying each brick, they bring near it the branch of the compasses, on which the curve of the core is shaped, so as that there may remain between it and the curve the distance of a line, to be afterwards filled up with layers of cement. The work is continued to the top, only leaving an opening for the coals to bake the core. This work is covered with a layer of cement, made of earth and horse dung, on which they move the compasses of construction, to make it of an even smoothness every where.

The first layer being finished, they put the fire to the core, by filling it half with coals, through an opening that is kept shut, during the baking, with a cake of earth, that has been separately baked. The first fire consumes the stake, and the fire is left in the core half or sometimes a whole day: the first layer being thoroughly dry, they cover it with a second, third, and fourth; each being smoothed by the board of the compasses, and thoroughly dried before they proceed to another.

The core being completed, they take the compasses to pieces, with intent to cut off the thickness of the model, and the compasses are immediately put in their place to begin a second piece of the mould. It consists of a mixture of earth and hair, applied with the hand on the core, in several cakes that close together. This work is finished by several layers of a thinner cement of the same matter smoothed by the compasses, and thoroughly dried, before another is laid on. The first layer of the model is a mixture of wax and grease spread over the whole. After which are applied the inscriptions, coats of arms, *&c.* besmeared with a pencil dipped in a vessel of wax in a chaffing-dish: this is done for every letter. Before the shell is begun, the compasses are taken to pieces, to cut off all the wood that fills the place of the thickness to be given to the shell.

The first layer is the same earth with the rest, sifted very fine; whilst it is tempering in water, it is mixed with cow's hair, to make it cohere. The whole being a thin cullis, is gently poured on the model, that fills exactly all the sinuosities of the figures, *&c.* and this is repeated till the whole is two lines thick over the model. When this layer is thoroughly dried, they cover it with a second of the same matter, but something thicker: when this second layer becomes of some consistence, they apply the compasses again, and light

light a fire in the core, fo as to melt off the wax of the infcriptions, &c.

After this, they go on with other layers of the fhell, by means of the compaffes. Here they add to the cow's hair a quantity of hemp, fpread upon the layers, and afterwards fmoothed by the board of the compaffes. The thicknefs of the fhell comes to four or five inches lower than the mill-ftone before obferved, and furrounds it quite clofe, which prevents the extravafation of the metal. The wax fhould be taken out before the melting of the metal.

The ear of the bell requires a feparate work, which is done during the drying of the feveral incruftations of the cement. It has feven rings; the feventh is called the bridge, and unites the others, being a perpendicular fupport to ftrengthen the curves. It has an aperture at the top, to admit a large iron peg, bent at the bottom; and this is introduced into two holes in the beam, faftened with two ftrong iron keys. There are models made of the rings, with maffes of beaten earth, that are dried in the fire, in order to have the hollow of them. Thefe rings are gently preffed upon a layer of earth and cow's hair, one half of its depth; and then taken out, without breaking the mould. This operation is repeated twelve times for twelve half-moulds, that two and two united may make the hollows of the fix rings: the fame they do for the hollow of the bridge, and bake them all, to unite them together.

Upon the open place left for the coals to be put in, are placed the rings that conftitute the ear. They firft put into this open place the iron-ring to fupport the clapper of the bell; then they make a round cake of clay, to fill up the diameter of the thicknefs of the core. This cake, after baking, is clapped upon the opening, and foldered with a thin mortar fpread over it, which binds the cover clofe to the core.

The hollow of the model is filled with an earth, fufficiently moift to fix on the place, which is ftrewed at feveral times upon the cover of the core; and they beat it gently with a peftle, to a proper height; and a workman fmooths the earth at top with a wooden trowel dipped in water.

Upon this cover, to be taken off afterwards, they affemble the hollows of the rings. When every thing is in its proper place, they ftrengthen the outfide of the hollows with mortar, in order to bind them with the bridge, and keep them fteady at the bottom, by means of a cake of the fame mortar, which fills up the whole aperture of the fhell. This they let dry, that it may be removed without breaking. To make room for the metal, they pull off the hollows of the rings, through which the metal is to pafs, before it enters into the vacuity of the mould. The fhell being unloaded of its ear, they range under the mill-ftone five or fix pieces of wood, about two feet long, and thick enough to reach almoft the lower part of the fhell; between thefe and the mould they drive in wooden wedges with a mallet, to fhake the fhell of the model whereon it refts, fo as to be pulled up, and got out of the pit.

When this and the wax are removed, they break the model and the layer of earth, through which the metal muft run, from the hollow of the rings, between the fhell and the core. They fmoke the infide of the fhell, by burning ftraw under it, that helps to fmooth the furface of the bell. Then they put the fhell in the place, fo as to leave the fame interval between that and the core; and before the hollows of the rings or the cap are put on again, they add two vents, that are united to the rings, and to each other, by a mafs of baked cement. After which they put on this mafs of the cap, the rings, and the vent, over the fhell, and folder it with thin cement, which is dried gradually by covering it with burning coals. Then they fill up the pit with earth, beating it ftrongly all the time, round the mould.

The furnace has a place for the fire, and another for the metal. The fire-place has a large chimney with a fpacious afh-hole. The furnace which contains the metal, is vaulted, whofe bottom is made of earth, rammed down; the reft is built with brick. It has four apertures; the firft, through which the flame revibrates; the fecond is clofed with a ftopple that is opened for the metal to run; the others are to feparate the drofs, or fcoriæ, of the metal by wooden rakes: through thefe laft apertures paffes the thick fmoke. The ground of the furnace is built floping, for the metal to run down.

FOUNDERY *of great guns and mortar pieces*. The method of cafting thefe pieces is little different from that of bells: they are run maffy, without any core, being determined by the hollow of the fhell; and they are afterwards bored with a fteel trepan, that is worked either by horfes, or a water-mill.

For the metal, parts, proportions, &c. of thefe pieces, fee CANNON.

Letter FOUNDERY, or *cafting of printing letters*. The firft thing requifite is to prepare good fteel-punches, on the face of which is drawn the exact fhape of the letter with pen and ink, if the letter be large, or with a fmooth blunted point of a needle, if fmall; and then, with proper gravers, the cutter digs deep between the ftrokes, letting the marks ftand on the punch; the work of hollowing being generally regulated by the depth of the counter-punch. then he files the outfide, till it is fit for the matrice.

They have a mould to juftify the matrices by, which confifts of an upper and under part, both which are alike, except the ftool and fpring behind, and a fmall roundifh wire in the upper part, for making the nick in the fhank of the letter. Thefe two parts are exactly fitted into each other, being a male and female gage, to flide backwards and forwards. See GAGE.

Then they juftify the mould, by cafting about twenty famples of letters, which are fet in a compofing-ftick, with the nicks towards the right hand; and comparing thefe every way with the pattern-letters, fet up in the fame manner, they find the exact meafure of the body to be caft.

Next they prepare the matrix, which is of brafs or copper, an inch and a half long, and of a proportionable thicknefs to the fize of the letter it is to contain. In

In this metal is funk the face of the letter, by ftriking the letter-punch the depth of an *n*. After this, the fides and face of the matrice are juftified, and cleared, with files, of all bunchings that have been made by finking the punch.

Then it is brought to the furnace, which is built upright of brick with four fquare fides, and a ftone at top, in which is a hole for the pan to ftand in.

Printing-letters are made of lead, hardened with iron or ftub-nails. To make the iron run, they mingle an equal weight of antimony, beaten fmall in an iron mortar, and ftub-nails together. They charge a proper number of earthen pots, that bear the fire, with the two ingredients, as full as they can hold, and melt it in an open furnace, built for that purpofe.

When it bubbles, the iron is then melted, but it evaporates very much. This melted compoft is ladled into an iron-pot, wherein is melted lead, that is fixed on a furnace clofe to the former, 3 ℔ of melted iron to 25 ℔ of lead; this they incorporate according to art.

The cafter taking the pan off the ftone, and having kindled a good fire, he fets the pan in again, and metal in it to melt. If it be a fmall-bodied letter, or a thin letter with great bodies, that he intends to caft, his metal muft be very hot, and fometimes red hot, to make the letter come. Then taking a ladle, of which he has feveral forts, that will hold as much as will make the letter and break, he lays it at the hole where the flame burfts out: then he ties a thin leather, cut with its narrow end againft the face, to the leather groove of the matrice, by whipping a brown thread twice about the leather groove, and faftening the thread with a knot. Then he puts both pieces of the mould together, and the matrice into the matrice-cheek; and places the foot of the matrice on the ftool of the mould, and the broad end of the leather on the wood of the upper haft of the mould, but not tight up, left it hinder the foot of the matrice from finking clofe down upon the ftool, in a train of work. Afterwards laying a little rofin on the upper part of the mould, and having his cafting-ladle hot, he, with the boilling fide, melts the rofin, and preffes the broad end of the leather hard down on the wood, and fo faftens it thereto. Now he comes to cafting, when placing the under half of the mould in his left hand, with the hook or jag forward, he holds the ends of its wood between the lower part of the ball of his thumb and his three hinder fingers; then he lays the upper half of the mould upon the under half, fo as the male gages may fall into the female; and, at the fame time, the foot of the matrice places itfelf upon the ftool, and clafping his left hand thumb ftrongly over the upper half, he nimbly catches hold of the bow or fpring, with his right hand fingers at the top of it, and his thumb under it, and places the point of it againft the middle of the notch in the backfide of the matrice, preffing it forwards as well towards the mould, as downwards, by the fhoulder of the notch, clofe upon the ftool, while, at the fame time, with his hinder fingers, as aforefaid, he draws the under half of the mould towards the ball of his thumb, and thrufts, by the ball of his thumb, the upper part towards his fingers, that both the regifters of the mould may prefs againft both fides of the matrice, and his thumb and fingers prefs both fides of the mould clofe together.

Then he takes the handle of his ladle in his right hand, and with the ball of it gives two or three ftrokes outwards upon the furface of the melted metal, to clear it of the fcum; then he takes up the ladle full, and having the mould in the left hand, turns his left fide a little from the furnace, and brings the geat of his ladle to the mouth of his mould; and turns the upper part of his right hand towards him, to pour the metal into it, while, at the fame inftant, he puts the mould in his left hand forwards, to receive the metal with a ftrong fhake, not only into the bodies of the mould, but, while the metal is yet hot, into the very face of the matrice, to receive its perfect form there as well as in the fhank. Then he takes the upper half of the mould off, by placing his right thumb on the end of the wood next his left thumb, and his two middle fingers at the other end of the wood: he toffes the letter, break and all, out upon a fheet of wafte paper, laid on a bench, a little beyond his left hand, and then is ready to caft another letter, as before, and likewife the whole number in that matrix.

Then boys, commonly employed for this purpofe, feparate the breaks from the fhanks, and rub them on a ftone, and afterwards a man cuts them all of an even height, which finifhes the fount for the ufe of the printer. See next article.

A workman will ordinarily caft 3000 of thefe letters in a day. The perfection of letters thus caft, confifts in their being all feverally fquare and ftraight on every fide; and all generally of the fame height, and evenly lined, without ftooping one way or other; neither too big in the foot, nor the head; well grooved, fo as the two extremes of the foot contain half the body of the letter; and well ground, barbed, and fcrapped, with a fenfible notch, *&c.* See PRINTING.

FOUNT, or FONT, among printers, a fet or quantity of letters, and all the appendages belonging thereto, as numeral characters, quadrates, points, *&c.* caft by a letter-founder, and forted.

FOUNTAIN, in philofophy, a fpring or fource of water rifing out of the earth. Among the ancients, fountains were held facred, and even worfhipped as a kind of divinities. For the phænomena, theory, and origin of fountains, fee HYDROSTATICS.

FOUNTAIN, or *Artificial* FOUNTAIN, called alfo a *jet d'eau*, is a contrivance by which water is violently fpouted upwards. See HYDROSTATICS.

FOURCHE'E, or FOURCHY, in heraldry, an appellation given to a crofs forked at the ends. See Plate LXXX. fig. 8.

FOWEY, a borough-town of Cornwall, which fends two members to parliament: W. long. 5°, and N. lat. 50° 26′.

FOWL, among zoologifts, denotes the larger forts of birds, whether domeftic or wild: fuch as geefe, pheafants, partridges, turkey, ducks, *&c.*

FOX, in zoology. See Canis.

Fox-glove, in botany. See Digitalis.

FOY, or St Foy, a town in Guienne, in France, thirty-two miles eaft of Bourdeaux; it is fituated under the meridian of London, in 44°, 50′, N. lat.

FRACTION, in arithmetic and algebra. See Arithmetic, p. 387. and Algebra, p. 83.

Decimal Fractions. See Arithmetic, p. 395.

FRACTURE, in furgery, a rupture of a bone, or a folution of continuity in a bone, when it is crufhed or broken by fome external caufe. See Surgery.

FRÆNUM, in anatomy, a term applied to fome membranous ligaments of the body.

Frænum linguæ. See Anatomy, p. 305.

Frænum penis. See Anatomy, p. 274.

FRAGA, a town of Arragon, in Spain, fituated under the meridian of London: N. lat. 41° 16′.

FRAGARIA, the Strawberry, in botany, a genus of the icofandria polygynia clafs. The calix is divided into ten fegments; the petals are five; and the receptacle is an oval deciduous berry. There are three fpecies, two of them natives of Britain, *viz.* the vefca, or common ftrawberry; and the fterilis, or baren ftrawberry.

FRANCE, a large kingdom of Europe, fituated between 5° W. and 7° E. long. and between 43° and 51° N. lat. being bounded by the Englifh channel and the Auftrian Netherlands, on the north; by Germany, Switzerland, Savoy, and Piedmont, in Italy, on the eaft; by the Mediterranean fea, and the Pyrenean mountains, which feparate it from Spain, on the fouth; and, by the bay of Bifcay, on the weft. This kingdom was formerly divided into twelve provinces; but at prefent it is divided into twenty-five general governments, over every one of which is an officer, called an intendant, appointed by the king, who has a power of controlling the governor, and all other officers of juftice; and prefides over the receivers-general of his generality.

FRANCFORT, a city of Germany, fituated on the confines of Heffe and Franconia, on both fides of the river Maine: E. lon. 7°20′, N. lat. 50° 10′.

Francfort *on the Oder*, a city of Germany, in the circle of Upper Saxony, and marquifate of Brandenburgh, fituated in E. long. 15°, N. lat. 52° 22′.

FRANCHE-comte, the fame with the county of Burgundy. See Burgundy.

Franche-comte, a province of France bounded by Lorrain on the north; by Alface and Switzerland, on the eaft; by La Brefs and Bugey, on the fouth; by the dukedom of Burgundy, on the weft.

FRANCHISE, in a general fenfe, a privilege or exemption from ordinary jurifdiction; as that for a corporation to hold pleas among themfelves to fuch a value, or the like.

FRANCISCAN monks, friars minor, or grey friars, religious of the order of St Francis, founded by him in the year 1709.

The rule of the Francifcans, as eftablifhed by St Francis himfelf, is briefly this: they are to live in common, to obferve chaftity, and to pay obedience to the pope and their fuperiors.

Before they can be admitted into the order, they are obliged to fell all they have, and give it to the poor: they are to perform a year's noviciate, and when admitted never to quit the order upon any account. They are to faft from the feaft of All-faints, to the Nativity. This order has produced four popes, forty-two cardinals, and an infinite number of patriarchs.

FRANCOLINI, a town of Italy, fituated on the river Po, about nine miles north-eaft of Ferrara.

FRANCONIA, a circle of the German empire, lying between Bohemia on the eaft, and the electorate of Mentz on the weft. Its capital is Nuremburg; and from this county the Franks, who conquered and gave name to the kingdom of France, are faid to have come.

FRANGULA, in botany. See Rhamnus.

FRANGULÆ species, in botany. See Maurocenia.

Frank language, or lingua franca, a kind of jargon fpoken on the Mediterranean, and particularly throughout the coafts and parts of the Levant, compofed of Italian, Spanifh, French, vulgar Greek, and other languages.

Frank, or Franc, an ancient coin, either of gold or filver, ftruck and current in France. The value of the gold frank was fomewhat more than that of the gold crown; the filver frank was a third of the gold one: this coin is long out of ufe, though the term is ftill retained as the name of a money of account; in which fenfe it is equivalent to the livre, or twenty fols.

FRANKENDAL, a city of Germany, in the palatinate of the Rhine, fituated on the weft fide of the river Rhine, in E. long. 8° 15′, N. lat. 49° 30′.

FRANCENIA, sea-heath, or sea-chickweed, a genus of the hexandria monogynia clafs. The calix is tunnel fhaped, and divided into five fegments; the petals are five; the ftigma has fix divifions; and the capfule confifts of one cell, with three valves. There are three fpecies, two of them natives of Britain, *viz.* the lævis, or fmooth fea-heath; and the pulverulenta, or broad leaved fea-heath.

FRANKENSTEIN, a town of Germany, in the palatinate of the Rhine, and dutchy of Zuebruggen, fituated twelve miles north-weft of Landau.

FRANKER, a town of the United Provinces in the province of Weft Friefland, nine miles weft of Lewarden.

FRANKS, Frankis, or Franquis, an appellation given by the Turks, and other nations of Afia, to all the people of the weftern parts of Europe, to which they give the name of *Frankiftan*.

FRANSTAT, or Fraustat, a town of Silefia, fituated twenty-five miles north-eaft of Glogaw, fubject to Pruffia.

FRASCATI, or Frescati, a town of Italy, in the campania of Rome, thirteen miles eaft of that city; near which place is the Tufculum of Cicero, called Grotto Ferrate.

FRATERNITY, in the Roman-catholic countries, fignifies

ſignifies a ſociety for the improvement of devotion.

Of theſe there are ſeveral ſorts; as, 1. The fraternity of the roſary, founded by St Dominic: it is divided into two branches, called the common roſary, and the perpetual roſary; the former of whom are obliged to confeſs and communicate every firſt Sunday in the month, and the latter to repeat the roſary continually. See ROSARY.

2. The fraternity of the ſcapulary, whom the bleſſed Virgin, according to the ſabbatin bull of pope John XXII. has promiſed to deliver out of hell the firſt Sunday after their death. See SCAPULARY.

3. The fraternity of St Francis's girdle, are cloathed with a ſack of a grey colour, which they tie with a cord; and, in proceſſions, walk bare-footed, carrying in their hands a wooden croſs.

4. That of St Auſtin's leathern girdle, comprehends a great many devotees.

Italy, Spain, and Portugal, are the countries where one ſees the greateſt number of theſe fraternities, ſome of which aſſume the name of arch-fraternities. Pope Clement VII. inſtituted the arch-fraternity of charity, which diſtributes bread every Sunday among the poor, and gives portions to forty poor girls on the feaſt of St Jerom their patron. The fraternity of death, buries ſuch dead as are abandoned by their relations, and cauſes maſſes to be celebrated for them.

FRATRICELLI, LITTLE BROTHERS, in church hiſtory, a ſect of heretics who appeared in Italy about the year 1298, and afterwards ſpread all over Europe. They wore the habit of the Franciſcan order, and pretended that eccleſiaſtics ought to have no poſſeſſions of their own.

FRATRIAGE, the partition among brothers or coheirs, coming to the ſame inheritance or ſucceſſion.

FRATRES ARVALES. See ARVALES.

FRATRICIDE, the crime of murdering one's brother. See PARRICIDE.

FRAUD, in law, ſignifies deceit in grants, or conveyances of lands, *&c.* or in bargains and ſales of goods, *&c.* to the damage of another perſon.

FRAXINUS, the ASH, in botany, a genus of trees, belonging to the polygamia diœcia claſs. The calix of the hermaphrodite is divided into four parts; it has no corolla; the ſtamina are two; and it has but one piſtil: the female has one piſtil, and one lanceolated ſeed. There are three ſpecies, only one of which, *viz.* the excelſior or common aſh, is a native of Britain.

The wood of this tree is in great uſe among ſeveral artificers, as wheel-wrights, cart-wrights, carpenters, turners, *&c.* alſo for making ploughs, harrows, axletrees, oars, balls, *&c.* It is ſaid to be as laſting for building as oak, and often preferred before it: though the timber of the trunk greatly excells that of a bough.

FRAY, among ſportſmen. A deer is ſaid to fray its head, when it rubs it againſt a tree, to cauſe the pills of the new horns to come off.

FREAM, a name given by farmers to plowed lands worn out of heart, and laid fallow till it recover.

FREDENBERG, a town of Germany, in the circle of Weſtphalia, fifty miles weſt of Caſſel.

FREDERICA, a town of Georgia, in North America, ſituated in W. long. 81° 30′, N. lat. 31°, on the iſland of St Simons, in the mouth of the river Alatamaha.

FREDERICKSBURG, a caſtle and palace of the king of Denmark, ſituated in the iſle of Zeland, twenty miles north-weſt of Copenhagen, built upon piles in the middle of a lake.

FREDERICKSBURG, a fort upon the gold-coaſt of Guinea, near cape Three-points, ſubject to the Danes. It lies in W. long. 2° N. lat 5°.

FREDERICKSHALL, a ſtrong town of Norway, in the province of Agerhuys, ſituated on the frontiers of Sweden, thirty miles north of Frederickſtat.

FREDERICKSODE, a town of Jutland, in the province of Reypen, ſituated on the little belt in the Baltick ſea, twenty miles weſt of Odenſee.

FREDERICKSTAT, a town of Sleſwick, or ſouth Jutland, ſituated on the river Eyder, near the German ocean, thirty-one miles weſt of Sleſwick.

FREDERICKSTAT, a town of Norway, in the principality of Agerhuys, ſituated on a bay of the ſea, called the Schaggerrack, near the frontiers of Sweden: E. long. 11° 24′, N. lat. 59°.

FREE, in a general ſenſe, is uſed in oppoſition to whatever is conſtrained or neceſſitated. When applied to things endowed with underſtanding, it more peculiarly relates to the liberty of the will.

FREE-HOLD, ſignifies lands or tenements which a perſon holds in fee-ſimple, fee-tail, or for term of life.

FREE-STONE, a whitiſh ſtone, dug up in many parts of Britain, that works like alabaſter, but is more hard and durable; being of excellent uſe in building, *&c.* It is a kind of the grit-ſtone, but finer ſanded, and a ſmoother ſtone; and is called free, from its being of ſuch a conſtitution as to cut freely in any direction.

FREE-THINKER. See DEIST.

FREEDOM, in general, the ſtate or quality of being free.

FREEDOM *of the will*, that power or faculty of the mind, whereby it is capable of acting or not acting, chuſing or rejecting whatever it judges proper. Of this every man muſt be ſenſible, who finds in himſelf a power to begin or forbear, continue or end ſeveral actions, barely by a thought or preference of the mind.

FREEZE, or FRIEZE, in commerce, a coarſe kind of woollen ſtuff, or cloth, for winter wear; ſo called, as being freezed or naped on each ſide.

FREEZING, in philoſophy, the ſame with congelation. See CONGELATION and FROST.

Philoſophers are by no means agreed as to the cauſe of this phænomenon. The Carteſians account for it by the receſs or going out of the etherial matter from the pores of the water. The corpuſcularians, on the other hand, attribute it to the ingreſs of frigorific particles, as they call them; and Hobbes aſſerts, that theſe particles

ticles are nothing elfe but common air, which entangling itfelf with the particles of water, prevents their motion. Others will have a kind of nitrous falt to be the caufe of congelation, by infinuating itfelf between the particles of water, and fixing them together, like nails. And, indeed, it feems probable that cold and freezing do arife from fome fubftance of a faline nature floating in the air; fince all falts, and particularly nitrous ones, when mixed with ice and fnow, greatly increafe their cold, and even bulk.

Boerhave obferves, that it is extremely difficult to exhibit to the eye the precife degree of cold wherein ice begins to form; fince heat and cold, once given to a body, adhere long to it before they quit it. When the air, therefore, is in fuch a ftate as keeps Fahrenheit's thermometer at 32 degrees, water will not freeze; becaufe water being 800 times denfer than air, retains the warmth confiderably longer than air. If any perfon, therefore, is curious to know in what degree of cold water begins to freeze, let him firft fufpend a thermometer in a free open air on all fides; and then wetting a thin linen cloth with clear water, and hanging it likewife in the open air, it will grow ftiff upon the firft accefs of the freezing cold, and thereby fhew when water is beginning to turn to ice. See THERMOMETER.

By means of freezing, wine, vinegar, and malt-liquors may be reduced to a fourth part of their quantity, without any confiderable lofs of their effential parts; fince only the aqueous parts freeze, leaving the vinous parts concentrated or brought into lefs compafs, and capable of being tranfported with lefs expence, and keeping for feveral years.

FREEZING MIXTURE. Mr Boyle fhews in his hiftory of cold, that not only all kinds of falts, but likewife fpirits, fugar, and faccharum faturni, mixed with fnow, are capable of freezing moft fluids; and the fame effect was alfo produced by the mixture of oil of vitriol, or fpirit of nitre with fnow.

FREIGHT, or FRAIGHT, in navigation and commerce, the hire of a fhip, or a part thereof, for the conveyance and carriage of goods from one port or place to another; or the fum agreed on between the owner and the merchant, for the hire and ufe of a veffel.

FRENCH, in general, fomething belonging to France: thus we fay, the French language, French cuftoms, polity, *&c.*

The French language is made up of Latin, Greek, Teutonic, and the language fpoken by the old Gauls. It is natural, and eafily pronounced, and therefore ufed by moft nations of Europe in converfing with foreigners. There are very few compound words in French, which is acknowledged to be its difadvantage. It has alfo few diminutives; but as to purity, eafinefs, and flexibility, it yields to none.

FRESCO, a method of painting in relievo on walls, fo as to endure the weather.

It is performed with water-colours on frefh plafter; or on a wall laid with mortar not yet dry. This fort of painting has a great advantage by its incorporating with the mortar, and, drying along with it, becomes very durable.

The compoft fhould be made of rubbifh ftones mixt with well-burnt flint, or lime, and water: but the faltnefs of the lime muft be wafhed out, by pouring water frequently on it. But this fhould not be done in moift weather.

To prevent the plafter from peeling, ftrike into the joints of the wall ftumps of horfe-nails fix inches diftant from each other. Firft plafter the walls pretty thick; then let it dry for fome time, the defign and colours being firft ready prepared. This painting is chiefly performed on walls and vaults newly plaftered with lime and fand; and the plafter is only to be put on in proportion as the painting proceeds.

Plafter the wall a fecond time, about the thicknefs of half a crown, only fo much as you intend to work upon; and while it is wet, work the colours therein, which will incorporate with the plafter fo as never to wafh out.

The painting muft be worked with a free hand, and your colours made high enough at firft, as there can be no alteration made after the firft painting.

In this work fcarce any thing elfe is ufed but earths, which ftill retain their colour, defending it from the burning and falt of the lime. The colours are white, made of lime flacked fome time, and white marble duft, red and yellow oker, violet red, verditer, lapis lazuli, fmalt, black Spanifh brown, Spanifh white, *&c.* all which are grounded and worked up with water.

The brufhes and pencils for this work muft be long and foft, or elfe they will rake and raze the painting: the colours muft be full and flowing from the brufh, and the defign or cartoon muft be perfect in the paper-copy.

FRESH, in general, fomething that is new, pure, and good; or, that has little or no falt in it.

FRET, or FRETTE, in architecture, a kind of knot or ornament, confifting of two lifts or fmall fillets varioufly interlaced or interwoven, and running at parallel diftances equal to their breadth.

FRET, in heraldry, a bearing compofed of fix bars, croffed, and varioufly interlaced, as reprefented in plate LXXX. fig. 9.

Some call it the true lover's knot.

FRET, in mufic, fignifies a kind of ftop on fome inftruments, particularly bafs-viols and lutes. Frets confift of ftrings tied round the neck of the inftrument, at certain diftances, within which fuch and fuch notes are to be found.

FRET-WORK, that adorned with frets. It is fometimes ufed to fill up and enrich flat empty fpaces; but is moftly practifed in roofs, which are fretted over with plafter work.

FREYSTAT, a town of Silefia, in Germany, E. long. 17° 55′, N. lat. 50°.

FRIABLE, among naturalifts, an appellation given to bodies that are eafily crumbled to pieces: fuch are the free-ftone, pumice-ftone, *&c.*

FRIAR, a term common to monks of all orders, founded

ed on this, that there is a kind of fraternity, or brotherhood, between the feveral religious perfons of the fame convent or monaftery.

Friars are generally diftinguifhed into thefe four principal branches, *viz.* 1. Minors, grey friars, or francifcans. 2. Auguftines. 3. Dominicans, or black friars. 4. White friars, or carmelites. From thefe four the reft of the orders defcend. See FRANCISCANS, AUGUSTINES, *&c.*

FRIBURG, the capital of a canton of the fame name in Switzerland, fituated eighteen miles fouth weft of Bern: E. long. 6° 55′, N. lat. 46° 50′.

FRIBURGH, a city of Swabia, in Germany, twenty-eight miles fouth of Strafburg.

FRICENTO, a town and bifhop's fee of Italy, forty-three miles eaft of the city of Naples.

FRICTION, in mechanics, the rubbing of the parts of engines and machines againft each other, by which means a great part of their effect is deftroyed. See MECHANICS.

FRIDBURG, an imperial city of Bavaria, in Germany: E. long. 10°, and N. lat. 48° 30′.

FRIDBURG is alfo the name of two other towns in Germany, both fituated in the circle of Upper Saxony, the one nine miles fouth-weft of Drefden, and the other thirty miles weft of Leipfic.

FRIEDBURG, an imperial city of Germany, fixteen miles north of Francfort on the main.

FRIESLAND, one of the moft northern provinces of the united Netherlands, bounded by the German ocean on the north, by Groningen and Overyffel on the eaft, by the Zuider-fea and Overyffel on the fouth, and by the fame ocean on the weft: its chief town is Lewarden.

Eaft-FRIESLAND, a province of Weftphalia, in Germany, being the north-weft part of Germany, bordering on Groningen.

FRIEZE, FREEZE, or FRISE, in architecture, a large flat face, or member, feparating the architrave from the corniche, being that part of the entablature between the architrave and the corniche. See ARCHITECTURE.

FRIGAT, among feamen, a fhip of war, light built, and that is a good failer.

A frigat has commonly two decks; whence that called a light frigat, is a frigat with only one deck.

FRIGID, is applied to a jejune ftyle, that is unanimated by any ornaments, and confequently without any force or vigour.

FRIGORIFIC, in phyfiology, fmall particles of matter, which, according to Gaffendus and others, being actually and effentially cold, and penetrating other bodies, produce in them that quality which we call cold.

FRILL, in falconry. When a hawk trembles, or fhivers, they fay fhe frills.

FRINGILLA, in ornithology, a genus belonging to the order of pafferes. The bill is conical, ftrait, and fharp-pointed. There are no lefs than thirty fpecies comprehended under this genus, diftinguifhed principally by varieties in their colour.

1. The brown fringilla with a tawny neck, and white fpots on the wings and hinder part of the back. It is the Carolina ortolan of Catefby, and is a bird of the ifland of Cuba; only the hens pafs into Carolina in the autumn. 2. The fringilla with black limbs, and the wings white on both fides; the three firft feathers of the tail are without fpots, but two of the chief are obliquely fpotted. It is the chaffinch of Englifh authors, and is a bird of Europe. 3. The fringilla, with the bafe of the wings underneath of a deep yellow colour. It is the brambling or mountain finch of Englifh authors, and is a bird of Europe. 4. The brown fringilla, with a reddifh breaft and fhoulders, and the black wings marked with a reddifh fpot: It is an inhabitant of Sweden. 5. The fringilla with a blackifh fpotted head, and a white fpot behind the eyes. It is the greater chaffinch of Albin, and is found in Lapland. 6. The fringilla with the limbs, wings, and tail black, only the outermoft from the middle externally white. It is a bird of Sweden. 7. The grey fringilla, fpotted with black, has a fpace running from the bill to the fides of the neck black. It is the fhomburgher, a-kin to the lark of Edwards, and is a bird of South America. 8. The black fringilla, with a reddifh glofs, and a reddifh belly, with a white fpot on the wings, is the American black fparrow with red eyes, of Catefby. 9. The fringilla, with the quill-feathers red forwards, and the outermoft without any fpots; the two outermoft are white in the middle, as the reft are at the point. This is the goldfinch of Englifh authors. 10. The fringilla with a red face and tail, the belly undulated with white and black, and the back green. It is the green goldfinch of Edwards, and is a Chinefe bird. 11. The fringilla with purple tail-feathers, with the hinder halves black. It is the amaduvad of Albin, and an inhabitant of the Eaft Indies. The cock is all over purple; but the hen is afh-coloured, except the bill and tail. 12. The green fringilla with a red head, a yellow collar, and a blue breaft. It is the red-headed green finch of Edwards. 13. The fringilla all over red, is the red fly-catcher of Catefby, and is a bird of America. 14. The yellow fringilla, with a black forehead and brown wings, is the American goldfinch of Catefby. 15. The fringilla with a black head, a tawny breaft, and a white ftreak on the wings and above and below the eyes, is the Bahama finch of Catefby. 16. The fringilla with a wedge-like tail, a reddifh body, a red bill, and the temples, rump and belly of a violet colour, is the red and blue Brafilian finch of Edwards. 17. The green fringilla, with the fupercilia, breaft and belly yellow, but the prime feathers of the wings are white on the outer edge. It is the Indian green finch of Edwards, and is found in Madera. 18. The fringilla with a whitifh body and bill, and the prime feathers of the wings and tail greenifh. This is the Canary bird of Englifh authors, and is found in the Canary iflands. 19. The fringilla with the prime feathers of the wings yellow in the middle, and the fore firft chief tail-feathers without fpots; but they are yellow at the bafe, and black at the points. It is the fifkin of Englifh authors, and haunts places where juniper-bufhes grow. 20. The brown fringilla, with a flame-coloured creft, is

is the brown linnet of Klein. 21. The brown fringilla, with a yellowifh bill, is an European bird, as are alfo the two former. 22. The fringilla, with the prime feathers of the wings, and the chief feathers of the tail black, but white on the edges. It is the greater red-headed linnet of Ray, and is a bird of Europe. 24. The fringilla, with a brown back, and a blue belly and tail, is the blue bellied finch of Edwards, and is found in Africa. 25. The violet-coloured fringilla, with the forehead and under part of the body of a deep yellow colour; the back, neck, prime feathers of the wings, and upper part of the tail are of a bluifh black colour; but the forehead, breaft, belly, and under part of the neck are of a deep yellow. The bill is exceeding fhort, triangular, black and crooked at the point. 26. The fringilla with the chief feathers of the tail brown, and the outermoft marked with a wedge-like fpot; the body is variegated with grey and black, and the head is black. It is the reed fparrow of Englifh authors, and is a bird of Europe. 27. The fringilla with the prime feathers of the wings and tail brown, the body variegated with grey and black, and a fingle white ftreak on the wings. This is the houfe-fparrow of Englifh authors, and is an European bird. 28. The fringilla with the prime feathers of the wings and tail brown, the body variegated with grey and black, and a double white ftreak on the wings. This is the mountain-fparrow of Ray, and is a bird of Europe. 29. The ferruginous fringilla, with a black head and a blue bill, is the Chinefe fparrow of Edwards. 30. The black fringilla, with a white belly, is the American fnow-fparrow of Catefby.

FRINWALT, or FRIDLAND, a town of Brandenburg, thirty miles north-eaft of Berlin, fituated on the weft fide of the river Oder.

FRIO, a cape or promontory of Brafil: W. long. 44°, and S. lat. 23° 30′.

FRISACH, a town of Bavaria, fixty miles fouth-eaft of Saltzburg: E. long. 14° 15′, and N. lat. 47° 20′.

FRISONE, in ornithology. See LOXIA.

FRIT, in the glafs-manufacture, the matter or ingredients whereof glafs is to be made, when they have been calcined or baked in a furnace; or it is the calcined matter to be run into glafs. See GLASS.

FRITH, in its moft ufual acceptation, fignifies an arm of the fea: fuch are the frith of Forth or of Edinburgh, the frith of Clyde, Murray frith, *&c.*

FRITILLARIA, in botany, a genus of the hexandria monogynia clafs. The corolla confifts of fix bell-fhaped petals, with a hollow nectarium above the unguis of each petal; and the ftamina are of an equal length with the petals. There are five fpecies, only one of which is a native of Britain, *viz.* the meleagris or common checkered daffodil.

FRIULI, a province of Italy, fubject to Venice, and bounded by Carinthia in Germany on the north, by Carniola on the eaft, by the gulph of Venice on the fouth, and by the Bellunefe and Feltrin on the weft.

FRIZING *of cloth*, a term, in the woollen manufactory, applied to the forming of the nap of a cloth, or ftuff, into a number of little hard burrs or prominences, covering almoft the whole ground thereof.

Some cloths are only frized on the back fide, as black cloths; others on the right fide, as coloured and mixed cloths, rateens, bays, freezes, *&c.*

Frizing may be performed two ways; one with the hand, that is, by means of two workmen, who conduct a kind of plank that ferves for a frizing inftrument.

The other way is by a mill, worked either by water, or a horfe, or fometimes by men. This latter is efteemed the better way of frizing, by reafon the motion being uniform and regular, the little knobs of the frizing are formed more equally and regularly.

FROBISHER's STRAITS, in weft Greenland, lie a little to the northward of Cape Farewel: W. long. 48°, and N. lat. 63°.

FRODINGHAM, a market-town of Yorkfhire, thirty miles eaft of York.

FRODSHAM, a market-town of Chefter, fourteen miles north eaft of Chefter.

FROG, in zoology. See RANA.

FRONTEIRA, a town of Portugal, in the province of Alentejo: W. long. 8° 6′, and N. lat. 38° 50′.

FRONTIER, the border, confine, or extremity of a kingdom or province, which the enemies find in front, when they would enter the fame: thus we fay, a frontier town, a frontier province, *&c.*

Frontiers were anciently called marches.

FRONTIS OS, in anatomy. See ANATOMY, p. 152.

FRONTIGNIAC, a town of Languedoc in France, fituated fixteen miles fouth-weft of Montpelier, and remarkable for producing excellent wine.

FROST, in phyfiology, fuch an exceffively cold ftate of the air as converts watery fluids into ice.

In very cold fnowy weather, not only water, but urine, beer, ale, milk, vinegar, and even wine, are either wholly or in part converted into ice, though the laft but flowly. As to the freezing of expreffed oils, a very intenfe cold may deprive them of their fluidity, fo as to be capable of being cut into portions of any figure; but whether they are convertible into real ice, is not yet determined. In Ruffia oil freezes much harder than with us, but does not even there become perfect ice. Common annifeed-water, and the like weak fpirits, are faid to be converted into an imperfect ice in Mufcovy; and the ftrong fpirits into a fubftance like that of oil. When brandy freezes, a liquid part, much ftronger than common brandy, retires to the centre of the veffel.

Even folid bodies are liable to be affected by froft: timber is often apparently frozen, and rendered exceedingly difficult to faw. Marle, chalk, and other lefs folid terreftrial concretions, will be fhattered by ftrong and durable frofts. Metals are contracted by froft: thus, an iron tube, twelve foot long, upon being expofed to the air in a frofty night, loft two lines of its length. On the contrary, it fwells or dilates fluids near one tenth of their bulk. Mr Boyle made feveral experiments with metalline veffels, exceeding thick and ftrong; which being filled with water clofe ftopped, and expofed to the cold, burft by the expanfion of the frozen fluid within them. Trees are frequently

quently burnt up with froſt, as with the moſt exceſſive heat; and in very ſtrong froſts, walnut-trees, aſhes, and even oaks, are ſometimes miſerably ſplit and cleft, ſo as to be ſeen through, and this with a terrible noiſe, like the exploſion of fire arms.

Froſt naturally proceeds from the upper parts of bodies downwards; but how deep it will reach in earth or water, is not eaſily known, becauſe this depth may vary with the degree of coldneſs in the air, by a longer or ſhorter duration of the froſt, the texture of the earth, the nature of the juices wherewith it is impregnated, the conſtitution of its more internal parts as to heat and cold, the nature of its effluvia, *&c.* Mr Boyle, in order to aſcertain this depth, after four nights of hard froſt, dug in an orchard, where the ground was level and bare, and found the froſt had ſcarce reached three inches and a half; and in a garden nearer the houſe, only two inches below the ſurface. Nine or ten ſucceſſive froſty nights froze the bare ground in the garden ſix inches and a half deep; and in the orchard, where a wall ſheltered it from the ſouth ſun, to the depth of eight inches and a half. He alſo dug in an orchard, near a wall, about a week afterwards, and found the froſt to have penetrated to the depth of fourteen inches. In a garden at Moſcow, the froſt in a hard ſeaſon only penetrates to two feet: and the utmoſt effect that capt. James mentions the cold to have had upon the ground of Charlton iſland, was to freeze it to ten feet deep: whence may appear the different degrees of cold of that iſland and Ruſſia. And as to the freezing of water at the above-mentioned iſland, the captain tells us, it does not naturally congeal above the depth of ſix feet, the reſt being by accident. Water alſo, expoſed to the cold air in large veſſels, always freezes firſt at the upper ſurface, the ice gradually increaſing and thickening downwards; for which reaſon frogs retire in froſty weather to the bottom of ditches: and it is ſaid, that ſhoals of fiſh retire in winter to thoſe depths of the ſea and rivers, where they are not to be found in ſummer. Water, like the earth, ſeems not diſpoſed to receive any very intenſe degree of cold at a conſiderable depth or diſtance from the air. The vaſt maſſes of ice found in the northern ſeas being only many flakes and fragments, which, ſliding under each other, are, by the congelation of the intercepted water, cemented together.

In cold countries, the froſt proves often fatal to mankind; not only producing cancers, but even death itſelf. Thoſe who die of it have their hands and feet firſt ſeized, till they grow paſt feeling it; after which the reſt of their bodies is ſo invaded, that they are taken with a drowſineſs, which if indulged, they awake no more, but die inſenſibly. But there is another way whereby it proves mortal, *viz.* by freezing the abdomen and viſcera, which on diſſection are found to be mortified and black.

Hoar-FROST, a cold moiſt vapour, that is drawn up a little way into the air, and in the night falls again on the earth, where it is congealed into icy cryſtals of various figures. Hoar-froſt therefore is nothing but dew, turned into ice by the coldneſs of the air.

FROTH, a white, light ſubſtance, formed on the ſurface of fluids, by vehement agitation, conſiſting of little ſpherules, or globules.

FROTH-SPIT, or CUCKOW-SPIT, a name given to a white froth, or ſpume, very common, in the ſpring and firſt months of the ſummer, on the leaves of certain plants, particularly on thoſe of the common white field lychnis or catch-fly, thence called by ſome ſpatling poppy.

All writers on vegetables have taken notice of this froth, though few have underſtood the cauſe or origin of it till of late; being formed by a little leaping animal, called by ſome the flea graſs-hopper, by applying its anus cloſe to the leaf, and diſcharging thereon a ſmall drop of a white viſcous fluid, which containing ſome air in it, is ſoon elevated into a ſmall bubble: before this is well formed, it depoſites ſuch another drop, and ſo on, till it is every way overwhelmed with a quantity of theſe bubbles, which form the white froth which we ſee.

FRUCTIFEROUS, ſignifies properly any thing that produces fruit.

FRUCTIFICATION, among botaniſts, in a more lax ſenſe, includes the flower and fruit, with their ſeveral coverings. See BOTANY.

FRUIT, in general, includes whatever the earth produces for the nouriſhment and ſupport of man, and other animals; as herbs, grain, hay, corn, *&c.*

FRUIT, more properly, ſignifies the production of a tree, or plant, for the propagation or multiplication of its kind; in which ſenſe the word takes in all kinds of ſeeds with their furniture. But botaniſts uſually underſtand by it that part of a plant wherein the ſeeds are contained.

FRUIT alſo implies an aſſemblage of ſeeds in a head; as in a ranunculus, *&c.* and all kinds of ſeeds, or grains, whether incloſed in a cover, capſule, or pod; and whether bony, fleſhy, ſkinny, membranous, or the like. See AGRICULTURE, Part I.

FRUMENTACEOUS, a term applied by botaniſts to all ſuch plants as have a conformity with wheat, in reſpect of their fruits, leaves, ears, or the like.

FRUMENTARII, a kind of ſoldiers, or archers, under the weſtern empire.

The firſt time we read of theſe officers is in the time of the emperor Adrian, who made uſe of them to inform himſelf of whatever paſſed. They did not make any particular corps diſtinct from the reſt of the forces, but there was a certain number of them in each legion. It is ſuppoſed, that they were at firſt a number of young perſons diſpoſed by Auguſtus throughout the provinces, particularly on all the grand roads, to acquaint the emperor, with all expedition, of every thing that happened.

Afterwards they were incorporated into the troops themſelves, where they ſtill retained their ancient name. As their principal office was the giving intelligence, they were often joined with the curioſi, with whom they agreed in this part of their office.

Their name of frumentarii is derived from their being alſo a ſort of purveyors to the armies, cities, *&c.* col-

collecting all the corn from the several provinces to furnish the common-wealth.

FRUMENTATION, in Roman antiquity, a largess of corn bestowed on the people. This practice of giving corn to the people was very ancient among the Romans; and frequently used to sooth the turbulent humour of the populace. At first the number of those to whom this largess was given, was indeterminate, till Augustus fixed it at two hundred thousand.

FRUSH, or FROG, among farriers, a sort of tender horn which arises in the middle of a horse's sole; and, at some distance from the toe, divides into two branches, running towards the heel in the form of a fork.

FRY, in zoology, signifies the spawn, or rather young, of fish.

FUCUS, in botany, a genus of submarine plants, belonging to the cryptogamia class.

The fucus consists of a tough matter, formed into a kind of leaves, which are flat and variously divaricated; and which have some appearance of fructification, in punctated tubercles, covering oblong vesicles, supposed by Linnæus to be male flowers; and smooth roundish vesicles, hollow and interwoven with filaments, which appear to him to be female flowers. There are thirty-four species of fucus, or sea wrack, many of them to be found on our coasts.

FUEL, whatever is proper to burn or make a fire; as, wood, turfs, peats, bituminous earths, coals, *&c.*

FUGALIA, in Roman antiquity, a feast supposed by some to be the same with the refugium, held on the 24th of February, in memory of the expulsion of the kings, and the abolishing of the monarchial government. Others again distinguish the fugalia from the regifuge. And others think, that the Fugalia was the same with the poplifugia, or the feast of Fugia, the goddess of joy, occasioned by the rout of an enemy, which was the reason the people abandoned themselves to riot and debauchery.

FUGITIVE, a person obliged to fly his country, or remove from a place where he had some abode, or establishment, on account of his crimes, debts, or other occasions.

FUGUE, in music, is when different parts of a musical composition follow each other; each repeating what the first had performed.

FULCRUM, in mechanics, the prop or support by which a lever is sustained. See MECHANICS.

FULD, a town and abbey of Germany, the abbot of which is a prince of the empire: E. long. 9° 35′, N. lat. 50° 34′.

FULICA, the COOT, in ornithology, a genus of birds, of the order of grallæ. It has a convex bill, with the upper mandible fornicated over the lower at the edge; the lower mandible is gibbous behind the tip. The forehead is bald, and the feet have four toes a little lobated. There are four species.

1. The Fulica with a bald forehead, a black body, and lobated toes. It is the coot of Ray, and an inhabitant of Europe, and feeds upon seeds and herbs, and runs as well as swims upon the water. 2. The fulica with a bald forehead, and toes without webs. It is the water-hen, or moor-hen of Ray, and is found in Europe. 3. The fulica with a bald forehead, a violet-coloured body, and toes without webs, is the purple water hen of Edwards, and it inhabits Asia and America. 4. The fulica with a carunculated forehead, a variegated body, spinous shoulders, and toes without webs; but the nail on the hinder toe is exceeding long. It is the spur-winged water-hen of Edwards, and is an inhabitant of South America. The nail on the hind toe is strait, and longer than a man's finger. The pollex rests upon one joint, and the wings are green.

FULIGINOUS, whatever proceeds from a thick, sooty smoke, such as litharge and lamp black.

FULIGNO, a city of Italy, in the pope's territories, ten miles north of Spoletto.

FULIGO, in natural history, a species of pumice-stone. See PUMICE.

FULLER, a workman employed in the woollen manufactories, to mill or scour cloths, serges, and other stuffs, in order to render them more thick, compact, and durable. See CLOTH.

FULLER'S EARTH, in natural history, a soft, greyish, brown, dense, and heavy marle: when dry, it is of a greyish ash-coloured brown, in all degrees from very pale to almost black, and it has generally something of a greenish cast: it is very hard and firm, of a compact texture, of a rough and somewhat dusty surface that adheres slightly to the tongue: it is very soft to the touch, not staining the hands, nor breaking easily between the fingers: it has a little harshness between the teeth, and melts freely in the mouth: thrown into water, it makes no ebullition, or hissing, but swells gradually in bulk, and falls into a fine soft powder. It makes no effervescence with aqua fortis.

It is of great use in scouring cloths, stuffs, *&c.* imbibing all the grease and oil used in preparing, dressing, *&c.* of the wool, for which reason it is made a contraband commodity, and is not to be exported under the penalty of 1 s. for every pound weight. See FULLING.

FULLER'S WEED, in botany. See DIPSACUS.

FULLERY, a place where cloths, *&c.* are fulled. See the next article.

FULLING, the art or act of scouring and pressing cloths, stuffs, stockings, *&c.* to cleanse, thicken, and render them more firm and strong, which is done by means of a water mill.

Fuller's earth is used with some proportion of soap; but soap alone would do much better, was it not dearer than fuller's earth.

Fulling of stockings, caps, *&c.* is performed either with the hands or feet, or a kind of wooden machine, either armed with wooden teeth, or those of horses or bullocks. The ingredients generally used on this occasion are fuller's earth, urine, white soap and green soap. But water softened with chalk is far preferable.

FULMINATING, something that thunders, or resembles thunder.

FULMINATION, in chemistry, is used in a synonymous sense with detonation.

Fulmination,

Fulmination in the depuration of the more perfect metals, is, when, upon infufing them with lead, a brighter colour fucceeds a kind of fulphureous cloud, before appearing in the metals, during the fufion.

Fulmination, in the Romifh canon law, a fentence of a bifhop, official, or other ecclefiaftic appointed by the pope, by which it is decreed, that fome bull fent from the pope fhall be executed.

FUMARIA, in botany, a genus of the diadelphia hexandria clafs. The calix confifts of two leaves; and the corolla is ringent. There are 11 fpecies, three of them natives of Britain, *viz.* the officinalis, or fumitory; the capreolata, or ramping fumitory; and the claviculata, or climbing fumitory.

The whole plant of the officinalis is ufed in medicine, being accounted good in the fcurvy, jaundice, and diforders of the mefentery and fpleen.

FUMIGATION, in chemiftry, a kind of calcination, when metals, or other hard bodies, are corroded, or foftened, by receiving certain fumes for that purpofe.

Fumigation, in medicine, the application of fumes to particular parts of the body; as thofe of factitious cinnabar, to venereal ulcers.

FUMITORY, in botany. See Fumaria.

FUNCHAL, the capital of the Madeira iflands, fubject to Portugal: W. long. 16°, N. lat. 32° 33′.

FUNCTION, the act of fulfilling the duties of any employment.

Function, being alfo applied to the actions of the body, is by phyficians divided into vital, animal, and natural The vital functions are thofe neceffary to life, and without which the individual cannot fubfift; as the motion of the heart, lungs, *&c.* The natural functions are fuch as it cannot fubfift any confiderable time without them, as the digeftion of the aliment, and its converfion into blood. Under animal functions are included the fenfes of touching, tafting, *&c.* memory, judgment, and voluntary motion, without any, or all of which an animal may live, but not very comfortably.

The animal functions perform the motion of the body by the action of the mufcles, and this action confifts chiefly in the fhortening the flefhy fibres, which is called contraction, the principal agents of which are the arteries and nerves diftributed in the flefhy fibres.

In fhort, all parts of the body have their own functions, or actions peculiar to themfelves. Life confifts in the exercife of thefe functions, and health in the free and ready exercife of them.

FUND, in commerce, fignifies the ftocks of the great trading and monied companies. See Stocks.

FUNDAMENT, in anatomy. See Anus.

FUNDI-BAY, that fituated between New England and New Scotland, in which there is faid to be an excellent fifhery.

FUNEN, the fecond ifland for magnitude belonging to the king of Denmark, fituated at the entrance of the Baltic fea, and feparated from Jutland by the ftrait called the leffer Belt, and from the ifland of Zeland by the ftrait called the great Belt. Its chief town is Odenfee.

FUNERAL rites, ceremonies accompanying the interment or burial of any perfon.

Thefe rites differed among the ancients according to the different genius and religion of each country. The Egyptians, among the reft of their funeral rites, embalmed their dead.

Among the ancient Greeks it was ufual fometimes, before the interment, to put a piece of money into the mouth of the deceafed, which was thought to be Charon's fare for wafting the departed foul over the infernal river. This ceremony was not ufed in thofe countries which were fuppofed to be fituated in the neighbourhood of the infernal regions, and to lead thither by a ready and direct road. The corpfe was likewife furnifhed with a cake, compofed of flour, honey, *&c.* which was defigned to appeafe the fury of Cerberus, the door-keeper of hell, and to procure the ghoft a fafe and quiet entrance.

During the time the corpfe continued in the houfe, there ftood before the door a veffel of water, the defign of which was, that thofe concerned about the body might purify themfelves by wafhing; it being the opinion of the Greeks, as well as of the Jews, that pollution was contracted by touching a dead body.

The ceremonies by which they expreffed their forrow for the death of their friends, were various; but it feems to have been a conftant rule to recede as much as poffible in habit and behaviour from their ordinary cuftoms. For this reafon they abftained from banquets and entertainments; they diverted themfelves of all ornaments; they tore, cut off, or fhaved their hair, which they caft into the funeral pile, to be confumed with the body of their deceafed friend. Sometimes they threw themfelves on the ground, and rolled in the duft, or covered their head with afhes; they beat their breafts, and even tore their flefh with their nails, upon the lofs of a perfon they much lamented. When perfons of rank, fuch as public magiftrates, or great generals, died, the whole city put on a face of mourning: all public meetings were intermitted; the fchools, baths, fhops, temples, and all places of concourfe were fhut up.

Interring or laying the dead in the ground, feems to have been the moft ancient practice among the Greeks; though burning came afterwards to be generally ufed among them. It was cuftomary to throw into the funeral pile thofe garments the deceafed ufually wore. The pile was lighted by one of the dead perfon's neareft relations or friends, who made prayers and vows to the winds to affift the flames, that the body might quickly be reduced to afhes; and during the time the pile was burning, the dead perfon's friends ftood by it, pouring libations of wine, and calling upon the deceafed.

When Numa reformed the religion of Rome, he ordered that the pontiffs fhould have the care of the funeral ceremonies; which, in moft refpects, were like thofe of the Greeks already defcribed.

The funeral rites among the Hebrews, were folemn and magnificent: when any perfon was dead, his relations and friends rent their cloaths; which cuftom is but faintly imitated by the modern Jews, who only cut off a

bit of their garment, in token of affliction. It was uſual to bend the dead perſon's thumb into the hand, and faſten it in that poſture with a ſtring; becauſe the thumb then having the figure of the name of God, they thought the devil would not dare to approach it. When they came to the burying place, they made a ſpeech to the dead in the following terms: "Bleſſed "be God, who has formed thee, fed thee, maintain-"ed thee, and taken away thy life. O dead! he knows "your numbers, and ſhall one day reſtore your life, *&c.*" Then they ſpoke the elogium, or funeral oration, of the deceaſed; after which they ſaid a prayer, called the righteouſneſs of judgment; then turning the face of the deceaſed towards heaven, they called out, "Go "in peace.

The ancient Chriſtians teſtified their abhorrence of the Pagan cuſtom of burning the dead; and always depoſited the body entire in the ground: and it was uſual to beſtow the honour of embalming upon the martyrs at leaſt, if not upon others. They prepared the body for burial, by waſhing it with water, and dreſſing it in a funeral attire. The exportation, or carrying forth of the body, was performed by near relations, or perſons of ſuch dignity as the circumſtances of the deceaſed required. Pſalmody, or ſinging of Pſalms, was the great ceremony uſed in all funeral proceſſions among the ancient Chriſtians.

In the Romiſh church, when a perſon is dead, they waſh the body, and put a crucifix in its hand. At its feet ſtands a veſſel full of holy water, and a ſprinkler, that they who come in may ſprinkle both themſelves and the deceaſed. In the mean time ſome prieſt ſtands by the corpſe, and prays for the deceaſed till it is laid in the earth. In the funeral proceſſion, the exorciſt walks firſt, carrying the holy water; next the croſs-bearer, afterwards the reſt of the clergy, and laſt of all the officiating prieſt. They all ſing the *miſerere*, and ſome other pſalms; and at the end of each pſalm a *requiem*. We learn from Alet's ritual, that the faces of deceaſed laymen muſt be turned towards the altar, when they are placed in the church; and thoſe of the clergy, towards the people. The corpſe is placed in the church ſurrounded with lighted tapers: after the office for the dead, maſs is ſaid; then the officiting prieſt ſprinkles the corpſe thrice with holy water, and as often throws incenſe on it. The body being laid in the grave, the friends and relations of the deceaſed ſprinkle the grave with holy water.

The funeral ceremonies of the Greek church, are much the ſame with thoſe of the Latin. It needs only be obſerved, that after the funeral ſervice, they kiſs the crucifix, and ſalute the mouth and forehead of the deceaſed: after which each of the company eats a bit of bread, and drinks a glaſs of wine in the church, wiſhing the ſoul a good repoſe, and the afflicted family all conſolation.

FUNERAL GAMES, a part of the ceremony of the ancient funerals.

It was cuſtomary for perſons of quality, among the ancient Greeks and Romans, to inſtitute games with all ſorts of exerciſes, to render the death of their friends more remarkable. This practice was generally received, and is frequently mentioned by ancient writers. Patroclus's funeral games, take up the greateſt part of one of Homer's iliads; and Agamemnon's ghoſt is introduced by the ſame poet telling the ghoſt of Achilles, that he had been a ſpectator at a great number of ſuch ſolemnities.

The celebration of theſe games among the Greeks, moſtly conſiſted of horſe-races; the prizes were of different ſorts and value, according to the quality and magnificence of the perſon that celebrated them. The garlands, given to victors on this occaſion, were uſually of parſly, which was thought to have ſome particular relation to the dead.

Thoſe games, among the Romans, conſiſted chiefly of proceſſions; and ſometimes of mortal combats of gladiators around the funeral pile. They, as well as the Greeks, had alſo a cuſtom, though very ancient, of cutting the throats of a number of captives before the pile, as victims to appeaſe the manes of the deceaſed. Cæſar relates, that the Gauls had this cuſtom.

The funeral games were aboliſhed by the emperor Claudius.

FUNERAL ORATION, a diſcourſe pronounced in praiſe of a perſon deceaſed, at the ceremony of his funeral.

FUNGIBLES, in Scots law, are ſuch things as are eſtimated by number, weight, or meaſure; as, coin, butter, ale, *&c.*

FUNGITÆ, in natural hiſtory, a kind of foſſile coral, of a conic figure, though ſometimes flatted and ſtriated longitudinally.

FUNGUS, in ſurgery, denotes any ſpongy excreſcence. See SURGERY.

FUNGUS, in botany, See BOTANY, p. 636.

FURCA, in antiquity, a piece of timber reſembling a fork, uſed by the Romans as an inſtrument of puniſhment.

The puniſhment of the furca was of three kinds: the firſt only ignominious, when a maſter, for ſmall offences, forced his ſervant to carry a furca on his ſhoulders about the city. The ſecond was penal, when the party was led about the circus, or other place, with the furca about his neck, and whipped all the way. The third was capital, when the malefactor, having his head faſtened to the furca, was whipped to death.

FURCHE', in heraldry, a croſs forked at the ends.

FURIES, in Pagan antiquity, certain goddeſſes whoſe office it was to puniſh the guilty after death. Theſe were three in number; Alecto, Megæra, and Tiſiphone, who were deſcribed with ſnakes inſtead of hair, and eyes like lightening, carrying iron-chains and whips in one hand, and in the other flaming torches; the latter to diſcover, and the former to puniſh the guilty; and they were ſuppoſed to be conſtantly hovering over ſuch perſons as had been guilty of any enormous crime.

Mythologiſts ſuppoſe, that Tiſiphone puniſhed the crimes which ſprang from hatred or anger; Megæra, thoſe from envy; and Alecto, thoſe from an inſatiable purſuit after riches and pleaſure. They were worſhipped at Caſina in Arcadia, and at Carmia in Peloponneſus.

fus. They had a temple at Athens, near the Areopagus, and their priests were chosen from amongst the judges of that court. At Telphusia, a city in Arcadia, a black ewe was sacrificed to them.

FURLING, in the sea language, signifies the wrapping up and binding any sail close to the yard; which is done by hauling upon the clew-lines, bunt-lines, *&c.* which wraps the sail close together, and being bound fast to the yard, the sail is furled.

FURLONG, a long measure, equal to one eighth of a mile, or forty poles.

It is also used, in some law-books, for the eighth part of an acre.

FURLOUGH, in the military language, a licence granted by an officer to a soldier, to be absent for some time from his duty.

FURNACE, an utensil, or vessel, proper to contain fire; or to raise and maintain a vehement fire in, whether of coal or wood. See Chemistry, p. 110.

FURNES, a town of Flanders, ten miles east of Dunkirk: E. long. 2° 25′, and N. lat. 51° 10′.

FUROR uterinus, a disorder peculiar to women. See Medicine.

FURR, in commerce, signifies the skin of several wild beasts, dressed in alum with the hair on, and used as a part of dress by princes, magistrates, and others. The kinds most in use are, those of the ermine, sable, castor, hare, coney, *&c.*

FURSTENBURGH, a town and castle of Germany, the capital of a county of the same name, thirty miles north-west of Constance: E. long. 8° 30′, and N. lat. 47° 50′.

FURSTENFIELD, a town of Austria and dutchy of Stiria, thirty-six miles east of Gratz: E. long. 16° 46′, N. lat. 47° 26′.

FURTHCOMING, in law, the name of an action competent to any person who has used arrestment in the hands of his debtor's creditor, for having the subject arrested declared his property. See Scots Law, title 25.

FURUNCLE, or Boil, in surgery, a small resisting tumour, with inflammation, redness, and great pain, arising in the adipose membrane, under the skin.

FURZE, in botany. See Ulex.

FUSANUS, in botany. See Euonymus.

FUSAROLE, in architecture, a moulding or ornament placed immediately under the echinus, in the Doric, Ionic, and Composite capitals.

FUSEE, in clock-work, is that conical part drawn by the spring, and about which the chain or string is wound; for the use of which, see Watch.

Fusee, or Firelock. See Musquet.

FUSIBILITY, in natural philosophy, that quality of bodies which renders them fusible.

FUSIL, in heraldry, a bearing of a rhomboidal figure, longer than the lozenge, and having its upper and lower angles more acute and sharp than the other two in the middle. It is called in Latin *fusus*, a spindle, from its shape. See Plate LXXX. fig. 10.

FUSILIERS, or Fusileers, in the military art, are foot-soldiers, armed with fusees, or firelocks.

FUSION, the melting of metals, minerals, *&c.* by means of fire. See Chemistry.

FUSTIAN, in commerce, a kind of cotton stuff, which seems as it were whaled on one side.

Right fustians should be altogether made of cotton-yarn, both woof and warp; but a great many are made, of which the warp is flax, or even hemp.

There are fustians made of several kinds, wide, narrow, fine, coarse; with shag or nap, and without it.

FUSTICK, or Fustock, a yellow wood, that grows in all the Caribbee islands, used in dying yellow. It pays no duty on importation.

FUTTOCKS, in a ship, the timbers raised over the keel, or the encompassing timbers that make her breadth.

FUTURE, in general, denotes whatever regards futurity, or the time to come.

G

GABARA, or Gabbara, in antiquity, the dead bodies which the Egyptians embalmed, and kept in their houses, especially those of such of their friends as died with the reputation of great piety and holiness, or as martyrs. See Embalming, and Mummy.

GABEL, according to the French duties or customs, a tax upon salt, which makes the second article in the king's revenue, and amounts to about one fourth part of the whole revenue of the kingdom.

GABIN, a town of great Poland, forty-six miles north-west of Warsaw: E. long. 20°, N. lat. 52° 35′.

GABIONS, in fortification, baskets made of ozier-twigs, of a cylindrical form, six feet high, and four wide; which being filled with earth, serve as a shelter from the enemies fire.

GABLOCKS, the artificial spurs of game-cocks.

GAD, among miners, a small punch of iron, with a long wooden handle, used to break up the ore.

One of the miners holds this in his hand, directing the point to a proper place, while the other drives it into the vein, by striking it with a sledge-hammer.

Gad-fly. See Oestrus.

GADUS, in ichthyology, a genus of fishes belonging to the order of jugulares. The head is smooth; there

are

are feven cylindrical rays in the branchioftege membrane; the body is oblong, with deciduous fcales; the whole fins are covered with the common fkin of the fifh; the rays of the back-fins are blunt, and thofe of the breaft are fharp. There are feventeen fpecies, principally diftinguifhed by their cirri, and the number of back-fins.

GAGE, in the fea-language. When one fhip is to windward of another, fhe is faid to have the weather-gage of her. They likewife call the number of feet that a veffel finks in the water, the fhip's gage: this they find by driving a nail into a pike near the end, and putting it down befide the rudder till the nail catch hold under it; then as many feet as the pike is under water, is the fhip's gage.

GAGE, among letter-founders, a piece of box, or other hard wood, varioufly notched; the ufe of which is to adjuft the dimenfions, flopes, *&c.* of the different forts of letters. See FOUNDERY.

Sliding-GAGE, a tool ufed by mathematical inftrument-makers, for meafuring and fetting off diftances.

Sea GAGE, an inftrument invented by Dr Hales and Dr Defaguliers, for finding the depth of the fea, the defcription whereof is this. AB (Plate LXXXVI. fig. 1. N° 1.) is the gage bottle, in which is cemented the gage-tube *Ff* in the brafs cap at G. The upper end of tube F is hermetically fealed, and the open lower end *f* is immerfed in mercury, marked C, on which fwims a fmall thicknefs or furface of treacle. On the top of the bottle is fcrewed a tube of brafs HG, pierced with feveral holes, to admit the water into the bottle AB. The body K is a weight hanging by its fhank L, in a focket N, with a notch on one fide at *m*, in which is fixed the catch *l* of the fpring S, and paffing through the hole L, in the fhank of the weight K, prevents its falling out when once hung on. On the top, in the upper part of the brafs tube at H, is fixed a large empty ball, or full-blown bladder I, which muft not be fo large, but that the weight K may be able to fink the whole under water.

The inftrument, thus conftructed, is ufed in the following manner: The weight K being hung on, the gage is let fall into deep water, and finks to the bottom; the focket N is fomewhat longer than the fhank L, and therefore, after the weight K comes to the bottom, the gage will continue to defcend, till the lower part of the focket ftrikes againft the weight; this gives liberty to the catch to fly out of the hole L, and let go the weight K; when this is done, the ball or bladder I, inftantly buoys up the gage to the top of the water. While the gage is under water, the water having free accefs to the treacle and mercury in the bottle, will by its preffure force it up into the tube F*f*, and the height to which it has been forced by the greateft preffure, *viz.* that at the bottom, will be fhewn by the mark in the tube which the treacle leaves behind it, and which is the only ufe of the treacle. This fhews into what fpace the whole air in the tube F*f* is compreffed; and confequently the height or depth of the water, which by its weight produced that compreffion, which is the thing required.

If the gage-tube F*f* be of glafs, a fcale might be drawn on it with the point of a diamond, fhewing, by infpection, what height the water ftands above the bottom. But the length of 10 inches is not fufficient for fathoming depths at fea, fince that, when all the air in fuch a length of tube is compreffed into half an inch, the depth of water is no more than 634 feet, which is not half a quarter of a mile.

If, to remedy this, we make ufe of a tube fifty inches long, which for ftrength may be a mufket-barrel, and fuppofe the air compreffed into an hundredth part of half an inch; then by faying, as 1 : 99 :: 400 : 39600 inches, or 3300 feet; even this is but little more than half a mile, or 2640 feet. But fince it is reafonable to fuppofe the cavities of the fea bear fome proportion to the mountainous parts of the land, fome of which are more than three miles above the earth's furface; therefore, to explore fuch great depths, the Doctor contrived a new form for his fea gage, or rather for the gage tube in it, as follows: BCDF (*ibid.* N° 2.) is a hollow metalline globe communicating on the top with a long tube AB, whofe capacity is a ninth part of that globe. On the lower part at D, it has alfo a fhort tube DE, to ftand in the mercury and treacle. The air contained in the compound gage-tube is compreffed by the water as before; but the degree of compreffion, or height to which the treacle has been forced, cannot there be feen through the tube; therefore, to anfwer that end, a flender rod of metal or wood, with a knob on the top of the tube AB, will receive the mark of the treacle, and fhew it, when taken out.

If the tube AB be 50 inches long, and of fuch a bore that every inch in length fhould be a cubic inch of air, and the contents of the globe and tube together 500 cubic inches; then, when the air is compreffed within an hundredth part of the whole, it is evident the treacle will not approach nearer than 5 inches of the top of the tube, which will agree to the depth of 3300 feet of water as above. Twice this depth will comprefs the air into half that fpace nearly, *viz.* $2\frac{1}{2}$ inches, which correfpond to 6600 which is a mile and a quarter. Again, half that fpace, or $1\frac{1}{4}$ inch, will fhew double the former depth, *viz.* 13200 feet, or $2\frac{1}{2}$ miles, which is probably very nearly the greateft depth of the fea.

GAIETA, a ftrong fortified town of the kingdom of Naples in Italy, thirty-five miles north-weft of the city of Naples: E. long. 14° 30′, and N. lat. 41° 20′.

GAINSBOROUGH, a market-town of Lincolnfhire, fourteen milles north-weft of Lincoln; which gives the title of earl to the noble family of Noel.

GAIOPHRAGMIA, in natural hiftory, a genus of feptariæ, divided by feptæ or partitions of earthy matter, of which there are feveral fpecies. See SEPTARIÆ.

GALACTITES, in natural hiftory, the name by which the ancients called a fmooth, afh-coloured, indurated kind of clay, faid to have been ufed with fuccefs for defluxions and ulcers of the eyes, and as an aftringent.

GALANGALS, in the materia medica, the name of a root

root kept in the ſhops, but now moſtly out of uſe in practice.

GALANTHUS, the SNOW-DROP, in botany, a genus of the hexandria monogynia claſs. It has three concave petals, a ſimple ſtigma, and a nectarium compoſed of three ſmall petals. There is but one ſpecies, a native of Germany.

GALATA, a great ſuburb belonging to Conſtantinople, oppoſite to the ſeraglio, on the other ſide of the harbour. It is here the Greeks, Armenians, Franks, Chriſtians, and Jews inhabit, and are allowed the exerciſe of their reſpective worſhips.

GALATIA, the ancient name of Amaſia, a province of Leſſer Aſia.

GALAX, in botany, a genus of the pentandria monogynia claſs. The calix conſiſts of ten leaves; and the capſule has one cell and two elaſtic valves. There is but one ſpecies, a native of Virginia.

GALAXY, in aſtronomy. See ASTRONOMY, p. 487.

GALBANUM, in pharmacy, a gum iſſuing from the ſtem of an umbelliferous plant, growing in Perſia and many parts of Africa.

It is ſometimes met with in the ſhops in looſe granules, called drops or tears; and ſometimes in large maſſes, formed of a number of theſe blended together; but in theſe maſſes ſome accidental foulneſs is often mixed with the gum. The ſingle drops uſually approach to a roundiſh, oblong, pear-like form. Galbanum is ſoft like wax, and, when freſh drawn, white; but it afterwards becomes yellowiſh or reddiſh: it is of a ſtrong ſmell, of an acrid and bitteriſh taſte; it is inflammable in the manner of a reſin, and ſoluble in water like a gum.

It attenuates and diſſolves tough phlegm, and is therefore of ſervice in aſthmas and inveterate coughs.

GALEGA, in botany, a genus of the diadelphia decandria claſs. The calix conſiſts of equal ſubulated teeth; and the pod has oblique ſtriæ, with a ſeed between each. There are eight ſpecies, none of them natives of Britain.

GALENISTS, in church-hiſtory, a branch of anabaptiſts, who are ſaid to have adopted ſeveral Arian opinions concerning the divinity of our Saviour.

GALEOBDOLON, in botany. See LEONURUS.

GALERITA, in ichthyology, a ſpecies of blennius. See BLENNIUS.

GALICIA, the moſt north-weſt province of Spain, bounded by the ocean on the north-weſt, by the provinces of Aſturias and Leon on the eaſt, and by Portugal on the ſouth.

GALICIA, or GUADALAJARA, a province of Mexico, bounded by new Mexico on the north, by the gulph of Mexico on the eaſt, by Mexico Proper on the ſouth, and by the Pacific Ocean and gulph of California on the weſt.

GALILE, or GALILEE, once a province of Judea, now of Turky in Aſia, was bounded by mount Lebanon on the north, by the river Jordan and the ſea of Galilee on the eaſt, by the river Chiſon on the ſouth, and by the Mediterranean on the weſt. It was the ſcene of many of our Saviour's miracles.

GALILEANS, a ſect of the Jews. Their founder was one Judas, a native of Galilee, from which place they derived their name. Their chief, eſteeming it an indignity for the Jews to pay tribute to ſtrangers, raiſed up his countrymen againſt the edict of the emperor Auguſtus, which had ordered a taxation or inrollment of all the ſubjects of the Roman empire.

They pretended that God alone ſhould be owned as Maſter and Lord; and in other reſpects were of the opinion of the Phariſees; but, as they judged it unlawful to pray for infidel princes, they ſeparated themſelves from the reſt of the Jews, and performed their ſacrifices apart.

GALL, in the animal œconomy. See BILE.

GALL-BLADDER. See ANATOMY, p. 269.

GALL, in natural hiſtory, denotes any protuberance or tumour produced by the puncture of inſects on plants and trees of different kinds.

Theſe galls are of various forms and ſizes, and no leſs different with regard to their internal ſtructure. Some have only one cavity, and others a number of ſmall cells communicating with each other. Some of them are as hard as the wood of the tree they grow on, whilſt others are ſoft and ſpongy; the firſt being termed gall-nuts, and the latter berry-galls, or apple-galls.

The general hiſtory of galls is this: an inſect of the fly kind is inſtructed by nature to take care for the ſafety of her young, by lodging her eggs in a woody ſubſtance, where they will be defended from all injuries: ſhe for this purpoſe wounds the leaves or tender branches of a tree; and the lacerated veſſels, diſcharging their contents, ſoon form tumours about the holes thus made. The hole in each of theſe tumours, through which the fly has made its way, may for the moſt part be found; and when it is not, the maggot inhabitant or its remains are ſure to be found within, on breaking the gall. However, it is to be obſerved, that in thoſe galls which contain ſeveral cells, there may be inſects found in ſome of them, though there be a hole by which the inhabitant of another cell has eſcaped.

Oak galls put, in a very ſmall quantity, into a ſolution of vitriol in water, though but a very weak one, give it a purple or violet colour; which, as it grows ſtronger, becomes black; and on this property depends the art of making our writing ink, as alſo a great deal of thoſe of dying and dreſſing leather, and other manufactures.

In medicine, galls are found to be very aſtringent, and good, under proper management, in diarrhœas, dyſentries, and hæmorrhages of all kinds; they have alſo a very eminent virtue as a febrifuge.

GALLERY, in architecture, a covered place in a houſe, much longer than broad, and uſually in the wings of a building; its uſe being chiefly to walk in.

GALLERY, in fortification, a covered walk acroſs the ditch of a town, made of ſtrong beams, covered over head with planks, and loaded with earth: ſometimes it is covered with raw hides to defend it from the artificial fires of the beſieged.

GALLERY *of a mine*, is a narrow paſſage, or branch of

a mine carried on under ground to a work designed to be blown up.

GALLERY, in a ship, that beautiful frame, which is made in the form of a balcony, at the stern of a ship without board; into which there is a passage out of the admiral's or captain's cabbin, and is for the ornament of the ship.

GALLEY, in naval affairs, a low-built vessel, using both sails and oars, and commonly carrying only a main-mast and fore mast, which may be struck or lowered at pleasure. Such vessels are much used in the Mediterranean, especially by the king of France. See SHIP.

GALLI, in antiquity, the priests of the goddess Cybele, who were eunuchs, and took their name from Gallus, a river in Phrygia.

When a youth was to be initiated into this order, the custom was to throw off his cloaths, to run crying aloud into the midst of the troop, and then drawing a sword to castrate himself; after this, he ran about the streets, carrying in his hands the marks of his mutilation, which he was to throw into a house, and in that house to put on a woman's dress.

GALLICIAN, any thing belonging to France: thus the term Gallician church denotes the church of France, or the assembly of the clergy of that kingdom.

GALLICISM, a mode of speech peculiar to the French language, and contrary to the rules of grammar in other languages.

GALLINÆ, in ornithology, an order of birds. See NATURAL HISTORY.

GALLINACIOUS, an appellation given to the birds of the order of the gallinæ.

GALLINULA, in ornithology. See SCOLOPAX.

GALLION, or GALLEON, in naval affairs, a sort of ships employed in the commerce of the West Indies. The Spaniards send annually two fleets; the one for Mexico, which they call the flota, and the other for Peru, which they call the gallions. Se FLOTA.

GALLIOT, a small galley designed only for chace, carrying only one mast, and two or three pattereroes; it can both sail and row, and has sixteen or twenty oars. All the seamen on board are soldiers, and each has a musket by him on quitting his oar.

GALLIPAGO-ISLANDS, are situated in the Pacific Ocean on both sides the equator, between 85° and 90°, W. long. and about four hundred miles west of Peru.

GALLIPOLI, a port town of European Turky, situated at the entrance of the Propontis, or Sea of Marmora, about 100 miles south-west of Constantinople: E. long. 28°, and N. lat. 40° 45′.

GALLIPOLI is also a port town of the kingdom of Naples, situated on the gulph of Otranto, about twenty-three miles west of that city: E. long. 19°, and N. lat. 40° 25′.

GALLIUM, LADIES BEDSTRAW, in botany, a genus of the tetrandria monogynia class. The corolla consists of one plane petal; and the seeds are two, and round. There are 23 species, 11 of them natives of Britain, *viz.* the verum, or yellow ladies-bedstraw; the mollugo, or wild madder; the montanum, or mountain ladies-bedstraw; the uliginosum, or marsh goose-grass; the erectum, or small mountain bastard madder; the pusillum, or least ladies-bedstraw; the palustre, or white ladies-bedstraw; the spurium, or goose-grass with smoother seeds; the aparine, cleavers, or goose-grass; the parisiense, or least goose-grass; and the boreale, or crosswood madder.

GALLO, an island on the Pacific Ocean near the coast of Peru, about 200 miles west of Popayan: W. long. 80°, and N. lat. 2° 15′.

GALLO is also a town of Italy, ten miles south of Ancona.

GALLO, or PUNTO GALLO, a sea-port of Ceylon, subject to the Dutch: E. long. 78°, and N lat. 6°.

GALLON, a measure of capacity both for dry and liquid things, containing four quarts; but these quarts, and consequently the gallon itself, are different, according to the quality of the thing measured: for instance, the wine gallon contains 231 cubic inches, and holds eight pounds averdupois, of pure water: the beer and ale gallon contains 282 solid inches, and holds ten pounds three ounces and a quarter averdupois, of water: and the gallon for corn, meal, *&c.* $272\frac{1}{4}$ cubic inches, and holds nine pounds thirteen ounces of pure water.

GALLOPAVO, in zoology. See MELEAGRIS.

GALLOWAY, a county of Scotland, which gives the title of earl to a branch of the noble family of Stuart.

It is divided into two districts; the western, called Upper Galloway, being the same with Wigtonshire; and the eastern, or stewartry of Kirkudbright, called Lower Galloway.

GALLOWAY is also the capital of a county of the same name, in the province of Connaught, in Ireland: W. long. 9° 12′, and N. lat. 53° 12′.

It has a good port, and is advantageously situated for foreign trade.

GALLUS, in ornithology. See PHASIANUS.

GALLY, in printing, a frame into which the compositor empties the lines out of his composing stick, and in which he ties up the page when it is compleated.

The gally is formed of an oblong square board, with a ledge on three sides, and a grove to admit a false bottom, called a gally-slice.

GAMBIA, a great river of Africa, which, running from east to west falls into the Atlantic ocean, 14° N. lat. and 15° W. lon.

GAMBOGE, is a concreted vegetable juice, the produce of two trees, both called by the Indians caracapulli, and is partly of a gummy, and partly of a resinous nature. It is brought to us either in form of orbicular masses, or of cylindrical rolls of various sizes; and is of a dense, compact, and firm texture, and of a beautiful yellow. It is chiefly brought to us from Cambaja, in the East Indies, called also Cambodja, and Cambogia; and from thence it has obtained its names of cambadium, cambogium, and gambogium.

It is a very rough and strong purge; it operates both by vomit and stool, and both ways with much violence, almost in the instant in which it is swallowed; but yet without griping. It requires caution and judgment in administring it; but those who know how to give it properly,

properly, find it an excellent remedy in dropsies, cachexies, jaundice, asthmas, catarrhs, and in the worst cutaneous eruptions.

GAME, in general, signifies any diversion, or sport, that is performed with regularity, and restrained to certain rules. See GAMING.

GAMES, in antiquity, were public diversions, exhibited on solemn occasions. Such, among the Greeks, were the Olympic, Pythian, Isthmian, Nemean, &c. games; and, among the Romans, the Apollinarian, Circensian, Capitoline, &c. games. See OLYMPIC, PYTHIAN, &c.

GAME, in law, signifies birds or prey, taken or killed by fowling, or hunting. There are several statutes for punishing offences committed by persons not qualified by law to take or destroy the game.

GAME-COCK, a fighting cock, or one kept for sport; a barbarous practice, which is a disgrace to any civilized nation.

GAMELIA, in Grecian antiquity, a nuptial feast, or rather sacrifice, held in the ancient Greek families on the day before a marriage; thus called, from a custom they had of shaving themselves on this occasion, and presenting their hair to some deity to whom they had particular obligations.

GAMELION, in the ancient chronology, was the eighth month of the Athenian year, containing twenty-nine days, and answering to the latter part of our January and beginning of February. It was thus called, as being, in the opinion of the Athenians, the most proper season of the year for marriage.

GAMING, the art of playing or practising any game, particularly those of hazard, as cards, dice, tables, &c.

Mr de Moivre, in a treatise de Mensura Sortis, has computed the variety of chances in several cases that occur in gaming, the laws of which may be understood by what follows.

Suppose p the number of cases in which an event may happen, and q the number of cases wherein it may not happen, both sides have the degree of probability, which is to each other as p to q.

If two gamesters, A and B, engage on this footing, that, if the cases p happen, A shall win; but if q happen, B shall win, and the stake be a; the chance of A will be $\frac{pa}{p+q}$, and that of B $\frac{qa}{p+q}$; consequently, if they sell the expectancies, they should have that for them respectively.

If A and B play with a single die, on this condition, that, if A throw two or more aces at eight throws, he shall win; otherwise B shall win; what is the ratio of their chances? Since there is but one case wherein an ace may turn up, and five wherein it may not, let $a=1$ and $b=5$. And, again, since there are eight throws of the die, let $n=8$; and you will have $\overline{a+b)}^{n}-b^{n}-nab^{n}-1$, to $b^{n}+nab^{n}-1$: that is, the chance of A will be to that of B, as 663991 to 10156525, or nearly as 2 to 3.

A and B are engaged at single quoits; and, after playing some time, A wants 4 of being up, and B 6; but B is so much the better gamester, that his chance against A upon a single throw would be as 3 to 2; what is the ratio of their chances? Since A wants 4, and B 6, the game will be ended at nine throws; therefore, raise $a+b$ to the ninth power, and it will be $a^9+9a^8b+36a^7bb+84a^6b^3+126a^5b^4+126a^4b^5$, to $84a^3b^6+36aab^7+6ab^8+b^9$: call a 3, and b 2, and you will have the ratio of chances in numbers, *viz.* 1759077 to 194048.

A and B play at single quoits, and A is the best gamester, so that he can give B 2 in 3, what is the ratio of their chances at a single throw? Suppose the chances as z to 1, and raise $z+1$ to its cube, which will be z^3+3z^2+3z+1. Now since A could give B 2 out of 3, A might undertake to win three throws running; and, consequently, the chances in this case will be as z^3 to $3z^2+3z+1$. Hence $z^3=3z^2+3z+1$; or, $2z^3=z^3+3z^2+3z+1$. And, therefore, $z\sqrt[3]{2}=z+1$; and, consequently, $z=\frac{1}{\sqrt[3]{2}-1}$. The chances, therefore, are $\frac{1}{\sqrt[3]{2}-1}$, and 1, respectively.

Again, suppose I have two wagers depending, in the first of which I have 3 to 2 the best of the lay, and in the second 7 to 4, what is the probability I win both wagers?

1. The probability of winning the first is $\frac{3}{5}$, that is the number of chances I have to win, divided by the number of all the chances: the probability of winning the second is $\frac{7}{11}$: therefore, multiplying these two fractions together, the product will be $\frac{21}{55}$, which is the probability of winning both wagers. Now, this fraction being subtracted from 1, the remainder is $\frac{34}{55}$, which is the probability I do not win both wagers: therefore the odds against me are 34 to 21.

2. If I would know what the probability is of winning the first, and losing the second, I argue thus: the probability of winning the first is $\frac{3}{5}$, the probability of losing the second is $\frac{4}{11}$: therefore multiplying $\frac{3}{5}$ by $\frac{4}{11}$, the product $\frac{12}{55}$ will be the probability of my winning the first, and losing the second; which being subtracted from 1, there will remain $\frac{43}{55}$, which is the probability I do not win the first, and at the same time lose the second.

3. If I would know what the probability is of winning the second, and at the same time losing the first, I say thus: the probability of winning the second is $\frac{7}{11}$; the probability of losing the first is $\frac{2}{5}$: therefore, multiplying these two fractions together, the product $\frac{14}{55}$ is the probability I win the second, and also lose the first.

4. If I would know what the probability is of losing both wagers, I say, the probability of losing the first is $\frac{2}{5}$, and the probability of losing the second $\frac{4}{11}$: therefore, the probability of losing them both is $\frac{8}{55}$; which being subtracted from 1, there remains $\frac{47}{55}$: therefore, the odds of losing both wagers is 47 to 8.

This way of reasoning is applicable to the happening or failing of any events that may fall under consideration.

deration. Thus if I would know what the probability is of missing an ace four tim s together with a die, this I consider as the failing of four different events. Now the probability of missing the first is $\frac{5}{6}$, the second is also $\frac{5}{6}$, the third $\frac{5}{6}$, and the fourth $\frac{5}{6}$; therefore the probability of missing it four times together is $\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}=\frac{625}{1296}$; which being subtracted from 1, there will remain $\frac{671}{1296}$ for the probability of throwing it once or oftener in four times: therefore the odds of throwing an ace in four times, is 671 to 625.

But if the flinging of an ace was undertaken in three times, the probability of missing it three times would be $\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}=\frac{125}{216}$; which being subtracted from 1, there will remain $\frac{91}{216}$ for the probability of throwing it once or oftener in three times: therefore the odds against throwing it in three times are 125 to 91. Again, suppose we would know the probability of throwing an ace once in four times, and no more: since the probability of throwing it the first time is $\frac{1}{6}$, and of missing it the other three times is $\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}$, it follows that the probability of throwing it the first time, and missing it the other three successive times, is $\frac{1}{6}\times\frac{5}{6}\times\frac{5}{6}\times\frac{5}{6}=\frac{125}{1296}$; but because it is possible to hit it every throw as well as the first, it follows, that the probability of throwing it once in four throws, and missing the other three, is $\frac{4\times125}{1296}=\frac{500}{1296}$; which being subtracted from 1, there will remain $\frac{796}{1296}$ for the probability of throwing it once, and no more, in four times. Therefore, if one undertake to throw an ace once, and no more, in four times, he has 500 to 796 the worst of the lay, or 5 to 8 very near.

Suppose two events are such, that one of them has twice as many chances to come up as the other, what is the probability that the event, which has the greater number of chances to come up, does not happen twice before the other happens once, which is the case of flinging 7 with two dice before 4 once? Since the number of chances are as 2 to 1, the probability of the first happening before the second is $\frac{2}{3}$, but the probability of its happening twice before it is but $\frac{2}{3}\times\frac{2}{3}$ or $\frac{4}{9}$: therefore it is 5 to 4 seven does not come up twice before four once.

But, if it were demanded, what must be the proportion of the facilities of the coming up of two events, to make that which has the most chances come up twice, before the other comes up once? The answer is 12 to 5 very nearly: whence it follows, that the probability of throwing the first before the second is $\frac{12}{17}$, and the probability of throwing it twice is $\frac{12}{17}\times\frac{12}{17}$, or $\frac{144}{289}$; therefore, the probability of not doing it is $\frac{145}{289}$: therefore the odds against it are as 145 to 144, which comes very near an equality.

Suppose there is a heap of thirteen cards of one colour, and another heap of thirteen cards of another colour, what is the probability that, taking one card at a venture out of each heap, I shall take out the two aces?

The probability of taking the ace out of the first heap is $\frac{1}{13}$, the probability of taking the ace out of the second heap is $\frac{1}{13}$; therefore the probability of taking out both aces is $\frac{1}{13}\times\frac{1}{13}=\frac{1}{169}$, which being subtracted from 1, there will remain $\frac{168}{169}$: therefore the odds against me are 168 to 1.

In cases where the events depend on one another, the manner of arguing is somewhat altered. Thus, suppose that out of one single heap of thirteen cards of one colour I should undertake to take out first the ace; and, secondly, the two: though the probability of taking out the ace be $\frac{1}{13}$, and the probability of taking out the two be likewise $\frac{1}{13}$; yet, the ace being supposed as taken out already, there will remain only twelve cards in the heap, which will make the probability of taking out the two to be $\frac{1}{12}$; therefore the probability of taking out the ace, and then the two, will be $\frac{1}{13}\times\frac{1}{12}$.

In this last question the two events have a dependence on each other, which consists in this, that one of the events being supposed as having happened, the probability of the other's happening is thereby altered. But the case is not so in the two heaps of cards.

If the events in question be n in number, and be such as have the same number a of chances by which they may happen, and likewise the same number b of chances by which they may fail, raise $a+b$ to the power n. And if A and B play together, on condition that if either one or more of the events in question happen, A shall win, and B lose, the probability of A's winning will be $\frac{\overline{a+b}|^n-b^n}{\overline{a+b}|^n}$; and that of B's winning will be $\frac{b^n}{\overline{a+b}|^n}$; for when $a+b$ is actually raised to the power n, the only term in which a does not occur is the last b^n: therefore all the terms but the last are favourable to A.

Thus if $n=3$, raising $a+b$ to the cube $a^3+3a^2b+3ab^2+b^3$, all the terms but b^3 will be favourable to A; and therefore the probability of A's winning will be $\frac{a^3+3a^2b+3ab^2}{\overline{a+b}|^3}$, or $\frac{\overline{a+b}|^3-b^3}{\overline{a+b}|^3}$; and the probability of B's winning will be $\frac{b^3}{\overline{a+b}|^3}$. But if A and B play on condition, that if either two or more of the events in question happen, A shall win; but in case one only happen, or none, B shall win; the probability of A's winning will be $\frac{\overline{a+b}|^n-nab^{n-1}-b^n}{\overline{n+b}|^n}$; for the only two terms in which aa does not occur, are the two last, *viz.* nab^{n-1} and b^n.

GAMMUT, in music, a scale whereon we learn to found the musical notes, *ut*, *re*, *mi*, *fa*, *sol*, *la*, in their several orders and dispositions. See MUSIC.

GANG-WAY is the several passages or ways from one part of the ship to the other; and whatever is laid in any of those passages, is said to lie in the gang-way.

GANGEA, the capital of a territory in the province of Chirvan, in Persia: E. long. 46°, N. lat. 41°.

GANGES,

GANGES, a large river of the hither India, rises in the mountains which separate India from Tartary; and, running from the north west to the south east near 1500 miles through the Mogul's dominions, discharges itself by several channels into the bay of Bengal.

GANGI, or COULER, a town of Golconda, in the hither India: E. long. 79°, and N. lat. 16°.

GANGLIO, or GANGLION, in surgery, a hard tubercle, generally moveable, in the external or internal part of the carpus, upon the tendons or ligaments in that part, usually without any pain to the patient.

GANGRENE, a very great and dangerous degree of inflammation, wherein the parts affected begin to corrupt, and put on a state of putrefaction. See MEDICINE and SURGERY.

GANTLET, or GAUNTLET, a large kind of glove, made of iron, and the figures covered with small plates. It was formerly worn by cavaliers, when armed at all points.

GAOL, a prison, or place of legal confinement.

GAOL DELIVERY, is where a commission or patent is granted by the king in the nature of a letter, to certain persons, who are thereby appointed his justices, or to two or three of them, authorising them to deliver his gaol, at such a place, of the prisoners contained therein; and for that end it commands them to meet at such a place, at the time they themselves shall appoint, when the sheriff of the county is commanded to bring all the prisoners in the gaol before them, *&c.*

GAP, a city and bishop's see of Dauphine, in France, eighteen miles west of Embrun: E. long. 5° 46′, N. lat. 44° 32′.

GARBE, in heraldry, a sheaf of any kind of grain, bore in several coats of arms, and said to represent summer, as a bunch of grapes does autumn.

GARCINIA, in botany, a genus of the icosandria monogynia class. The flower consists of four roundish patent petals; and the fruit is a large unilocular coriaceous berry, containing eight hairy and fleshy seeds, convex on one side, and angular on the other. There are two species, none of them natives of Britain.

GARDA, a town of the Veronese, in Italy, subject to Venice: E. long. 11°, N. lat. 45° 25′.

GARDANT, or GUARDANT, in heraldry, denotes any beast full faced, and looking right forward. See Plate LXXXVII. fig. 6. which represents a lion gardant.

GARDELEBEN, a town of Bradenburg, in Germany: E. long. 11° 45′, N. lat. 52° 40′.

GARDENING.

GARDENING, a branch of agriculture, containing the cultivation of gardens.

The simplest idea of a garden, is that of a spot embellished with a number of natural objects, trees, walks, polished parterres, flowers, streams, *&c.* One more complex comprehends statues and buildings, that nature and art may be mutually ornamental. A third approaching nearer perfection, is of objects assembled together, in order to produce, not only an emotion of beauty, essential to every garden, but also some other particular emotion, grandeur for example, or gaiety. The most perfect idea of a garden is an improvement upon the third, requiring the several parts to be arranged in such a manner, as to inspire all the different emotions that can be raised by gardening. In this idea of a garden, the arrangement is an important circumstance; for some emotions figure best in conjunction, and others ought always to appear in succession and never in conjunction. When the most opposite emotions, such as gloominess and gaiety, stillness and activity, follow each other in succession, the pleasure on the whole will be the greatest; but such emotions ought not to be united, because they produce an unpleasant mixture. For that reason, a ruin, affording a sort of melancholy pleasure, ought not to be seen from a flower-parterre, which is gay and cheerful: but to pass from an exhilarating object to a ruin, has a fine effect; for each of the emotions is the more sensibly felt by being contrasted with the other. Similar emotions, on the other hand, such as gaiety and sweetness, stillness and gloominess, motion and grandeur, ought to be raised together; for their effects upon the mind are greatly heightened by their conjunction.

Kent's method of embellishing a field, is admirable; which is, to paint a field with beautiful objects, natural and artificial, disposed like colours upon a canvas. It requires indeed more genius to paint in the gardening way: in forming a lanscape upon a canvas, no more is required but to adjust the figures to each other: an artist who lays out ground in Kent's manner, has an addditional task; he ought to adjust his figures to the several varieties of the field.

One garden must be distinguished from a plurality; and yet it is not obvious wherein the unity of a garden consists. A notion of unity is indeed suggested from viewing a garden surrounding a palace, with views from each window, and walks leading to every corner: but there may be a garden without a house; in which case, what makes it one garden, is the unity of design, every single spot appearing part of a whole. The gardens of Versailles, properly expressed in the plural number, being no fewer than sixteen, are indeed all of them connected with the palace, but have scarce any mutual connection: they appear not like parts of one whole, but rather like small gardens in contiguity. Were these gardens at some distance from each other, they would have a better effect: their junction breeds confusion of ideas, and upon the whole gives less pleasure than would be felt in a slower succession.

Regularity is required in that part of a garden which joins the dwelling-houſe; for being conſidered as a more immediate acceſſory, it ought to partake the regularity of the principal object: but in proportion to the diſtance from the houſe conſidered as the centre, regularity ought leſs and leſs to be ſtudied; for, in an extenſive plan, it hath a fine effect to lead the mind inſenſibly from regularity to a bold variety. Such arrangement tends to make an impreſſion of grandeur: and grandeur ought to be ſtudied as much as poſſible, even in a more confined plan, by avoiding a multiplicity of ſmall parts. A ſmall garden, on the other hand, which admits not grandeur, ought to be ſtrictly regular.

Milton, deſcribing the garden of Eden, prefers juſtly the grand taſte to that of regularity:

Flow'rs worthy of paradiſe, which not nice art
In beds and curious knots; but Nature boon
Pour'd forth profuſe on hill, and dale, and plain;
Both where the morning-ſun firſt warmly ſmote
The open field, and where the unpierc'd ſhade
Imbrown'd the noontide bow'rs. *Paradiſe Loſt, b.* 4.

An hill, by being covered with trees, appears both more powerful and more lofty; provided no other beauties be hid that might be ſeen if the hill were naked. To diſtribute trees in a plain requires more art: near the dwelling-houſe they ought to be ſo thin, as not to break the unity of the field; and even at the greateſt diſtance of diſtinct viſion, they ought never to be ſo crowded as to hide any beautiful object.

In the manner of planting a wood or thicket, much art may be diſplayed. A common centre of walks, termed *a ſtar*, from whence are ſeen a number of remarkable objects, appears too artificial, and conſequently too ſtiff and formal, to be agreeable: the crowding withal ſo many objects together, leſſens the pleaſure that would be felt in a ſlower ſucceſſion. Abandoning therefore the ſtar, let us try to ſubſtitute ſome form more natural, that will lay open all the remarkable objects in the neighbourhood. This may be done by various openings in the wood contrived to catch ſurrounding objects, which in walking bring ſucceſſively under the eye theſe objects as by accident; ſometimes a ſingle object, ſometimes a plurality in a line, and ſometimes a rapid ſucceſſion of them. In this form, the mind at intervals is rouſed and cheered by agreeable objects; and the ſcene is greatly heightened by the ſurpriſe it occaſions when we ſtumble, as it were, upon objects of which we had no expectation.

An object terminating in a narrow opening in a wood, appears at a double diſtance. This ſuggeſts another rule for diſtributing trees in ſome quarter near the dwelling-houſe; which is, to place a number of thickets one behind another, with an opening in each directing the eye to the moſt diſtant through all the intermediate thickets; which, by making theſe thickets appear more diſtant from each other than they are in reality, will enlarge in appearance the ſize of the whole field. To give this plan its utmoſt effect, the thickets ought to be at a conſiderable diſtance from each other: and, in order that each may be ſeen diſtinctly, the opening neareſt the eye ought to be wider than the ſecond, the ſecond wider than the third, and ſo one to the end.

By a judicious diſtribution of trees, various beauties may be produced, far exceeding what have been mentioned; which will appear as follows. A landſcape ſo rich as to ingroſs the whole attention, and ſo limited as ſweetly to be comprehended under a ſingle view, has a much finer effect than the moſt extenſive landſcape that requires a wandering of the eye through ſucceſſive ſcenes. This conſideration ſuggeſts a capital rule in laying out a field; which is, never at any one ſtation to admit a larger proſpect than can eaſily be taken in at once. A field ſo happily ſituated as to command a great extent of proſpect, is a delightful ſubject for applying this rule: let the proſpect be ſplit into proper parts by means of trees; ſtudying at the ſame time to introduce all the variety poſſible. A plan of this kind executed with taſte will produce charming effects: the beautiful proſpects are multiplied: each of them is much more agreeable than the entire proſpect was originally: and, to crown the whole, the ſcenery is greatly diverſified,

As gardening is not an inventive art, but an imitation of nature, or rather nature itſelf ornamented, it follows neceſſarily, that every thing unnatural ought to be rejected with diſdain. Statues of wild beaſts vomiting water, a common ornament in gardens, prevails in thoſe of Verſailles. Is this ornament in a good taſte? A jet d'eau, being partly artificial, may, without diſguſt, be tortured into a thouſand ſhapes: but a repreſentation of what really exiſts in nature, admits not any unnatural circumſtance. Theſe ſtatues therefore of Verſailles muſt be condemned; and yet ſo inſenſible has the artiſt been to juſt imitation, as to have diſplayed his vicious taſte without the leaſt colour or diſguiſe: a lifeleſs ſtatue of an animal pouring out water, may be endured without much diſguſt; but here the lions and wolves are put in violent action, each has ſeized its prey, a deer or a lamb, in act to devour; and yet, inſtead of extended claws and open mouth, the whole, as by a hocus-pocus trick, is converted into a different ſcene; the lion, forgetting his prey, pours out water plentifully; and the deer, forgetting its danger, performs the ſame operation.

In gardening, every lively exhibition of what is beautiful in nature has a fine effect; on the other hand, diſtant and faint imitations are diſpleaſing to every one of taſte. The cutting evergreens in the ſhape of animals, is a very ancient practice; as appears from the epiſtles of Pliny, who ſeems to be a great admirer of this puerile conceit. The propenſity to imitation gave birth to this practice; and has ſupported it wonderfully long, conſidering how faint and inſipid the imitation is. But the vulgar, great and ſmall, devoid of taſte, are entertained with the oddneſs and ſingularity of a reſemblance, however diſtant, between a tree and an animal. An attempt in the gardens of Verſailles, to imitate a grove of trees by a group of jets d'eau, appears, for the ſame reaſon, not leſs ridiculous.

In laying out a garden, every thing trivial or whimſical ought to be avoided. Is a labyrinth then to be juſtified? It is a mere conceit, like that of compoſing verſes in the ſhape of an ax or an egg: the walks and hedges may be agreeable; but in the form of a labyrinth, they ſerve to no end but to puzzle: a riddle is a conceit not ſo mean; becauſe

becauſe the ſolution is a proof of ſagacity, which affords no aid in tracing a labyrinth.

The gardens of Verſailles, executed with infinite expence by the beſt artiſts that could be found, are a laſting monument of a taſte the moſt depraved: the faults above mentioned, inſtead of being avoided, are choſen as beauties, and multiplied without end. Nature, it would ſeem, was deemed too vulgar to be imitated in the works of a magnificent monarch; and for that reaſon preference was given to things unnatural, which probably were miſtaken for ſupernatural.

A ſtraight road is the moſt agreeable, becauſe it ſhortens the journey. But in an embelliſhed field, a ſtraight walk has an air of ſtiffneſs and confinement: and at any rate is leſs agreeable than a winding or waving walk; for in ſurveying the beauties of an ornamented field, we love to roam from place to place at freedom. Winding walks have another advantage: at every ſtep they open new views. In ſhort, the walks in a field intended to pleaſe the eye, ought not to have any appearance of a road. This rule excludes not long ſtraight openings terminating upon diſtant objects; which openings, beſide variety, never fail to raiſe an emotion of grandeur, by extending in appearance the ſize of the field: an opening without a terminating object, ſoon cloſes upon the eye; but an object, at whatever diſtance, continues the opening, and deludes the ſpectator into a conviction, that the trees which confine the view are continued till they join the object: and the object alſo, as obſerved above, ſeems to be at a greater diſtance than it is in reality. Straight walks alſo in receſſes do extremely well: they vary the ſcenery, and are favourable to meditation.

An avenue ought not to be directed in a ſtraight line upon a dwelling houſe: better far an oblique approach in a waving line, with ſingle trees and other ſcattered objects interpoſed. In a direct approach, the firſt appearance continues the ſame to the end: we ſee a houſe at a diſtance, and we ſee it all along in the ſame ſpot without any variety. In an oblique approach, the interpoſed objects put the houſe ſeemingly in motion: it moves with the paſſenger, and appears to direct its courſe ſo as hoſpitably to intercept him. An oblique approach contributes alſo to variety: the houſe, being ſeen ſucceſſively in different directions, takes on at every ſtep a new figure.

A garden on a flat ought to be highly and variouſly ornamented, in order to occupy the mind, and prevent its regretting the inſipidity of an uniform plan. Artificial mounts in this view are common: but no perſon has thought of an artificial walk elevated high above the plain. Such a walk is airy, and tends to elevate the mind: it extends and varies the proſpect: and it makes the plain, ſeen from a height, appear more agreeable.

Whether ſhould a ruin be in the Gothic or Grecian form? In the former; becauſe it exhibits the triumph of time over ſtrength, a melancholy but not unpleaſant thought: a Grecian ruin ſuggeſts rather the triumph of barbarity over taſte, a gloomy and diſcouraging thought.

Fountains are ſeldom in a good taſte. Statues of animals vomiting water, which prevail every where, ſtand condemned. A ſtatue of a whale ſpouting water upward from its head, is in one ſenſe natural, as whales of a certain ſpecies have that power; but it is ſufficient to make this deſign be rejected, that its ſingularity would make it appear unnatural: there is another reaſon againſt it, that the figure of a whale is in itſelf not agreeable. In the many fountains in and about Rome, ſtatues of fiſhes are frequently employed to ſupport a large baſon of water. This unnatural conceit is not accountable, unleſs from the connection between water and the fiſh that ſwim in it; which, by the way, ſhows the influence of even the ſlighter relations.

Hitherto a garden has been treated as a work intended ſolely for pleaſure; or, in other words, for giving impreſſions of intrinſic beauty. What comes next in order is the beauty of a garden deſtined for uſe, termed *relative beauty*; ſee BEAUTY: and this branch ſhall be diſpatched in a few words. In gardening, luckily, relative beauty need never ſtand in oppoſition to intrinſic beauty: all the ground that can be requiſite for uſe, makes but a ſmall proportion of an ornamented field; and may be put in any corner without obſtructing the diſpoſition of the capital parts. At the ſame time, a kitchen-garden, or an orchard, is ſuſceptible of intrinſic beauty; and may be ſo artfully diſpoſed among the other parts, as by variety and contraſt to contribute to the beauty of the whole.

Gardening being in China brought to greater perfection than in any other known country, we ſhall take a ſlight view of Chineſe gardens, which will be found entirely obſequious to the principles that govern any one of the fine arts. In general, it is an indiſpenſible law there, never to deviate from nature; but in order to produce that degree of variety which is pleaſing, every method is uſed that is conſiſtent with nature. Nature is ſtrictly imitated in the banks of their artificial lakes and rivers; which ſometimes are bare and gravelly, ſometimes covered with wood quite to the brink of the water. To flat ſpots adorned with flowers and ſhrubs are oppoſed others ſteep and rocky. We ſee meadows covered with cattle; rice grounds that run into lakes; groves into which enter navigable creeks and rivulets: theſe generally conduct to ſome intereſting object, a magnificent building, terraces cut in a mountain, a caſcade, a grotto, an artificial rock, or ſuch like. Their artificial rivers are generally ſerpentine; ſometimes narrow, noiſy, and rapid; ſometimes deep, broad, and ſlow: and to make the ſcene ſtill more active, mills and other moving machines are often erected. In the lakes are interſperſed iſlands; ſome barren, ſurrounded with rocks and ſhoals; others inriched with every thing that art and nature can furniſh. Even in their caſcades they avoid regularity, as forcing nature out of its courſe: the waters are ſeen burſting from the caverns and windings of the artificial rocks, here an impetuous cataract, there many leſſer falls: and the ſtream often impeded by trees and ſtones, that ſeem brought down by the violence of the current. Straight lines are ſometimes indulged, in order to take the advantage of ſome intereſting object at a diſtance, by directing openings upon it.

Senſible of the influence of contraſt, the Chineſe artiſts deal in ſudden tranſitions, and in oppoſing to each other, forms, colours, and ſhades. The eye is conducted from

from limited to extenfive views, and from lakes and rivers to plains, hills, and woods: to dark and gloomy colours, are oppofed the more brilliant: the different maffes of light and fhade are difpofed in fuch a manner, as to render the compofition diftinct in its parts, and ftriking on the whole. In plantations, the trees are artfully mixed according to their fhape and colour; thofe of fpreading branches with the pyramidal, and the light green with the deep green. They even introduce decayed trees, fome erect, and fome half out of the ground. In order to heighten contraft, much bolder ftrokes are rifked: they fometimes introduce rough rocks, dark caverns, trees ill formed and feemingly rent by tempefts or blafted by lightning, a building in ruins or half confumed by fire. But to relieve the mind from the harfhnefs of fuch objects, they are always fucceeded by the fweeteft and moft beautiful fcenes.

The Chinefe ftudy to give play to the imagination. They hide the termination of their lakes: the view of a cafcade is frequently interrupted by trees, through which are feen obfcurely the waters as they fall. The imagination once roufed, is difpofed to magnify every object.

Nothing is more ftudied in Chinefe gardens than to raife wonder or furprize. In fcenes calculated for that end, every thing appears like fairy-land; a torrent, for example, conveyed under ground, puzzling a ftranger by its uncommon found to guefs what it may be; and, to multiply fuch uncommon founds, the rocks and buildings are contrived with cavities and interftices. Sometimes one is led infenfibly into a dark cavern, terminating unexpectedly in a landfcape inriched with all that nature affords the moft delicious. At other times, beautiful walks infenfibly conduct us to a rough uncultivated field, where bufhes, briers, and ftones interrupt the paffage: when we look about for an outlet, fome rich profpect unexpectedly opens to view. Another artifice is, to obfcure fome capital part by trees or other interpofed objects: our curiofity is raifed to know what lies beyond; and after a few fteps, we are greatly furprized with fome fcene totally different from what was expected.

Thefe curfory obfervations upon gardening, fhall be clofed with fome reflections. Rough uncultivated ground, difmal to the eye, infpires peevifhnefs and difcontent: may not this be one caufe of the harfh manners of favages? A field richly ornamented, containing beautiful objects of various kinds, difplays, in full luftre, the goodnefs of the Deity, and the ample provifion he has made for our happinefs; which muft fill every fpectator with gratitude to his Maker, and with benevolence to his fellow-creatures. Other fine arts may be perverted to excite irregular, and even vicious, emotions: but gardening, which infpires the pureft and moft refined pleafures, cannot but promote every good affection The gaiety and harmony of mind it produceth, inclining the fpectator to communicate his fatisfaction to others, and to make them happy as he himfelf is, tend naturally to eftablifh in him a habit of humanity and benevolence.

Having thus unfolded the general principles of gardening, that have an influence upon tafte or manners; we fhall now fubjoin the practical part, in the form of a calendar.

JANUARY.

Flower-Garden.

This is the proper time for planting roots of the ranunculus; the foil fhould be rich and fandy, and they fhould be planted at leaft three inches deep. By laying a quantity of earth made of old thatch or ftraw, about feven inches beneath the furface of the ground, and then filling it up with rich mould, a prodigious number of thefe flowers may be produced. A fine earth may likewife be made of tanner's bark, or the bottom of a wood pile, well mixed with about a third of natural foil, which will prove peculiarly ferviceable.

As the wind and froft are very prejudicial to carnations and auriculas, they fhould this month be kept covered.

Anemonies fhould be planted in beds of fine earth; no dung muft be ufed in planting them. The roots of thefe flowers may be increafed by breaking the knots, about the fize of a fmall button, afunder, and letting them lie two or three days in the fun, before you plant them. It fhould be remembered, that the roots of the anemony are to be taken up about the end of June or the beginning of July; after being dried in the fun, they fhould be preferved in a dry cool place, or kept in fand for a month, and then put in papers till the feafon for planting them. When thefe roots are firft tranfplanted, a thin layer of willow-earth, or rotten fally-wood, being put under them, forwards their growth.

Fruit-Garden.

The prunning of pears, vines, and plumbs, is the chief employment of this month. In pruning the pear, thofe buds which appear fuller than the reft fhould be carefully preferved; all branches that proceed from the knob, whereon the ftalk of a pear grew, are to be taken away, but the knob muft remain; and the extremity of the laft year's pruning is to be taken off.

As the large branches of a pear-tree are ufelefs in bearing, care fhould be taken to extend the branches fideways, and none but fmall branches fuffered to grow in the middle, and not even thofe to grow directly perpendicular, as, by that means, they would foon become what is called *great wood*.

A pear-tree that is vigorous and luxuriant fhould not be pruned till after it has begun to fhoot. A languifhing pear-tree may be reftored to its former ftate by pruning and removal into better ground. Another very good method of treating pear-trees not in a bearing ftate, is to bark the luxuriant branches all round about a quarter of an inch wide, more or lefs, according to their ftrength. Apple-trees will likewife bear this operation, which fhould be done in April. Trees that are too vigorous may be made to bear by cutting off the fap roots, or taking them up, and re-fetting them, for they are often planted

planted too deep. Plumbs and cherries may be pruned in the ſame manner as pears.

The winter-pruning of the vine (which requires a firſt, ſecond, third, and ſometimes a fourth pruning) ſhould be done either in October, November, December, or this month. The vigour of the vine is to be regarded; the ſmall weak ſhoots that never bear any fruit muſt be cleared away, and the other branches are to be ſo proportioned as not to occaſion any confuſion; ſuch as are thickeſt and beſt placed ſhould be preſerved, and the ſtrong ſhort branches left nine inches or more, according to the ſize of the vine. When they have ſhot twelve or fifteen inches long, which will be in the ſummer, you muſt begin to nail them up; and when they have ſhot two or three feet, ſtop or cut off the ends of the ſhoots; thoſe on the ſide ſhould not be broke off till the fruit is ſet: and a fruit bearing branch ſhould be cut within three or four eyes of the fruit.

All ſuckers ſhould be cut off as ſoon as they have ſhot ſeven or eight inches. The vine ſhould be kept thinner of wood than any other tree, though it puts forth the largeſt ſhoots. All the old wood ſhould be cut out, and its place ſupplied with vigorous young ſhoots.

All dead or cankered branches ſhould this month be cut from the ſtandard fruit-trees, as alſo ſuch as croſs each other; but in doing this you muſt be careful to make the wounded part as ſmooth as poſſible, and ſloping, that the wet may not enter and be detained there, to the great prejudice of the trees.

Kitchen-Garden.

The management of hot-beds claims almoſt the ſole attention of the kitchen-gardener this month. The place moſt expoſed to the ſun is beſt for making a hot-bed: when you have marked out the dimenſions of the bed, drive ſtakes into the ground on every ſide, a yard above the ground, and a foot aſunder; wind theſe round with bands made of hay or ſtraw, and then fill them up with wet litter and new horſe-dung, treading it down very hard as you fill; in doing which you muſt be careful to leave room for the earth and the ſhooting of your plants.

When you have thus laid the bed, fix your wooden frames fitted to the ſame, for the reception of the mould at top, and for the ſupport of glaſs frames, which are to be fixed ſloping.

The hot bed ſhould then be finiſhed by putting in the earth; an old hot bed, well rotted, affords excellent ſtuff for this purpoſe; but if that cannot be procured, ſome very rich mould well ſifted will do.

Over the whole you muſt fix matts ſupported by ſhort ſticks, which muſt remain about a week; by which time the bed will abate of its extreme heat, and be of a proper temperature for uſe.

The bed ſhould be warm, not hot; and when the heat leſſens too much, by applying new dung to the ſides, you may renew it.

When plants are come up in a hot bed, they ſhould have air and the ſun by degrees; and when ſtrong enough, ſhould be removed to a ſecond hot-bed, of leſs heat than the former, or into very rich earth, where they ſhould be frequently watered gently, and kept from the meridian ſun till well ſettled; and when the weather is cold, by covering the glaſſes a little before ſun-ſet with litter and matts, they may eaſily be defended from it.

Gardeners in general make their ſeed beds for cucumbers and melons in this month, for raiſing them before their natural ſeaſon; but the better method is, to make hot-beds the latter end of October or beginning of November: about four feet ſquare, and two feet high, is the proper ſize, wherein, after the heat is moderated, cucumbers and melons may be ſown.

About a week after their coming up, plant them four inches apart in the ſame bed, after having well ſtirred up the earth. As the days in October are uſually warm, the plants may be allowed to have air; but in January they muſt be kept covered up cloſe. In this firſt raiſing of plants, a gardener may, with due care, make them as hardy as he pleaſes.

It is uſual with ſome people to keep their melon ſeeds in milk four and twenty hours before they make uſe of them; others uſe them without that preparation: they ſhould be ſet two or three in a hole, in the hot-bed, about an inch deep, and covered cloſe up, to keep them warm. About the end of April is the time for planting melons, which ſhould firſt be done in ſmall baſkets made of old willow-twigs, three inches deep, and eight or nine inches over.

Two or three plants ſhould be planted in one baſket, and when they will bear it, moved on another hot bed, covered with a ſandy loam five or ſix inches thick, ſifted fine, wherein they are to grow all the ſummer.

Cucumbers are propagated after the ſame manner as melons; but as a bad ſeaſon may prevent their being ſucceſsfully raiſed, it is highly neceſſary to put ſome ſeeds into the bed at three or four different times this month, that if ſome ſhould fail, the others may ſupply their loſs. In order to raiſe aſparagus for hot-beds, make choice of a piece of ground that has been well dug and mellowed, then ſtrike out lines ſeven or eight inches from each other, and plant the aſparagus roots in them at ſix or ſeven inches apart when they are a twelvemonth old: let them be kept free from weeds, and remain in the nurſery two years, in which time they will be fit for the hot-bed. The hot-bed for the reception of theſe roots ſhould be made pretty ſtrong, and covered with earth ſix inches thick, encompaſſed round with bands of ſtraw. The aſparagus-roots ſhould be planted as cloſe as they can be placed together without trimming; which being done, cover the buds of the plants two inches thick with earth; in which ſtate let them remain five or ſix days before the frames and glaſſes are put over them; and then lay on over the whole three inches thick of freſh earth.

As ſoon as the buds appear, give them what air the ſeaſon will permit, which will make them green, and of a good taſte. The bed will laſt good about a month, producing daily freſh buds, if the weather be not too ſevere: when it begins to cool, warm horſe-litter laid upon the glaſſes every night will contribute as much to facilitate the ſhoot of the buds as if new dung were applied to the roots.

It ſhould be obſerved, that the time for this work is not only in this month, but from November till April; (making freſh buds every month to follow one another for a conſtant ſupply) and in April comes the natural crop.

A very moderate hot-bed made after the manner firſt directed, will ſerve to propagate early ſtrawberries.

You may make a bed in two or three hours, with the uſe of hot lime and powdered dung, the dung being in the middle, and the lime underneath and at top; over which you ſhould lay a quantity of fine rich mould.

To raiſe radiſhes in the hot-bed with ſucceſs, you ſhould have ſufficient thickneſs of rich light mould, that they may have proper depth to root in before they reach the dung.

Radiſhes may be ſowed all the year, but in hot-beds in the winter.

Muſtard, lettuce, creſſes, and other ſallading, are generally raiſed from the ſeeds ſown in drills or lines, in ſuch an expoſure as is required by the ſeaſon of the year; in the winter-ſeaſon, on moderate hot beds; in the ſpring, under glaſſes and frames; and in the ſummer, on natural beds of earth.

Creſſes ſown in the natural ground in Auguſt, reſiſt the froſts of the winter, and help greatly to inrich the hot-bed ſallads with the high taſte they maintain by being expoſed to the open air.

Small herbs ſhould be drawn up by the roots from the hot beds; and, in ſowing a ſecond crop, ſeeds of another kind ſhould be ſown, and not the ſame kind in the ſame place.

The hotſpur, charlton maſter, and other peas, muſt be ſown in drills three feet aſunder, that you may have room to go between them; and the lines ſhould run from north to ſouth.

When they have ſhot about ſix inches high, earth them about four inches on both ſides of the lines, raiſing a little bank on the eaſt ſide of them, to defend them from the blaſting winds.

In February you may ſow a ſecond crop, and in March a third.

You muſt, in the beginning of the winter, ſow twice the quantity of peaſe you need to do, if you ſtay till February or March; becauſe the cold weather and the mice will deſtroy great part of them.

FEBRUARY.

Flower-Garden.

For the better management of the auricula, which is to be ſown this month, prepare a box of oak or deal, four feet long, two feet wide, and ſix inches deep, with holes in the bottom, ſix inches diſtance from each other; in which, after laying two inches thick of cinders or ſea-coals; and ſpreading over them ſome earth taken out of hollow willow-trees, till you have filled the box, ſow the ſeeds on the top, without any covering of earth, preſſing them into the mould with a flat board, in order to ſettle them below the edges of the box that the light ſeeds may not float over the brim in watering.

From the time of ſowing to the beginning of April, this box muſt be placed where it will receive the ſun; but after that time, it muſt be removed into a ſhady place; and the ſeeds muſt be continually refreſhed with gentle waterings.

If the ſeedlings do not come up the firſt year, they will the ſecond; and in July or Auguſt, after they appear above ground, will be ſtrong enough to tranſplant; when you muſt ſet them in beds of light earth well ſifted, at about four inches diſtance from each other, and place them where they may receive only the morning ſun.

The April afterwards they will begin to ſhew themſelves, when they ſhould be tranſplanted into pots filled with ſoil made of one load of melon-earth, or dung well rotted, half a load of ſea-ſand, and half a load of ſandy loam; or a load of melon earth, and the like of ſandy loam; or one load of rotten wood, or the bottom of a wood-pile, the ſame quantity of loam, and half a load of melon earth, prepared as above.

Theſe flowers muſt be carefully ſheltered from the rains, which greatly impair their colours.

Provided the weather is mild, you may, toward the end of this month, plant out your choice carnations into the pots where they are to remain to flower; in doing which, you ſhould not take too much of the earth from their roots; and when they are planted, it will be proper to place the pots in a warm ſituation (but not too near walls, or pales, which will draw them up weak); and arch them over with hoops, that in bad weather they may be covered with mats; for unleſs they acquire ſtrength in the ſpring before the heat comes on, they will not produce large flowers.

The polyanthus ſeed muſt be ſown upon a place prepared with earth taken out of decayed willows, often watered and kept ſhaded from the ſun all April and May, till the young plants are come up.

The ſeedlings will be fit to tranſplant the July or Auguſt following into beds: the ſoil of which ſhould be ſomewhat binding, and their expoſure only to the morning ſun.

You may have an annual ſupply of larkſpurs without the trouble of ſowing, by ſuffering the ſeeds of the flowers to drop, which will come up the enſuing ſpring: they are ſown in ſpots, and flouriſh in variety of ground.

The ſingle ſort of Sweet William is raiſed by ſeeds ſown in February or March; the double ſorts, propagated from ſlips taken near the root about March or April, and planted in a loamy ſoil: they may alſo be laid down in the earth like carnation layers.

Holyhocks are raiſed by ſeeds ſown in this month, removed in Auguſt or September to their proper places of vegetation, in rich earth.

The moſt agreeable diſpoſition of this flower is, under ſome coarſe wall, which they will handſomely fill, or in any other place guarded from the winds.

Pinks, and candy-tufts, are generally uſed in edgings in gardens, and inſides of borders, where they are planted in ſpots, and have a very agreeable effect.

The ſeed is ſown in lines in this month or March; or they may be propagated from ſlips planted very early in the ſpring, or in Auguſt.

Roſe-

Rofe-trees, of which there are various forts, fucceed beft in a ftrong holding ground, tolerably moift; they may either be raifed from layers or fuckers, laid down and taken from the old roots in February or March, and tranfplanted immediately before the roots grow dry: fhould there be a neceffity for keeping them out of the ground for fome time, lay their roots in water five or fix hours before they are planted.

The rofe-tree does well in borders, or in the quarters of wildernefs works, among other flowering fhrubs; and fome or other of them will be in flower for ten months in the year.

The laburnum tree is commonly planted among the other flowering fhrubs of the wildernefs, and will grow in the moft open expofure, as well as under the fhade of large trees: it may eafily be raifed from feeds fown in this month, and tranfplanted two years after it comes up.

The althæa may be raifed from layers or feeds; there are feveral different colours of this flower, and they may be budded fo as to have all the colours on one plant.

The pomegranate profpers moft in a light foil; and being propagated by laying down the young fhoots in this month or March, may be tranfplanted either in the fpring or autumn feafon, when they may be put in pots, or againft a fouth wall, where the fruit will ripen.

The pomegranate may alfo be raifed from feed.

The fyringa may be raifed from feeds; but it is hardly thought worth the trouble, as it is very apt to put forth fuckers; thefe, however, may with eafe be taken off and tranfplanted at this time of the year, and in September.

It is a fhady pofition which makes this fhrub fhoot, and the fun makes it flower; but it will grow almoft any where.

The lilach is a plant which grows to a pretty large tree, bearing bunches of purple bloffoms, likes plumes of feathers, in May; and is raifed by laying down the young branches in this month or March, or by taking off the fuckers, and planting them in a light foil, about the fame time, or in September.

Thefe trees are highly ornamental in the quarters of wildernefs works, and fmall walks of them are very pleafant.

The Spanifh broom is planted in wildernefs works, and may be raifed from feeds fown in light earth; alfo by laying down the tender branches, and cutting them at the joints, after the manner of the carnation; but the latter method is not fo certain as the other, though it is far more troublefome.

The laurus tinus is greatly admired for producing its flower in the winter; and may be raifed from the berries, managed as the holly; or from layers, which is the moft expeditious way.

This plant is greatly hurt by froft, and fucceeds beft in moift fhady places; it will flourifh in loamy foil, without the help of any rich manure, which forwards its growth too much.

The laurus tinus, is often trained up as a headed plant, though it is beft planted againft a wall, or in wilderneffes; and it is obfervable, that this plant, like all other exotics, is naturally inclined to bloffom about the fpring in its own country, which is our autumn; for which reafon, it fhould be pruned in our fpring feafon after it has done blowing.

The phillyrea, may in general be propagated from the berries, or raifed from layers, which will prefently take root.

This plant, which fucceeds beft in a natural light foil, grows very faft; and being well fupported with rails or ftakes, a number of them makes a very thick and handfome hedge.

The yew-tree delights in a light barren foil, and is more plentifully produced on the coldeft mountains than in the richeft foils.

The berries of the yew may be laid in fand, as thofe of the holly, before they are fown; and there is no difficulty in propagating this plant, or removing it, if the roots are pruned from time to time, by digging about it while it ftands in the nurfery.

The holly will grow to a very large tree; but being a rooted plant, does not fucceed well when tranfplanted, unlefs the roots have been often pruned in the nurfery.

The berries of this plant, when ripe, are to be gathered; and after they have been laid to fweat fome time, are to be put in fand or earth, till the autumn following, when, and likewife in this month, they may be fown in nurfery beds.

They will lie in the ground for a long time before they begin to fpring, and it will be four or five years before the young ftocks will be fit to graft or inoculate upon.

The grafting muft be done in March, and the inoculating in July; but for ftandard trees or hedges, they muft be planted at their proper diftances while very young, that they may be accuftomed to the foil.

The bay-tree, which is managed as the holly, is raifed by berries fown in this month, on a bed of earth frefh dug, and covered with fome frefh natural earth, well fifted, about two inches thick.

In about fix weeks, the feeds thus fown will come up, fhould the weather prove moift; they fhould he covered with ftraw, or fern, for the three firft winters, after which time they muft be tranfplanted.

When thefe plants are difcoloured by froft, cut off the top-branch in the fpring, and they will fhoot afrefh.

The bay-tree may alfo be raifed from layers laid down in the month of October, for cuttings, fet in pots of fine earth, two or three inches deep; and from fuckers taken up with as much root as may be, and planted in the fhade, in a gravelly foil, being well watered to fettle the earth about their roots.

The laurel is propagated in the fame manner as the bay-tree, loves fhade, refifts the weather, and will thrive in almoft every foil.

Towards the end of this month, if the feafon proves favourable, ftir the furface of the ground of your flower-beds, and clear them from weeds, mofs, and whatever filth may appear thereon, which will not only make your garden look neat, but be of peculiar fervice to the flowers.

Fruit-Garden.

The bufinefs of this month is chiefly pruning and grafting

ing; and is more particularly the feafon for pruning fruit-trees.

When a tree has produced two well difpofed branches with fome weak ones intermixed, they fhould be fhortened equally to the length of five or fix inches; and if the pofition of the two branches be irregular, there muft be only one left to begin the formation of your tree.

A tree will fometimes fhoot five, fix, or feven branches, the firft year; when this happens, three or four only of the beft branches are to be preferved.

A multitude of branches in the firft year, is not always a fign of vigour; for they fometimes prove weak, occafioned by the infirmity of the roots: in pruning, generally a vigorous tree cannot have too many branches, if they are well difpofed, nor a weak one too few.

The fap of all trees muft be kept within due bounds, and a greater liberty is to be allowed to ftrong trees than to weak ones; for which reafon ftrong and vigorous branches are left of a greater length than feeble ones: and it is beft to prune weak fickly trees early, that the fap may not be too much wafted.

In the pruning of wall-fruit-trees, all the branches fhooting directly forward are to be cut off clofe to the branch they fpring from; and the utmoft care muft be taken to prevent their being too much crouded with wood, it being often neceffary to take off even bearing branches, to preferve your trees in beauty and health; for it is impoffible too great a number of branches fhould be fupplied with juices as they ought; and if they are not, either the bloffoms will drop off, or the fruit never ripen.

You fhould ever be careful to preferve a convenient fpace between one branch and another in all prunings; alfo that one branch does not crofs another: a flender bearing branch may, notwithftanding, fometimes be permitted to fteal behind the main body of the tree, and be no offence to the eye.

That a tree may be the better difpofed to bear fruit, the branches fhould be carried horizontally as much as poffible; for the more perpendicular the branches of a tree are led, the more they are inclined to run into great wood and barrennefs.

Small weak branches, fhooting from the like, fhould be cut away, as fhould all fhoots put forth in autumn.

When an old tree fhoots ftronger branches towards the bottom than the top, and the top is fickly, it muft be cut off, and a new figure formed from the lower branches; but if the top be in good health, you muft cut off the lower ones, unlefs it be a few that are well placed.

Where old trees are in a weak condition, to preferve them, they are to be difburthened totally, leaving a few branches only fhortened to five or fix inches.

Having thus laid down the principal rules for pruning in general, we now come to the management of the peach and other fruit trees in particular.

When peach trees are vigorous, it is beft to defer the firft pruning till they are ready to bloffom, when you may be at a certainty in preferving thofe branches which are moft promifing of fruit, and then to fhorten them as they require.

You may foon difcover the fruit-bearing branches by their fwelling buds, and you fhould reduce them to the length of five or fix inches; the laft year's fhoots may be left ten or twelve inches long.

In the fpace of about three years, all the wood muft at feveral prunings be taken away, but in the mean time the wall is to be furnifhed with other wood.

When you have reduced your tree to beauty and order, you have little to do but thinning your fruit till Midfummer, when the fhoots are to be fhortened and faftened to the wall, giving the fruit the advantage of the fun as much as poffible.

If the peach-tree makes over-hafte in its bearing, it is a fign of infirmity, and muft be accordingly managed, by pruning the branches fhort, and plucking off all or moft of the bloffoms or fruit; which it is much lefs difficult to do than when a peach is over vigorous; for then nature is apt to make a confufion, which requires the greateft fkill to know what branches are fit to be chofen, and what rejected.

The peach tree requires a fecond, and fometimes a third pruning; the laft of which is to be performed about the middle of May, or in June or July.

The apricot and nectarine may be pruned in the fame manner as the peach; but it fhould be obferved, that the apricot is more apt to run to wood than any other of thefe kind of wall-fruit trees.

The ufual ways of grafting are, in the cleft—in the bark—by approach, and whip-grafting.

Grafting in the cleft, or flip-grafting, is performed on the cherry, pear, and plumb ftocks, in the manner following.

When you have chofen a ftock, in a fmooth place cut off the head of it, floping: then, with your knife make the top horizontally even; which being done, make a flit of near two inches deep down the middle of the ftock; in which fix a cyon, floped on each fide from a bud; and clofing the bark of both exactly, tie them round with bafs.

When you have thus finifhed your grafting, put a quantity of clay and horfe-dung, tempered together, round the ftock and lower part of the cyon; in doing which, be careful not to difturb the latter.

Grafting in the bark is generally performed only on apples, by cutting the head of the ftock as already directed; but inftead of flitting it, flit only the bark a little above an inch on the fouth-weft fide, or as long as the floped part of the cyon; then, loofening the top of the bark with your knife, put in your cyon (being prepared with a flat flope about an inch long, ending in a point, and begun from the back-fide of an eye) and clofing it as above, cover it alfo in the fame manner with clay.

When either an apple, pear, plumb, or cherry tree, wants a branch to make the tree uniform, a graft may be put into the fide without cutting the head of it.

Grafting by approach, or inarching, is performed when a ftock grows fo near another tree, the fruit of which you would propagate, that it may be joined with a branch of that tree, by cutting the fides of the branch and ftock about three inches long, and fitting them, that the paffages of the fap may meet; in which pofture let them be bound and clayed.

When they are well cemented, cut off the head of the ftock

ftock about four inches above the birding; and in March following, having cut off the ftubb that was left of the ftock, and the cyon underneath, clofe the grafted place, that it may fubfift by the ftock only.

This manner of grafting agrees beft with vines, pomegranates, oranges, and fuch like fhrubs.

When the ftock and cyon are of the fame bignefs, the operation of whip-grafting is performed, by floping the ftock and cyon about an inch, fo as to make them fit, and then tying them together, and claying the place.

Kitchen Garden.

Hot-beds for radifhes and fpring carrots fhould now be made, according to the directions given for a common hot-bed in the preceding month; which, by proper management, will do for all forts of feeds that are annual.

To make a mufhrum bed, dig a trench five or fix inches deep, and lay in it either the dung of horfes, mules, or affes, in ridges, which dung muft be the laft covering before the earth is laid on.

The bed, when it is complete, muft be three or four feet high; and after covering the dung about two or three inches deep with fuch earth as is taken from under a turf, put fome mufhroom-earth all over the bed on the laft covering of dung.

Should the weather be fevere, you may defend the bed with ftraw or dry litter, eight or ten inches thick, or cover it with matts faftened on hoops.

The bed muft be kept properly watered, twice or thrice a-week, and the mufhrooms will come up in two months time at fartheft; fometimes in a month, when they muft be immediately cut.

By putting fome mufhroom earth on your cucumber-beds, you will greatly forward their growth.

In the natural ground potatoes love a fandy foil; and the fmaller roots, or knots of them, are commonly faved to raife a crop from, being fet about four or five inches deep in the ground, and five or fix inches apart; and when their haulms begin to decay, which is generally about Michaelmas, you may take them out of the ground with forks as you have occafion to ufe them.

The Jerufalem artichoke fucceeds beft in a ftiff foil, and affords a root as large as an ordinary turnip, being in tafte fomewhat like a potatoe, but rather more watery.

The feveral forts of cabbages, as the red cabbage, the Dutch cabbage, the Savoy cabbage, the Ruffia cabbage, the Batterfea cabbage, and the two forts of the fugar-loaf cabbage, fhould be planted at proper diftances, according to their feveral ftatures.

The Savoy cabbages are for winter ufe, and towards the fpring put forth fprouts preferable to the cabbages themfelves.

Almoft any ground will ferve for cabbages; but if the weather be dry, it muft be well watered before planting.

The hardeft cabbages may be taken up before the great frofts come on; and after they have hung up by the roots about a fortnight, lay them in a cellar, where they will keep a long time; or plant them deep in the ground clofe to one another, and cover them with haulm or ftraw, till you have occafion to ufe them.

Carrots are moft profperous in a light ground, in which their roots will grow to a great bignefs.

Spring-carrots are fown in July or Auguft; thofe intended for a winter-crop, in February or March, in dry weather.

When your carrots are come up, and have been above ground about a month, they muft be houghed, leaving the fpace of about five inches between the plants; and after the firft houghing they fhould be kept as clean as poffible till they are full grown, when they may be taken up for prefent ufe, and kept in fand during the winter.

Parfnips thrive beft in a rich foil, and, excepting that they fhould not ftand fo thick, are to be managed in the fame manner as carrots.

The fkirret requires a light, moift, yet a rich foil; and is propagated either by fowing feeds, or by tranfplanting the offsets from the roots,

As foon as the leaves begin to put forth, they fhould be taken out of the ground, and parted into as many flips as can be conveniently taken off with the roots, fo as only the frefh fpringing fibres remain on them; drills about four or five inches deep muft then be prepared to plant them five or fix inches apart, and they muft be kept well watered till their roots are fully grown.

The ufual time for fowing turnips is in July or Auguft, but fome people fow them in this month, by way of providing them for the fummer. They thrive beft in a fandy, loamy foil, but will grow in any ground: when the plants have two or three leaves, they fhould be houghed at the diftance prefcribed for parfnips and carrots.

Onions are fown in this month, and in March, in rich garden foil; and toward the latter end of April, being come up, they are houghed, when about three inches fhould be left between the plants till they begin to grow fit for fallads, and then they may be drawn, or thinned where they grow too clofe together.

In fowing onions you muft not be fparing of feeds, as it often happens many of them, being bad, have no effect.

When the leaves begin to change their colour, they fhould be pulled up, (in dry weather;) and after being well dried without doors, they muft be fpread on fome floor, to dry more thoroughly for winter ufe.

Such onions as fpire in the houfe, may this month be planted in lines fix inches apart, and two inches diftance for feeds for another year.

The leek is fown in a well-wrought ground, and is to be kept free from weeds, and houghed like the onion; the plants are tranfplanted in July, in rich light foil, in lines about five inches apart.

Strawberries profper moft in ground inclining to clay; and the beft way of managing them, is to provide a quantity of horfe-dung and coal-afhes well mixed together, and lay it upon the land to be dug or trenched in this month; then make borders three feet wide, on which the flips are to be planted from eight to eighteen inches apart, according to the forts: the chila ftrawberries being largeft, fhould be fet two feet afunder.

Afterwards you may ſet beans for a ſummer crop, and plant roſes, ſweet brier, currants or gooſeberries, at every five or ſix feet diſtance, as the plants will not begin to bear fruit to any purpoſe till the following year, and it will be the third year after planting before there will be a full crop; in the mean time the roſes, gooſeberries, *&c.* turn to a good account, beſides being ſerviceable to the plants by ſhading them.

The ſtrawberries ſhould be kept clear of weeds, and, if their blowing ſeaſon be dry, well watered: early in the ſpring you muſt cleanſe them, and fling looſe earth among them to ſtrengthen their roots.

Of ſtrawberries there are five ſorts, the chila ſtrawberry, the hautboy, the ſcarlet, the red, and the white wood-ſtrawberry.

There are two kinds of raſpberries, the red and white; the latter is the greater rarity, and thrives in ſuch ground as agrees beſt with ſtrawberries, being propagated by ſlips taken from the roots the latter end of this month or in March.

Raſpberries ſhould be planted in ſingle rows, about a foot or eighteen inches aſunder, and three feet between every row, leaving the heads two feet high when planted.

The Muſcovy cluſtered raſpberry, planted againſt a wall between the trees where there is a vacancy, will ripen very ſoon; and their chief culture is to keep them clean from weeds in the ſpring; to prune the tops of the ſtrongeſt ſhoots of the laſt year, leaving them about three feet high; and to cut away all dead and weak branches.

The gooſeberry is propagated either by ſeeds, ſuckers, or cuttings; the firſt may be ſown as ſoon as ripe, and will come up the ſpring following; the ſuckers are taken from the roots of old trees when their leaves are fallen, and tranſplanted in nurſeries, in open weather; and the cuttings will take root, being planted in the months of September or October.

This tree requires a ſtrong holding ſoil, and may be tranſplanted with more ſafety in October than at this time of the year.

Currants are to be raiſed in the ſame manner as the gooſeberry, and thrive beſt in the ſame kind of ſoil.

Liquorice ſhould be planted at this ſeaſon of the year; and the ground made choice of for planting it ſhould be trenched three feet deep, and the liquorice ſet at a foot diſtance every way.

MARCH.

Flower-Garden.

The roſe campion is propagated either from ſeeds ſown this month, or from ſlips taken from the roots: the double-bloſſom kind is raiſed from ſlips only, as it does not produce any ſeeds; the laſt-mentioned thrives beſt in a loamy ſoil, and open expoſure.

In this month alſo off-ſets of the white hellebore are planted in a rich light ſoil.

Seeds are now ſown of the fox-glove, which ſucceed beſt in the ſhade and a loamy ſoil; this flower does not blow till two months from the time of ſowing.

The poppy, which is an annual, is ſown in ſpots; as is the Venus looking-glaſs: the latter is proper alſo for edgings.

The valerian is raiſed from ſeeds, and ſome kinds of it are increaſed by parting the roots.

The primroſe tree will grow in any ſoil, and the ſeed of it is ſown in the natural ground towards the end of this month: it is very proper for the middle of borders in large gardens; and the ſeedling plants, which will not bloſſom till the ſecond year, are to be ſown in the nurſery, and the young plants removed to proper places in the Auguſt after they come up.

Slips of the gentianella are planted in a ſandy ſoil in this month or Auguſt.

Cardinal flowers are raiſed by ſeeds ſown in hot-beds, in fine ſifted earth; and the ſeeds being ſmall, are to be lightly covered with mould: theſe flowers, which are commonly cultivated in pots, may be increaſed by parting their roots in April, and planting them in places well expoſed to the ſun.

You ſhould now ſow the ſeeds of the ſtock-gilliflowers, and tranſplant them in the Auguſt following, in a light natural dry ſoil.

The double kinds of this flower may be increaſed by ſlips or cuttings planted in May, June, or July.

Sow the ſeeds of the acanthus, in a ſandy ſoil, and in the ſhade.

A loamy ſoil is requiſite for raiſing the double rocket flower, which is propagated from ſlips taken from about the root.

The ſcarlet lynchis is propagated either from ſeeds, or ſlips taken from the root; it is alſo cultivated in pots, and requires a loamy ſoil, and open expoſure.

The ſeveral ſorts of double wall-flowers may be raiſed from ſlips planted in ſhady places, either in March, April, May, or June; but the bloody wall-flower may be more eaſily raiſed from ſeeds ſown in this month: and a ſandy ſoil is requiſite to make them thrive.

The monk's hood, a flower of a poiſonous quality, is propagated by parting the roots, which ſhould be done in this month, and will thrive beſt in a loamy ſoil, in the moſt ſhady place in your garden.

The ſun-flower, which will grow in any ſoil, is raiſed from ſeeds ſown in large borders; and alſo by parting the roots, either in this month or in Auguſt.

The aſters, or ſtarworts, will thrive in any ſoil, and are fit companions for the talleſt flowers in your garden: they are propagated from ſlips taken from the root; and the beſt method is to plant them in pots, otherwiſe they will grow ſo numerous as to become a nuſance rather than an ornament.

Seeds or layers of the paſſion-tree may be ſown this month; and every cutting of it, being planted in fine earth, will take root about May or June.

This tree is a prodigious quick grower, and very hardy; loves moiſt and cool places; and, if conſtantly watered, and dunged about the roots, it will bear fruit reſembling lemons.

The arbutus, thrives in a light, gravelly ſoil, and may be raiſed either from ſeeds or layers; and the fruit (which muſt be gathered about Chriſtmas, and laid to dry for

a

a month) is to be ſown in pots of light earth, and covered about a quarter of an inch with fine mould in this month; and the gentle heat of a hot bed will greatly aſſiſt the germination of the ſeeds, which are to be frequently ſprinkled with pond-water as they come up.

The layers of the arbutus are made of the moſt tender ſhoots about September; but will not be ſtrong enough to tranſplant the ſpring following, though they will take root in a year's time.

The apocynum, or dog's-bane, is propagated from ſeeds ſown this month in hot-beds, or from cuttings; a light natural ſoil agrees beſt with them; they ſhould be watered but ſeldom, and then gently; and they ſhould be ſet in the hot-houſe ſooner or later, as they are more or leſs tender.

Set the ſtone of the fruit of the palm-tree this month in light earth, and give them the aſſiſtance of the hot-bed; it is a green-houſe plant, but might be made to ſtand abroad, after ſheltering for three or four years.

The green privet, which is a plant of a quick growth, and makes an admirable hedge, is propagated by ſowing the berries in light earth, about an inch deep, watering them frequently till they come up; a hot gravelly ſoil is the moſt proper for this tree; and they are to be tranſplanted from the ſeed-bed the ſecond year after ſowing.

The mezeron, ſhould now be ſown in a loamy ſoil, and care ſhould be taken to preſerve it from the birds.

The berries of the juniper-tree may be ſown this month in rich ground without watering, or in any light manure, and in about two months they will come up; and they are to remain in the ſeed-bed two years, during which time they muſt be kept free from weeds, and then they may be tranſplanted.

You may now take off the ſuckers of the *ſpiræa frutex*, and plant them in a light ſoil.

Sow the ſeeds of the ſeveral kinds of firs ornamental in wilderneſs-works, which will flouriſh in any ſoil; in order to keep their bodies ſmooth and free from knots, you muſt break off their collateral buds while they are young and tender.

Upon the hot-bed, ſow ſuch exotic ſeeds as are leſs tender, and arrive ſooner at perfection than thoſe ſown the laſt month; among which are the China or Indian pink, the *naſturtium Indicum*, *convolvulus*, and balſamines; and none of theſe muſt be planted in the natural ground till the middle of May: if you have no hot-bed, you may defer growing the marvel of Peru and the *naſturtium* till the next month, when they will come up in the natural ground.

Plant tube-roſes in pots of freſh earth, giving them a gentle warmth, but no water till they ſprout out of the ground.

The ſeeds of the *campanula pyramidalis* ſhould now be ſown, and ſlips taken off from the roots; freſh air ſhould be given to the pots of this flower, and they ſhould be ſet in ſome pit where the ſun may come at them, by which means they will grow tall.

Mend and repair your ſhelves and places of ſhelter for auriculas, which ſhould now be guarded on all ſides but the eaſt from the ſun, and defended from rain; put canvas coverings or matts over your tulips, to prevent their being blighted; and tranſplant your carnation layers for blowing, if they were not planted out in autumn.

The ſeeds of the humble and ſenſitive plants may now be ſown upon the hot-beds; and the *noli me tangere* in the natural ground.

You may tranſplant your evergreens; graft the Spaniſh white jeſſamin upon the common Engliſh ſort; and ſlip or ſet box for edgings, or in figured works.

Such exotic plants as have ſuffered in the green-houſe, ſhould be removed to the hot-houſe; where, to prevent the ſteam of the bed from being of bad conſequence, the dung ſhould be covered with a due thickneſs of earth.

Fruit-Garden.

You may make layers of the vine either in this or the next month, and they will be fit to tranſplant at Michaelmas; this tree is alſo propagated by laying down the young branches as ſoon as the fruit is gathered, or by making plantations of cuttings at that time.

If the weather proves open in February, that is the beſt time for planting vines; and the ſoil in which they beſt ſucceed is rocky or gravelly.

A chalky hill, lying very open to the ſun, will produce better grapes than any of the rich ſoils prepared with horſe-dung; but a tolerable good compoſt, to mix with the earth about the roots, may be made with the rubbiſh of old buildings.

In planting a vine, let the places where your vines are to ſtand be open and prepared before any of the plants are taken out of the nurſery, when great care ſhould be taken in their removal; they are to be planted ſix or ſeven feet every way, and the beſt grapes for a vineyard are the marlmorſe, chiante, claret grape, and Burgundy black morellon.

Theſe vines are to be pruned the September before tranſplanted, according to their ſtrength, leaving not more than four buds on the ſtrongeſt; and to cleanſe them from weeds is all the care they will require the firſt ſummer.

Shorten the ſummer-ſhoots about the end of September, and the ſtrongeſt of them will begin to ſhew a little fruit the ſummer following.

In May or June of this ſecond year, the ſmall ſhoots and ſuperfluous branches are to be carefully broke off, and two or three ſhoots only preſerved on each vine, which ſhould be ſupported by ſtakes or poles, till the September following, (for the nearer the grapes grow to the ground, provided they do not touch it, the ſweeter they will be) and then they may be ſhortened.

The vineyard, thus planted and managed, will, in five or ſix years time, ptoduce a good crop of grapes.

The fig is raiſed either from layers, ſeeds, or ſuckers; the layers are ordered like thoſe of the vine; the ſeeds are ſown in rubbiſh, or ſuch like ſoil; and the ſuckers are ſeparated from the old roots the beginning of this month, and tranſplanted without cutting off their tops.

The fig-tree thrives in the ſame ſort of ſoil as the vine, and may be planted either againſt walls or in ſtandards.

The pruning of this tree is very different from that of

of other fruit-trees; for as the practice is to take away the ſmall branches in pruning other trees, ſo here it is to be avoided, becauſe the fig puts forth its fruit chiefly at the extremities of the laſt year's ſhoots; but you may cut off ſome of the weak ſmaller ſhoots which do not promiſe to bear, ſo as you do it cloſe to the great wood.

The branches muſt not be ſuffered to grow too high, as they are prevented by that means from being full; the new thick branches muſt be ſhortened yearly to about a foot, and the bud at the end of the branches broken off in the ſpring time, which will cauſe the figs to ſhoot out more early, and inſtead of a ſingle branch there will be two.

The pruning ſeaſon of the fig is towards the end of this month; and it is beſt in the ſummer to let this tree have ſome liberty from the wall, and not ſuffer it to continue cloſe tacked to it like other fruit-trees; but in the winter ſome of the ſtraggling branches ſhould be cut off, and the beſt and biggeſt branches tacked to the wall in November, that they may be more effectually ſettled, and ſheltered from the froſt in the winter by the defence of a matt, or otherwiſe, eſpecially when the ſeaſon is very cold.

The ſuckers which this tree puts forth in great abundance, muſt be kept down, and whatever you cut away, muſt be as cloſe to the great wood or roots as you can; and a whole tree may, after an unkind winter, be cut down for the recovery of its former ſtate of health.

The following is the method of making the horizontal ſhelters for fruit trees: Lay rows of tiles in the ſtructure of the wall, at certain diſtances one above another, the tiles jetting forward, and hanging over the plane of the wall about an inch and a half; this is neither a difficult nor a chargeable work, if the wall be of brick, to place between every two rows of bricks theſe horizontal ſhelters of tiles: and if the wall be of ſtone, and the joints be any thing regular, it is not leſs eaſy.

In order to avoid the inconvenience of branches riding over the edges of the tiles, in each row, at convenient diſtances, muſt be left void places or gaps, for the wood branches to paſs through; which gaps are to be left wider at the bottom than at the top of the wall; and the rows of the tiles are not to be laid exactly horizontal, but rather a litt'e ſloping, the beter to ſhoot off the water from the fruit.

Bloſſoms and tender fruit are more eſpecially preſerved by theſe horizontal ſhelters, than by matts, or coverings, of any kind whatſoever; and by their aſſiſtance a good quantity of the choiceſt fruit may be depended on in the moſt difficult and unſeaſonable year.

KITCHEN GARDEN.

DIRECTIONS have, in the month of January, been given how to ſow peaſe in drills, or lines, and to earth them when they come out of the ground; when beans may be planted three feet aſunder between the rows, and the large peâs four feet, being ſet about five inches apart in a ſtiff ſoil, without any manure, kept clean and watered about the time of their bloſſom.

Thyme is raiſed either by ſeeds ſown in this month or April, or from ſlips planted at the ſame time.

Sage is alſo propagated from ſeeds or ſlips, but moſt commonly from the latter, taken from the roots at the end of this month, or the beginning of the next, and planted, in light earth, a foot apart.

Of marjoram there are two ſorts; one of which is called winter ſweet marjoram, and propagated by planting the ſlips about March or April in moiſt ground; and the other ſort is ſown annually on hot-beds.

Camomile and penny-royal are propagated from ſlips planted in this or the next month, in ſtiff ſoil and in a ſhady part of the garden.

Fennel is raiſed from ſeeds ſown in this month in the natural ground; as is parſley, dill, &c.

Mint and balm will grow any where, and are propated by parting their roots in any time of the ſpring as well as by ſowing.

Mint is more generally propagated than balm, and when it is about a foot high you may cut it in branches, and dry it in the ſhade for winter uſe.

Rue is a plant which is multiplied by ſlips ſet in a light ſoil, and ſhould have a place in the ſhade.

Tanſy is a plant, which ſhould always be kept dry in winter, and is increaſed by parting the roots in the ſpring.

Sellery is a hot herb, and raiſed from ſeed ſown in this month, or April, in ſome well expoſed place in the garden; it muſt be planted out about ſix weeks after it is come up in beds, allowing ſix inches diſtance between the plants, and they may remain to the middle of June, at which time ſome of the firſt ſowing will be fit to plant in trenches for blanching, in a light rich ſoil.

Your trenches muſt be eight or ten inches wide, and of the ſame depth; in which the plants are to be put as ſoon as made, after having pruned off their tops and roots; place them at five inches diſtance; as they increaſe in growth, earth them up within four or five inches of their tops. Endive may be ſown in this month, but April is the more proper time; a light ſoil agrees beſt with it, and when it has been come up about ſix weeks, plant it in beds as directed for ſellery, and about the middle of July plant it in rows about ſix inches apart.

When it is well grown, tie up ſome of it to whiten; which work ſhould be continued every ten or twelve days.

Purſlane is ſown in this month, and glaſſes are uſed to help it forward; and in April it is ſown in warm places.

Sorrel is ſown in rows or drills, like other ſallading.

Of ſpinach, in March, April and May, you are to ſow ſeveral parcels of ground at different times, about a fortnight from each other, as a conſtant ſupply for the table, till there is plenty of other greens.

There are two ſorts of ſpinach, the prickly ſort, and the round ſpinach, both of which thrive in a light rich ſoil; and ſuch as is intended for winter uſe muſt be ſown in Auguſt.

Chives are raiſed by off-ſets from the roots, planted at ſix inches diſtance, cutting off their branches at the time of planting; they ſucceed beſt in a light, rich ground; and the oftener they are cut, the ſmaller and finer they are.

Tarragon

Tarragon is raiſed from ſlips and ſeeds; the ſlips are taken from the root, and planted in this month in as warm an expoſure as poſſible.

Artichoke ſeeds are ſown about the beginning of this month, and planted out in April; and the middle of this month is the moſt proper time to ſlip the roots for new plantations; for they are raiſed by ſuckers as well as ſeeds.

When you have ſevered the ſlips, three heads are to be left growing upon every old root; and theſe ſlips are to be planted two feet apart, in lines four feet diſtance from each other, and well watered after planting.

Artichokes thrive beſt in a ſtrong rich ground, expoſed to the ſun, with dung well mellowed in it: when they bloſſom the firſt year, the roots are endangered; you may therefore break off the bloſſoms, and about the middle of July break off the ſtems of the old roots that have done blowing, by which means you will furniſh yourſelves with freſh ſhoots.

The ſeeds of the cabbage and lettuce of all kinds may now be ſown in the open ground among the crops; a light rich ground and a warm expoſure agrees beſt with them; and that there may not be wanting a ſupply of them, they are to be ſown every month from March to Auguſt, when the winter crops are to be put in, which ſhould be planted out three weeks after they come up, at about five inches diſtance.

Such as produce large cabbages early in the ſpring may be permitted to ſtand for ſeed, and are to be ſtaked up and defended from the wind; the ſeeds will be fit to gather as ſoon as they begin to ſhew their down, and then the plants are to be pulled up and ſet to dry in a green-houſe.

The cauliflower ſeed is ſown in ſome well-expoſed corner of the garden, where the young plants may be ſheltered; and about the middle of April, when they are in their firſt leaf, they are to be planted in a nurſery about five or ſix inches aſunder, and there continue till the latter end of May, or June, when they are to be tranſplanted abroad for your crop, which ſhould be done in moiſt or rainy weather; or if it be a dry ſeaſon, holes are to be made in the ground, about three feet apart, and to be well watered before you plant the cauliflowers, which will make the plants ſhoot, being alſo frequently watered afterwards.

In the autumn following they will bear large flowers; but ſome of them will not flower till after Michaelmas, and ſuch plants may be taken up with the earth round their roots, and ſet together in the green-houſe, or ſome ſuch place, where they will enlarge themſelves, and be fit for uſe in the winter.

To raiſe ſummer cauliflowers, you muſt ſow the ſeed the beginning of Auguſt, upon ſome decayed hot-bed; and as ſoon as they have put out their leaf, tranſplant them about three inches diſtance, upon ſome other bed: in the middle of September draw out every other plant, and ſet them ſix inches apart under a ſouth wall, to ſtand there till ſpring, when they are to be planted out for flowering; or you may ſet them in the places where they are to bloſſom, covering them with glaſs-bells in the winter.

If the weather is open, the firſt week in this month you may ſow aſparagus; and the ſeedlings will be fit for planting out the February or March following.

The following is the method uſed by the beſt gardeners to produce a natural crop.

After meaſuring out the ground, allowing four feet for the breadth of each bed, and two feet for the alleys between the beds; open a trench at one end, and lay into the bottom of it horſe-dung about ſix or eight inches thick; then go on and trench the ſame quantity of ground lying next to the firſt trench, throwing the earth of the ſecond trench upon the dung at the bottom of the firſt, and thus continue working till the whole is done.

Having finiſhed your beds, plant aſparagus, taken freſh out of the nurſery, in lines at eight or ten inches diſtance, ſpreading their roots, and covering their buds with earth about four inches thick; each bed takes up four rows; and when they are all planted, ſow the whole with onions, and rake it level, for the alleys will not be of any uſe till after Michaelmas, when the onions will be off, and the ſhoots of the aſparagus plants made that ſummer are to be cut down, the alleys dug up, part of the ſoil thrown upon the beds, to raiſe the earth about five or ſix inches above the buds of the plants, and the alleys ſupplied with dung, or ſome rich ſoil.

In March following the earth muſt be raked down; and the alleys are to be turned up every winter, and now and then enriched with dung.

When Michaelmas is paſt, you may cut down the haulm, and give them their winter-dreſſing; and you ſhould not be later than the middle of March in raking and laying down the beds.

It is a general rule, not to cut any of the aſparagus till the fourth year after planting; but where the plants are ſtrong, a few may be taken here and there in very ſmall quantities the third year.

The aſparagus appears above ground the beginning of April, and may be cut till the beginning of June, when they have ſtood five years; but if they are younger, you muſt not cut them after the middle of May.

No buds that appear above ground ſhould be ſuffered to grow in the cutting ſeaſon, unleſs they proceed from freſh plants, to make good deficiencies; and thoſe muſt be ſuffered to run up every year, till they have gathered ſtrength: it is beſt to cut them downwards a little ſloping with a knife made blunt at the point.

APRIL.

Flower-Garden.

In this month, and the beginning of May, the ſeeds of the carnation are to be ſown in a compoſt made of ſandy loam, and well-conſumed melon-earth, two loads of the former to one load of the latter; ſift them well together, and let them lie in a heap for a time to mellow; then ſift it a ſecond time either to ſow the carnation-ſeeds in, or to plant your layers or roots of them upon.

Having filled your pots with this earth, and ſmoothed them on the top, ſprinkle on your ſeeds; and covering them with the ſame compoſt, preſs it gently with a board, and let them ſtand expoſed to the weather.

 The

The feed will come up in about three weeks; and in the July following the young plants will be big enough to tranfplant into beds, where they muft be fet about ten inches diftant from one another, and fhaded from the fun with mats for about three weeks.

You may find many varieties from the feedling plants in the fecond year; and whatever rarities appear, they muft be laid down as foon as poffible, by cutting half through a joint, and fplitting the internode upwards, half way to the other joint above it; then the wounded part muft be buried in the earth, and faftened down till it takes root, which, provided the earth is light, will be in about two months.

The moft proper feafon for laying down the layers of the feedlings is in July; and when planted they muft be carefully guarded, both from the intenfe heat in fummer, and the chilling frofts in winter.

The flower ftems will begin to put forth about April, when each flower muft be fupported by its ftem being tyed to a ftick about four feet long; and as foon as the flower-buds appear, leave only one or two of the largeft upon each flower ftem, to bloffom; and about ten days before the flowers open, the round poded kinds will begin to crack their hufks on one fide, when you fhould fplit or open the hufk on the oppofite fide to the natural fraction with a fine needle; and three or four days before the complete opening of the flower, you muft cut off the points on the top of the flower-pod, and fupply the vacancies on each fide of the hufk with two fmall pieces of vellum, which may be eafily flipped between the flower-leaves and the infide of the hufk, by which means the flower will make an equal difplay of its parts, and the form of it, confequently, be entirely regular.

When the bloffom begins to fhew its colour, you fhould fix a piece of flat board upon the fticks, to fhelter it from the fun's extreme heat.

The feeds of the carnation muft be gathered towards the end of September, in dry weather, and be expofed for a month or two, through a glafs, without opening the hufks till the time of fowing the feeds comes round again.

The feeds of the columbine are fown in the nurfery this month, from whence you may remove the choice plants to the garden, and next year they will yield flowers; the roots of this flower will hold good for three or four years, when you muft have a fupply of frefh ones.

The feed of the fcarlet bean is annually fown in good ground, well expofed to the fun; and fticks fhould be fixed in the ground, round which they will twine, and make a very agreeable fhew.

The amaranthus is an annual, fown on a hot-bed; and the feeds being fown in this or the preceding month, in the hotteft part of your garden, are to be raifed under glaffes.

The African marygold is alfo an annual, raifed on a hot-bed.

Fruit-Garden.

You fhould now carefully weed your beds of ftrawberries, and take off their runners; and if the feafon is dry, it will be proper to water them, for they produce but little fruit when this is neglected.

Lay the branches of the peach-tree horizontally, and keep them free from great wood, and perpendicular fhoots in the middle, that the fap may be carried in fuch due proportion as is neceffary; and it fhould be ever obferved, that too much vigour is as pernicious as too little, with refpect to the tree bearing a fufficient quantity of fruit.

When a pear or apple-tree is ungovernable, and will not bear frnit, ftrip off the bark of the ftrongeft branches half an inch, or an inch, according to the bignefs of the tree, and take it entirely away to the wood.

Thefe branches will continue to bear fruit for feveral years; and when they die, there are always in a pear-tree a fufficient number of others to fucceed them, efpecially in the middle of the tree; which, if ungovernable, ought to undergo the fame kind of difcipline.

This work, which fhould be practifed only on low dwarfs, or wall-trees, is beft done in March or April.

Cherry-trees, not in a thriving condition, fhould now be flit perpendicularly down with the point of a knife, juft entering the bark of the ftem of the tree, to prevent being hide-bound; after which operation they will thrive and profper wonderfully, when, for want of it, they will continue almoft barren for ten or fifteen years.

At this time you fhould look carefully to your young fruit-trees which were planted in the fpring, obferving to water them in dry weather; and if you obferve the leaves beginning to curl up, you fhould water them gently all over their branches; which may alfo be practifed to great advantage on old trees; but it muft not be done in the heat of the day, left the fun fhould fcorch their leaves, nor too late in the evening, efpecially if the nights are cold.

Where you obferve the fruit-trees to be greatly infefted with infects, you fhould wafh the branches with water, in which a great quantity of tobacco-ftalks have been fteeped; which, if carefully done, will infallibly deftroy the infects, and not do any any injury to the trees; or if the leaves which are curled are taken off, and fome tobacco-duft thrown on the branches, it will deftroy the infects, and may, in a day or two, be wafhed off again.

Towards the end of this month, you muft look over your efpaliers and walls of fruit-trees, training in the regular kindly fhoots in their proper fituation, and difplacing all fore-right and luxuriant ones.

In the middle of this month uncover thofe fig trees which were fcreened from the froft in the winter; but do it with caution, as the young fruit, which now begins to appear, may be greatly hurt by being expofed to the air too fuddenly.

Kitchen-Garden.

The middle of this month is the proper time to plant out melons, which are to be raifed under paper: in making thefe ridges, if the ground is dry, the dung fhould be but a half a foot higher than the furface of the ground, and the earth fhould be laid at leaft a foot and a half thick upon the dung, that the plants may have depth enough to root; they will require no watering, after they are

well

well rooted, and hereby a choicer ſort of melons may be generally obtained; which, in the common method, frequently miſcarry, or produce but little fruit.

The alleys between theſe beds ſhould be afterwards raiſed with dung and earth to the level of the beds, that the roots may have room to extend on each ſide, for the roots of theſe plants ſpread as far in the ground as their branches extend on the ſurface.

Of kidney-beans we have two ſorts; the one, which is called the Batterſea-bean, bears early, and near the root, without running high; and the other, grows near ſix feet high.

We ſow theſe beans, the firſt week in this month, about four inches apart, in drills from north to ſouth, in a light freſh ſoil, covering them with earth, raiſed in a ridge, to keep the wet from them: the lines of the Batterſea-beans ſhould be too feet apart; and the other ſort are be ſown in rows like rounceval-peas, having alleys between them two feet and a half wide; the former kind need not be ſtaked, but the others will not bear well unleſs they are ſtaked.

From the firſt ſowing in this month, you may, once every three weeks till the middle of July, continue to ſow freſh ground with kidney-beans to ſucceed one another; obſerving, that when the ground is very dry, as in June and July, and the weather hot, you muſt water the drills as ſoon as you have opened them, before you put in the ſeed, which will contribute to their vegetation; but after they are ſown, you muſt avoid watering them.

Toward the end of this month, you may ſow the nonpareils, and the Spaniſh morotto-peas, about two or three inches apart in lines, leaving a ſpace of three or four feet for alleys, till the whole is ſown; and when they grown up ſix inches high, earth them up, and ſet one row of ſticks or boughs about ſix feet high, on each ſide, for them to run up, and you will have a plentiful crop.

The charlton, or maſter-hotſpur, ſhould be ſown in December, for the firſt crop, in drills about two or three feet aſunder, the lines running from north to ſouth: a ſecond crop of the ſame kind of peas ſhould be ſown in February; and in March we may put in a third crop of the ſame ſort.

Some ground may be prepared about the beginning of April for the dwarf-peas, which ſeldom riſe higher than half a foot, and are to be ſet four or five inches apart, in lines about eighteen inches diſtant from one another; and in order to have a conſtant ſupply of young peas, there is a ſort of dwarf peas which may be ſown in May or June, in edgings upon a gentle hot-bed, the firſt week in September, and will produce peas in the winter.

Spaniſh chardons may now be ſown in the natural ground; you are to make holes for the ſeeds about five or ſix feet diſtance, and put four or five ſeeds in each hole; and when they are come up, leave growing only one ſtrong plant in a hole for blanching.

Lavender and roſemary are raiſed from ſlips planted in this month, which take root almoſt immediately if they are ſhoots of the laſt year, but if they are older they will not grow: theſe plants ſhould be ſet in a light ſandy-ſoil, in the warmeſt and drieſt part of the garden.

MAY.

FLOWER-GARDEN.

THE ficoides, which is propagated by the cuttings, being planted abroad in a natural bed of earth in this month, will be fit to put in pots in Auguſt, where it may remain in open air till the latter end of September; ſome kinds of this plant being annual, muſt be raiſed from ſeeds every year; and one ſort of it will ſtand the winter, if we raiſe young plants of it about July or Auguſt, that do not bloſſom in three or four months.

The ſhrub-kinds, which have their ſtalks woody, will bear moderate waterings; but the others, which are more ſucculent, muſt have very little water. Theſe plants muſt be expoſed to the ſun, which will open their bloſſoms, unleſs it be two kinds, which only flower in the night. The cuttings of theſe plants ſhould not be planted before the wounded parts have been dried a day or two in the ſun.

The torch-thiſtle is a ſucculent plant, raiſed from cuttings planted between May and the end of July, upon a little hill in the middle of the pot, for they can hardly endure water: and before they are put into the hot bed, they muſt ſtand abroad about twenty days to take root; their waterings muſt be ſeldom, and gentle: and the beſt compoſt for this plant is, the rubbiſh of old walls, mixed with about one third of ſandy ſoil. The ſidums, eſpecially the tree-kind, are eaſily propagated from branches ſet in the earth in a light ſandy ſoil, either in this or any of the ſummer-months, giving them a little water, and as much air and ſhade as poſſible in the ſummer; and in the winter no water at all.

There are ſeveral ſorts of the geranium, which are raiſed by planting the cuttings, this month, in natural ground, where they will become proper for tranſplanting the Auguſt following; and from ſeeds ſown in March on hot-beds. Thoſe planted in the natural ground require a medium ſoil without dung, muſt be frequently watered, and houſed with the orange-trees.

The amomum Plinii is raiſed from cuttings planted this month in the natural ground: during the ſummer it muſt ſtand in ſome place defended from the ſun, and be conſtantly ſupplied with water.

Cuttings of the Arabian j ſſamin may this month be planted in a ſandy ſoil, and is more injured by wet than cold. At the time the cuttings are taken from this plant, it ſhould pruned to within ſix inches of the laſt year's ſhoot, and have freſh earth put to the roots; by which means it will ſhoot near a foot in the enſuing ſummer.

Layers of the myrtle-tree ſhould be made this month: the youngeſt ſhoots muſt be bent into the earth, after it is well ſtirred; and being often refreſhed with water, will take root, and be fit to take off from the mother-plants in the ſpring following. In July, the cuttings of this tree are planted, ſtripping off the leaves, two inches from each cutting, and ſetting them that depth, about an inch apart, in pots of fine light earth, watering them frequently till they have taken root, which will be about the latter end of Auguſt; and this young plantation is to remain till the

the ſecond of March before they are to be tranſplanted into pots. About the middle of April you may prune, and put earth about the roots of ſuch old myrtle-trees as are in a bad ſtate, and cut the branches off their heads within three or four inches of the ſtem.

The melianthus is a plant propagated with eaſe from ſlips taken about the roots any time between this month and Auguſt, planted in a ſandy ſoil, and frequently watered.

The pyracantha is raiſed from cuttings, planted in May or June, in pots of fine earth, and watered frequently, keeping them from the ſun till the following winter, when a warm expoſure will be ſerviceable to them. This tree may alſo be raiſed from layers and ſeeds, and thrives beſt in a dry gravelly ſoil, unmixed with dung or any other rich manure.

The oleander plant has many varieties; the moſt common of which is the ſcarlet oleander, which being of a hardy nature, may be kept abroad all the winter under a ſouth wall; but the ſweet-ſcented oleander is more tender, and ſhould be houſed with the orange-tree. Theſe ſhrubs are raiſed by layers in this month or the next, in a medium ſoil, and with moderate watering, and will take root to tranſplant the Auguſt following.

Orange and lemon trees may this month be removed and tranſplanted without danger, as well as brought out of the conſervatory: upon bringing out your exotics, and other plants, bruſh and cleanſe them from the duſt they have contracted in the houſe, give them freſh earth on the ſurface of their pots, and water them well, when they are placed in the order they are to ſtand. When you tranſplant or remove orange-trees, you are to do it carefully, without injuring their bodies; let the caſes for your trees be filled with a compoſition of two parts in ſandy loam, one part rotten dung, and one part white ſand; and when your orange-trees are ſo removed, give them frequent waterings, but without wetting either the ſtem or the leaves; ſet them in the ſhade for a fortnight, and let them have the ſun by degrees; as, when it is too hot upon them, it turns their leaves yellow.

Fruit-Garden.

In the beginning of this month, look carefully over your wall and eſpalier trees, and take off all fore-right ſhoots, and ſuch as are luxuriant and ill-placed; and train ſuch kindly branches as you would preſerve regularly to the wall or eſpalier, which will prevent your trees from growing into confuſion.

Fruit-trees may be tranſplanted in the ſummer months, from May to Auguſt, even when the trees are in bloſſom: the method of tranſplanting them is, by preparing holes for them before you begin to take them up; and the earth taken out of the holes you are to make very fine, and mix with water in large tubs to the conſiſtence of thin batter, with which each hole is to be filled for the tree to be planted in, before the earthy parts have time to ſettle or fall to the bottom. A tree, thus planted in batter, has its roots immediately cloſed, and guarded from the air; and as the ſeaſon now diſpoſes every part of the tree for growth and ſhooting, it loſes very little of its vigour if you are careful of its roots, obſerving to wound but few of them at the taking the tree out of the ground, and not let them dry in the paſſage from one place to another. Though this pap is of uſe in ſummer-plantations, yet in the uſual winter-plantations it is pernicious, as it will then chill and rot the root of your trees.

As the cutting and wounding ſome roots of a tree, and among them of the capital ones, cannot be avoided, a mixture of gum has been contrived to plaiſter over the wounded parts of the great roots, and prevent the air and wet penetrating too much into the veſſels of the roots; and if the root be very large, you may at the ſame time mark its correſponding limb or branch in the head, to be cut off about a fortnight afterwards in the ſame proportion, and then to be plaiſtered in the ſame manner as the root was done before.

In the removal of trees, care muſt be taken that it be ſudden; for if the roots are permitted to grow the leaſt dry, we may preſently diſcern a failure in the top-branches, which will require time to redreſs; for which reaſon, it has been thought impoſſible to remove a large tree to any conſiderable diſtance.

There is one convenience in this laſt way of planting, which is not in the common way; and that is, that the tree may be taken up without any earth about the roots, which makes the tranſportation more eaſy; and by this method, and the aſſiſtance of prepared gums, peach trees, nectarines, pear-trees, plumb-trees, and cherry-trees, with fruit upon them, either green or ripe, may be removed, though the trees are ſix or ſeven years old; and trees of all ſorts may be thus tranſplanted in the ſummer.

Kitchen-Garden.

You may now give your melons air in the middle of the day, and look to your melon-ridges, weeding them, and carefully pruning off the water branches, which are known by their flatneſs and extraordinary breadth; it is alſo neceſſary to pinch off the tops of the runners that have fruit upon them, having three or four joints above the fruit, and taking care that the fruit be well ſheltered with leaves from the power of the ſun, otherwiſe their growth will be ſpoiled; but when the growth is perfected, you cannot expoſe them too much to the ſun for ripening. If the ſeaſon be dry, rather float the alleys between the melon-ridges, than pour water upon the plant, or near the ſtems.

About the beginning of this month, ſow cucumbers in the natural ground, both for ſallad and pickling: in ſowing thoſe for ſallads, put about twelve ſeeds in each hole; but leave only four or five when they come up; let the earth be freſh, and well worked with a ſpade, rather light than ſtiff; and a plantation of this kind will produce twice as much fruit as one of the ſame quantity of ground forced with dung.

To raiſe cucumbers for pickling, ſow them in a drill, as you do peaſe or French beans; and put a row of buſhy ſticks on each ſide of them: the rows muſt be four or five feet aſunder; and if ſowed in the ſouth border, where

where there is a vacancy, and nailed againſt the wall, they will grow ſtraiter and finer flavoured than thoſe on the ground.

Replant imperial and Sileſia lettuce: ſow ſome of the white and brown Dutch cos-lettuce, to be planted out for cabbaging in June: ſow radiſhes and endive very thin, to be branched without tranſplanting; and you may alſo ſow purſlane and cabbage-feed; tranſplant cauliflower-plants; make your firſt drills for ſellery, if your plants are large enough. Plant out cabbages and beet-chard; and you may yet ſow thyme, ſweet marjoram, and gilly-flowers.

You ſhould now be very careful to deſtroy weeds before they ſhed their ſeeds; deſtroy alſo the neſts of caterpillars and other inſects which annoy your trees; prune off all crumpeled leaves, for they harbour the worſt of vermin; and if the weather be dry, water new-planted trees, aſparagus, *&c.*

JUNE.

FLOWER-GARDEN.

THE leaves of the ſaffron crocus appear as ſoon as the flower is paſt, and remain all winter, which in the ſpring ſhould be tied together in knots to help the increaſe of the roots; and theſe will be fit to remove or tranſplant about Midſummer. This plant delights in chalky ground, but it will proſper alſo in a ſandy ſoil; and the piſtillum contains the ſaffron uſed in medicine. The roots of the ſeveral kinds of crocus may be taken out of the ground in this month, and replanted with other bulbs; they love a light ſoil, and may be increaſed by off-ſets.

The cyclamen is propagated from ſeeds ſown as ſoon as ripe, in a light ſoil, and tranſplanted in Midſummer when their leaves are decayed; and it is a general rule, that all bulbs may be ſafely tranſplanted, when their flowers and leaves are decayed.

The colchicum thrives beſt in a ſandy ſoil, and will only bear tranſplanting about Midſummer, when the roots are entirely at reſt. There are many ſorts of aloes, the moſt common whereof are brought from America; but Africa produces the greateſt variety, where they grow upon rocky ground; therefore the earth proper for them is to be made with one half ſandy ſoil, and the other rubbiſh of old walls, mixed and ſifted together; you ſhould plant them ſhallow in the pots, raiſing the earth about them, ſo that the plant may, as it were, ſtand on a hill; and when you water them, do it without touching any part of the plant, otherwiſe they will be in danger of rotting; the off-ſets of the aloe may be planted in the latter end of this month, and the beginning of July, when they ſhould be ſuffered to ſtand abroad for about nine days; and they may be helped with a hot-bed as ſoon as they begin to take root; if the weather be fair while the aloes are abroad, their earth being dry, will require watering once a-week; and from the time of their being houſed till the middle of October, gentle refreſhments may be given them while the ſun is upon them in the morning; but from October to March, they muſt be kept very dry. In May they ſhould be tranſplanted, without diſturbing the roots; the ſeeds of many kinds of aloes ripen in Britain, and may be ſown in April upon hot-beds. The fritillaria is propagated by planting their branches in a natural bed of earth any time between June and Auguſt, and they will ſoon be fit to plant into pots; they ſucceed beſt in the ſame ſort of earth as the aloe.

The Indian fig is raiſed by planting its leaves ſingly about two inches deep, in pots of earth compoſed of lime, rubbiſh, and ſandy ſoil, after their wounds are dried, and letting them ſtand abroad till they take root, and then they may have the help of the hot-bed; you muſt give theſe plants a good deal of the ſun, and the leaves ſhould be planted during the ſummer-months.

FRUIT-GARDEN.

THE inoculation of fruit-trees now demands the attention of the gardener, and the following is the moſt approved method of performing the operation. About Midſummer take off a vigorous ſhoot from any tree you would propagate; and after having made choice of a ſtock of about three or four years growth, in a ſmooth part of it make a downright ſlit in the bark, a little above an inch in length, and another croſswiſe at the top of that, to give way to the opening of the bark; then gently looſen the bark from the wood on both ſides, beginning at the top; which being done, cut off your bud with a penknife, entering pretty deep into the wood, as much above as below the bud, to the length of the ſlit in the ſtock: after the bud is thus prepared, take out the woody part of it (carefully preſerving the eye of the bud) then put it in between the bark and the wood of the ſtock at the croſs ſlit, putting it downward by the ſtalk, where the leaf grew, till it exactly cloſes; then bind it about with coarſe woolen yarn, the better to make all parts regularly cloſe, and the bud incorporate with the ſtock: in three weeks time the bud will be incorporated with the ſtock, when you muſt looſen the yarn, that it may not gall the place too much: the quicker this operation is performed, the better; and you muſt put two buds into one ſtock, in inoculating nectarines aud peaches. If the buds inoculated this month do not hit, you may make another attempt in the ſame year, and on the ſame ſtock. The proper time for inoculating is from the beginning of this month to the latter end of Auguſt; and care muſt be taken that the branch and ſhoot made choice of for inoculation, do not lie by, but that they be uſed as ſoon as cut.

You may upon one tree, bud peaches, nectarines, apricots, plumbs, and almonds.

KITCHEN-GARDEN.

KIDNEY-BEANS, radiſhes, lettuces for cabbaging, and endive, may now be ſown; as may alſo the large ſort of peas, about five or ſix inches apart, allowing three or four feet diſtance between the lines, and they will in September afford a good crop.

Replant cabbage-lettuces; tranſplant leeks in light rich ground, and at ſix inches diſtance from each other; and if the weather be dry, you may gather herbs for drying againſt

gainſt the winter, ſuch as lavender, roſemary, ſage, mint, ſweet marjoram, thyme, *&c.*

Take eſpecial care to preſerve your plants from the ſcorching ſun; ſtir up ſtiff ground; continue to deſtroy weeds; and give your plants gentle waterings about their extreme fibres, which ſhould be done at the cloſe of day.

JULY.

Flower-Garden.

There is little to be done in the flower-garden this month: the berries of the coffee-tree which are now ripe, may be ſown, firſt cleaning their ſeeds from the pulp, in pots of fine earth, about an inch deep; and if you give them the help of a hot-bed, in leſs than ſix weeks time they will ſprout.

The fruit of the ananas being ripe in this month, if you cut off the crown of the leaves which grows on the top of it, and plant it in a light ſandy earth, it will, with the aſſiſtance of a hot-bed, preſently take root.

Anemony feeds, now ſown, muſt be ſprinkled with water frequently and gently.

Fruit-Garden.

The management of the vine ſhould this month be chiefly attended to: it is to be obſerved, that from a vigorous ſhoot of a vine already once pruned, there will puſh again ſeveral Midſummer ſhoots weaker than the former, from the firſt, ſecond, and third bud towards the extremity; which ſhoots are to be taken off, only remembering that it is proper to ſpare the laſt of ſuch ſhoots ſo far as to leave one bud upon it, from whence, in Autumn, nature may a third time exert herſelf; for if thoſe ſhoots were all entirely removed, the vine would puſh at thoſe bearing buds which lie at the bottom of the ſhoots; in conſequence of which, there would be either a want of fruit at thoſe places next year, or a neceſſity of pruning the branch ſhorter than was intended, or is in the winter convenient.

There is no danger in expoſing the grapes this month to the ſun; for though the vines appear thin of wood and leaves, the Autumn ſhoots will recover that fault.

Put nets over your grapes to preſerve them from the birds; and you ſhould alſo guard againſt waſps and other inſects, which now deſtroy the peaches, apricots, and other fruit; by placing phials of honey and ale near the trees, you may ſoon entrap a great number of them.

Kitchen-Garden.

You may know ſow kidney-beans, and ſome peas, to bear in September and October; ſow cucumbers upon a bed made with dry horſe-litter, and covered with light earth ten inches thick; they muſt be covered at night in September with a common frame and glaſs, to keep them from froſt and rain, and by this method you may have ſome cucumbers till Chriſtmas.

Make a bed for muſhrooms as directed in February; and be ſure to cover it very thin with earth.

About the middle of this month ſow royal Sileſia, and brown Dutch, white goſs, and other ſorts of lettuces, chervil, carrots, and turnips.

Plant cabbages, and ſavoys; tranſplant endive for blanching againſt winter; earth up ſellery in drills, and plant out a new crop to ſucceed the former; take up ſhallots, garlick; and water plentifully all herbs that are ſeeding.

AUGUST.

Flower-Garden.

The tulip-tree being a plant of the wood, ſhould be among ſuch trees as are deſigned for groves, where it will riſe to a great height: the ſeeds of this tree come from Virginia, and are to be ſown in pots this month, and ſheltered the winter, and they will come up all in the ſpring following.

At two years growth the young plants may be tranſplanted into ſingle pots, and muſt have ſhelter in the winter for the firſt nine years at leaſt, till they have gathered ſtrength enough to reſiſt the ſeverity of the froſts, when they may be planted in the natural ground, rather a ſandy ſoil than any other.

The iris flower has many varieties, ſome with bulbous and ſome with tuberous-roots: the roots of the bulbous iris may be taken up as ſoon as the leaves begin to wither, and planted in Auguſt; and they may be increaſed by off-ſets taken from their roots when their ſtalks are decayed: the beſt of the tuberous kind is the the chalcedonian iris, commonly called the toad-flag, which requires a warm and rich ſoil, and muſt be carefully ordered, or it will not thrive well.

The narciſſus, or daffodil, is a flower of a hardy nature, and thrives greatly in any ground; theſe flowers are propagated from off-ſets from their roots, planted in this month, and may be raiſed by ſeeds ſown in September, which will produce great varieties: the ſeedling plants are to remain without removal two or three years, when they are to be taken up in June, and replanted in good ground at a proper diſtance.

The jonquil is of the ſame kind with the daffodil, and flowers much about the ſame time; the roots, which are bulbous, are to be taken out of the ground, and replanted like other bulbs.

The bulbous violet, or ſnow-drop, is reckoned amongſt the daffodils, and is one of the earlieſt flowers in the ſpring.

You may now plants off-ſets of the hyacinth, in beds of ſandy ſoil; the tuberous hyacinth is a plant of an aſpiring head, and very tender nature; the roots of it muſt be taken up in April, and replanted in pots of prepared earth; and, like other ſhrubs, it requires the aſſiſtance of a hot-bed: you may take up the bulbs of this plant in September, and preſerve them in dry ſand.

This is the proper time for parting the roots of the lily, which ſucceeds beſt in an open ſandy ſoil: the ſtriped

ped white lily is ſo great a rarity as to deſerve a place in the niceſt garden, and the orange-lily is a proper companion for it; the lily of the valley is eaſily raiſed from plants, and thrives beſt in ſhady ground.

The crown-imperial may be raiſed from ſeeds, but is commonly propagated from off ſets that ſpring yearly from old roots, which are to be taken up in June when the ſtalks are dry, and replanted in Auguſt.

The work to be done this month, in the fruit and kitchen-garden, is the ſame as directed in the preceding month.

S E P T E M B E R.

Flower-Garden.

The tulip is propagated in the following manner: the ſtems of this flower being left remaining upon the root, will perfect their ſeeds about July, which will be fit to gather when the ſeed-veſſels begin to burſt; and then they are to be cut cloſe to the ground in a dry day, and laid in ſome dry place till September, when they are to be ſown, in a ſoil compoſed of natural black earth and ſand; and after their ſecond appearance above ground, they may be taken from the pots they were ſown in, and put in a bed of natural ſandy ſoil, well ſifted, where the thickneſs of half an inch of the ſame earth ſhould be ſpread over them; and thus they are to continue, without any other culture than every year adding half an inch for their covering, till they begin to blow, which will be in five or ſix years time: in this manner tulip-ſeeds are every year to be ſown for new varieties.

In planting tulips, all the forward blowers ſhould be planted in a bed together; and of the late flowering tulips the talleſt ſorts ſhould be placed in the middle line of the bed, with two rows of the ſhorter on each ſide.

Tulips planted in this month need no ſhelter till March, when, the flower-buds appearing, they ſhould be defended from blights with mats, or other covering; which covering will alſo ſerve to ſhelter them, when blown from the too powerful heat of the ſun, and pernicious damps.

There are two claſſes of tulips; the prœcoce tulips or early blowers, and the ſerotine or later blowers; and theſe are diſtinguiſhed by their double and ſingle flowers: they have alſo different denominations, from their colour and ſtature, as bagats, which are the talleſt flowers, commonly purple and white marbled; agates, which grow ſhorter, and are veined with two colours; and beazarts, which have four colours, tending to yellow and red, of ſeveral ſorts.

You may now take up the roots of the peony, part and plant them; they will proſper in any ſoil.

The ſeed of the mullein may now be ſown, in a ſandy ſoil, and a ſhady part of the garden; it is a beautiful plant, and bloſſoms four feet high.

Violets are increaſed by tranſplanting their runners either in this month or in February, which will of themſelves take root at every joint; they thrive beſt in a binding ſoil, ſhady ſituation, and ſhould be planted in the moſt rural parts of the garden.

You may now increaſe daiſies by parting their roots; and they make very pretty edgings for flower beds.

Layers of the honeyſuckle may now be put down; they thrive beſt in the ſhade, and are moſt eaſily trained up in pots.

There are ſeven ſorts of the jeſſamine: the common white, the yellow, and the Perſian jeſſamine, are propagated from layers or cuttings, and will grow in any ſoil; the layers are made in this month, and the cuttings may at the ſame time be planted, which ſhould always be a foot long, and two joints be under ground. The jeſſamine ſhould be planted againſt walls or trees, or mixed in hedges. There are jeſſamines of a more tender nature, which require to be ſheltered in the conſervatory in the winter, as the Spaniſh jeſſamine, the Portugal jeſſamine, the Indian jeſſamine, and the Arabian jeſſamine: theſe are propagated by grafting on the common white jeſſamine in March, or by inarching in May, or cuttings planted at the ſame time: the inarched plants are to be cut off the middle of Auguſt following, and in February you are to cut off the branches within four or five inches of the ſtem; and, after they have freſh earth put to their roots, they may be ſet near the glaſſes or windows of the green-houſe: they ſucceed beſt in a medium ſoil between ſand and clay, without dung, and ſhould not be watered too frequently.

The virgin's bower is raiſed from layers in this month, and from cuttings alſo: it is of a twining nature, muſt be ſupported with ſtakes: it may either be planted againſt a wall, or ſet in the wilderneſs; and it thrives beſt in a light ſoil.

The Virginia dog-wood bloſſoms early in the ſpring; and the flowers are ſucceeded by red berries, which hang a long time upon the tree: the ſeeds are ſown in pots of light earth in autumn, and they are to ſtand the winter in the green-houſe, giving them the aſſiſtance of the hot-bed the following ſpring.

The Virginia myrtle, which bears berries, from which is drawn the green wax whereof candles are made, is propagated by ſowing the berries in pots of black ſandy earth, which ſhould be kept continually moiſt.

The ſaſſafras-tree is a plant of Virginia, which loſes its leaves in winter, and in the ſpring puts forth its yellow flowers in cluſters, which are ſucceeded by blue berries, like thoſe of the laurus tinus; theſe berries are ſown in autumn, in a ſandy ſoil.

You may now make layers or ſlips of the box-tree; and the ſeeds may be ſown as ſoon as ripe, or laid in ſand during the winter, to be ſown in the ſpring following; this plant thrives beſt in a chalky ſoil.

The dwarf or Dutch box, is of great uſe for edging of flower-beds, or making ſcroll-works; it will remain good, without renewing, a long time; and ſo great is the increaſe of it, that being earthed up every year, in four or five years after the planting, it may be taken up, parted, or ſlipped, and be made to plant four times the ground it ſtood upon.

Fruit Garden.

You may now gather the different ſorts of fruit as they ripen; for thoſe which are in eating this month, ſeldom continue long good.

Tranſplant

Tranſplant ſtrawberries, gooſeberries, raſpberries, and currants, towards the end of this month, if the weather proves moiſt, otherwiſe it will be better to defer it till the beginning of the next month; and this is the beſt ſeaſon to plant cuttings of gooſeberries and currants, which will take root, and make better plants than thoſe which are propagated by ſuckers.

Your fruit trees againſt the wall of your forcing-frame, muſt now be pruned and trained cloſe to the wall or eſpalier, that their buds may be preparing before the ſeaſon for applying the heat; and you ſhould alſo prepare for the ground where the fruit-trees are deſigned to be planted the next month, that it may lie to mellow and ſweeten.

Kitchen-Garden.

Sow Spaniſh radiſhes for the winter, and ſpinach to be cut in February; make plantations of the Dutch brown lettuce to ſtand the winter; ſow ſorrel, chervil, and ſmall herbs for ſallads, in ſome well-expoſed place, obſerving to provide ſuch mixtures for this ſeaſon as are hotter to the taſte, than in the former months.

You may now replant endive, and all ſorts of fibrous-rooted herbs; continue to earth up ſellery; raiſe the banks of earth about chardones for blanching; tranſplant aſparagus-roots; make plantations of cabbages and coleworts; tranſplant young cauliflower plants in places where they are to flower; tranſplant ſtrawberries; make beds for muſhrooms; cover muſhrooms ſown in July every night; earth up your winter-plants; prepare compoſts; and, if the weather be dry, water your plants and herbs in the morning, and give your turnips the firſt houghing.

Such cucumbers as are now ripe, muſt be cut open, and the ſeed or pulp taken out of them, which ſhould lie three or four days together before they are waſhed, and ten days in the ſun before it is laid up; and it ſhould ever be obſerved, that if ſeeds are not thoroughly dry before they are laid up, they will rot, and be good for nothing.

OCTOBER.

Flower-Garden.

You ſhould now plant anemonies, and ranunculuſes; and as ſoon as they appear, defend them from winds and froſts, with ſaw-duſt, dry ſtraw, or matts; and make an end of putting tulips into the ground: and likewiſe put hyacinths, tulips, narciſſuſes, *&c.* in glaſſes made for that purpoſe, to blow early in the houſe.

Continue to tranſplant and lay roſes, and ſuch like flowering ſhrubs; and to plant the cuttings of jeſſamines and honeyſuckles in ſhady borders. Sow the berries of yew, holly, and other evergreens, prepared in earth or ſand; and prune theſe kinds of plants if the ſeaſon be mild.

This is a proper time to remove your ananas or pine-apples out of the bark-beds into the ſtove; and always keep a tub of water in the ſtove to water them when it is wanted, which ſhould ſtand twenty-four hours before it is uſed.

Set your pots of carnations, which are now blowing, into your green-houſe near the door; and the beginning of this month you are to houſe your myrtles, amomum Plinii, melianthus, and ſuch tender greens as remain yet abroad. Tie up thoſe plants that grow diſorderly, and place the aloes, torch-thiſtles, euphorbiums, *&c.* neareſt the ſun; and the other plants, which are more hardy, towards the back of the houſe.

When you water your houſed greens, let it be in the morning, when the ſun ſhines upon them; but you are to give no more waterings to your tender ſucculent plants after the middle of the month.

The windows of the green-houſe are to be kept open day and night till about the fifteenth of this month: after that, in the day time only.

Fruit-Garden.

You may now plant peaches, apricots, and other fruit-trees; and as nothing is more prejudicial to them than dung, this ſhould be done in untried earth.

Should this month be a wet one, you muſt raiſe the borders, and the trees planted high; for it is certain death to peaches and apricots, to ſtand where the water ſtagnates in the winter.

Vines ſhould now be planted againſt walls ſeven or eight feet aſunder, in a ſoil compoſed of ſea coal aſhes, drift ſand, or the rubbiſh of old buildings, with an equal quantity of natural earth mixed with rotten dung.

About the middle of this month ſow cyder-preſſings in beds of freſh earth, to raiſe ſtocks for grafting, or even making of orchards without grafting; and from a nurſery of this kind we may have as many different ſorts of apples as we raiſe plants, although the ſeeds come all from the ſame tree.

You may now have plantations of apples, grafted upon paradiſe ſtocks, in pots; they will bear when the trees are very ſmall, and very greatly ſet off an entertainment, being placed growing upon a table among diſhes of fruit.

Tranſplant trees of all ſorts, and lay up acorns and maſt in ſand; lay bare the roots of old unthriving forward blowing trees; ſtir up new-planted ground; and lay in a good ſtock of untried earth to be ready upon all occaſions, for fruit-trees, ever-greens, and flowers.

Kitchen-Garden.

This is the proper ſeaſon to lay up roots for winter-ſtore, ſuch as carrots and parſnips; take the roots of turnips out of the ground, and lay them up in ſand; make plantations of currants and gooſeberries, from the ſuckers or cuttings.

The firſt week of this month ſow cucumbers on the natural ground, to be afterwards tranſplanted into pots, for the convenience of ſheltering from cold nights, till a hot-bed is prepared for them. This is better than to begin after the uſual method in December or January.

Make plantations of lettuce, for winter-uſe: tranſplant

cabbages

cabbages and cauliflower plants. Take up thofe cauliflower plants which begin to flower, tie their leaves together, and bury their roots and ftalks in fand, in a cellar, or fome cool place. Cut artichokes with long ftalks, and preferve them in the houfe by fetting their ftalks in fand. Earth up and drefs fuch artichokes as have done blowing: and continue to earth up fcllery for blanching.

Sow kidney-beans in bafkets under a fouth wall, to be afterwards forwarded by hot-beds, for early beans; and hot-fpur peas, and Spanifh beans, in fome well expofed border, under a wall or a hedge. Sow alfo radifhes in fome warm place, to draw early in the fpring; and creffes, lettuce, muftard, fpinach, *&c.* upon a decayed hot-bed: Put likewife fome roots of mint upon a gentle hot-bed for winter fallads.

NOVEMBER.

Flower-Garden.

You may now cut down the ftalks of fuch tall blowing flowers as have done bloffoming within three inches of the root. Tie up all trees and fhrubs to ftakes, otherwife by their being loofe, and at liberty, the winds will deftroy them. Lay up heaps of earth for your feveral forts of flowers, and make the proper mixtures for exotics; obferving, that where the ground is too ftiff, it may be brought to a ftate of loam, by adding to it a fufficient quantity of drift or fea-fand.

Peonies, and fome fibrous roots, may now be planted. If the weather be open, you may yet tranfplant rofes, jeffamines, honeyfuckles, fyringa, and lilac. Unnail your paffion-trees from the wall, and lay them upon the ground, that in cafe of fevere frofts they may be covered with ftraw.

Plant hyacinths, jonquils, narciffus's, and polyanthus's, in pots, and plunge them into hot-beds, to bloffom about Chriftmas: lay down your auricula pots upon their fides, the plants towards the fun, to drain them from moifture, and preferve them from frofts; and fhelter young feedling bulbs from the froft, but give them daily airings.

Fruit-Garden.

The bufinefs of this month being principally planting, it may be neceffary to give the reader directions for bringing fruits to perfection in the winter, fo as to have, by a particular management in planting, ripe fruit throughout the year.

Apricots, cherries, early peaches, nectarines, currants, goofeberries, are to be planted in the following manner, againft a paling of five feet high: the ftakes to fupport this paling muft be fet about four feet diftance from one another; to which you are to nail whole deal-boards of twelve feet long, well-jointed to one another, and ploughed on the edges, fo as to fet in laths, that thereby the fteam of the dung, which is to lie at the back, may not get among the plants; becaufe wherever fuch fteam comes, it will caufe mildews.

The deals are to be an inch in thicknefs; for if they are not quite fo thick, the trees will be apt to be fcorched upon the firft application of the hot dung; and if they are thicker, the artificial heat applied to their backs, upon the time it begins to decline, will not be powerful enough to warm thoroughly, and then the dung muft be oftener refrefhed.

When the paling is up, you are to mark out a border on the fouth fide of it, about four feet wide; and on the outfide of the border, faften to the ground, in a ftraight line, fome fcantlings of wood about four inches thick, to reft glafs lights upon, which are to flope back to the paling, to fhelter the fruit as occafion requires: between thefe glafs-lights, there muft be bars cut of whole deal, about four inches wide, for the glaffes to reft upon; and the bars muft always remain fixed, as in a frame for a hot-bed.

There muft be a door, fhaped to the profile of the frame, at each end, to be opened, either the one or the other, as the wind happens to blow, ever obferving that the door be opened on that fide only which is moft free from the wind.

You may plant fruit-trees in a frame of this fort the fame fummer it is made, and the trees will take very good root before winter, and be fo well ftored with fap againft the following fpring, that they will fhew no fign of their removal, but bear extremely. Befides, by this fummer planting, the trees feldom or never throw away their ftrength in autumn-fhoots, or make any attempts towards it, till September and October, when the frofts prevent their defign.

The trees planted muft have time allowed for the juices to digeft, before you begin to force them: therefore the hot dung is not to be applied to the back of the paling before November.

About the middle of this month, or towards the end, is the time to bring ripe cherries in February: and at the fame time likewife the heat may be ufed for apricots, fo as to make the mafculine apricots as large as duke cherries by February, and ripen them the beginning of April. The Anne peach will ripen about the end of April, as will alfo feveral forts of forward plumbs.

The early nectarine thus forced will ripen with the mafculine apricot: we may have green goofeberries fit for tarts in January and February; and ripe goofeberries and currants in March and April; but cherries do not bear this alteration in nature fo well.

The grapes that do beft for this fort of work, are, the royal mufcadine, marlmorfe, black fweet water, and black morillon: the beft forts of the forward peaches, nectarines, cherries, and plumbs, and the Dutch rafpberry, fhould be ever fixed on for forcing in the above manner. A row or two of ftrawberries may alfo be planted in this frame, which would ripen at the end of February, or beginning of March; and amongft the fruit you may mix here and there a monthly rofe-tree; and have a border planted with early tulips, hyacinths, jonquils, narciffus's, and other flowers, which by the forcing heats would make a kind of fummer all the winter.

The trees planted in thefe frames muft be clofe to the paling, contrary to the methods of planting againft walls;

for the roots will run under the pales, and draw nouriſhment equally from the earth about them ; but with walls it is otherwiſe.

The trees need not be planted at a greater diſtance than four or five feet; and thoſe that have ſtood ſeven or eight years againſt walls, may be removed to theſe forcing-frames without any danger: as to pruning theſe trees, the ſame method is to be followed as recommended for other trees in February; but the ſeaſon for doing it is not the ſame; for in the forcing frames our ſpring begins in November; but in the other caſe it does not begin till the end of January, or beginning of February.

The trees are to be pruned and nailed to pales about a week before the forcing heat is applied, and all the glaſſes put up as ſoon as they are pruned.

The hot-dung intended to be laid at the back of the pales, ſhould be toſſed up in an heap ſome days before it is uſed, that it may yield an heap every where alike: when it is fit to be applied to the pales, lay it four feet wide at the baſe; and let it ſlope to two feet at the top, the height in all being at firſt within four inches of the top of the pales, and in about ſix weeks time it will ſink to four feet, when you are to apply freſh dung. The bloſſoming of the tree is very much helped by covering them with the glaſs lights in froſty weather: but they ſhould not be denied the rain, if the weather be tolerably mild, till the buds begin to ſtir; after that, the glaſſes to remain over them conſtantly, till the ſun begins to have ſome power.

When the ſun ſhines warm, and the wind is not too ſharp, give the air at the front of your frame; and if this does not happen during a fortnight's ſpace, then give air at the end, and put up mats or canvas to correct the winds, and cauſe the air to circulate in the frames.

About three changes of dung will be ſufficient to bring your cherries to ripeneſs in February, allowing each parcel to remain a month at the back of the pales: but if April proves cold, the forcing heat is to be continued till May, for plumbs, peaches, nectarines, and apricots.

Kitchen-Garden.

Hot beds for aſparagus ſhould now be made; alſo gentle hot-beds for the cucumbers and kidney-beans ſown in October: continue to ſow radiſhes, lettuce, creſſes, ſpinach, *&c.* on a hot-bed; and if your nurſery is without roots, provide them from ſome old plantations.

Sow peaſe, and beans of the hotſpur and Spaniſh kinds, in open ground; and if the weather be fair, earth up thoſe ſown in September. Earth up ſellery, and tie up endive plants for blanching: and this is the beſt time to cut down aſparagus haulm, when it is turned yellow; it muſt be cut within two or three inches of the ground, and the earth of the alleys flung up upon the beds; or if the aſparagus be worn, you are to give it a covering of rich dung, not quite rotten: and cover well your artichokes with long dung, to defend them from froſts, otherwiſe they will be deſtroyed in a ſevere winter. Houſe, and cover with ſand, carrots, parſnips, *&c.* and houſe cabbages.

You muſt now trench your ground, and lay it up in ridges to mellow; and in a froſty ſeaſon wheel on dung and other manures upon ſuch places as want to be enriched.

Plants are to be guarded againſt froſts, and ſheltered againſt cold rains; and trees muſt be ſtaked, to defend them againſt violent winds, common in this month.

DECEMBER.

Flower-Garden.

You ſhould now cover the beds of choice anemonies, hyacinths, and ranunculus's; pick off dead and rotten leaves from all exotic plants; lay mulch about the roots of new-planted trees and ſhrubs; cover the pots of ſeedling flowers; turn over the earth prepared for the flower garden, that the froſt may make it mellow; and mix up ſome new heaps, that there may be a ſufficient quantity ready for uſe eight or ten months before it is wanted.

You muſt not be too haſty in warming your green-houſe with artificial heats, but let in as much ſun as poſſible, which being a natural heat, is the moſt agreeable to your tender plants. The chief buſineſs is to keep out froſts; to effect which, the doors and windows of your green-houſe muſt be well matted, and guarded from the piercing air.

But as no plant can live without air, therefore to recruit it in the houſe, and feed the plants therewith without pinching them, it is adviſeable, that at the end of your green-houſe there ſhould be an antichamber, through which you are to paſs to the houſe; which chamber will have freſh air from abroad every time you go into it; and upon opening the door of it into the green-houſe, the air will there mix with the other that has been pent up, and impregnate it with new parts, by which means, it will contribute to the vegetation of plants, without coming upon them too ſuddenly.

Fruit-Garden.

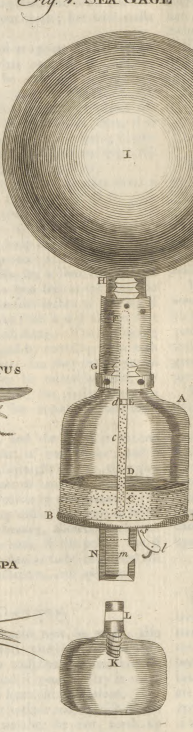
Continue to prune vines; prune and nail wall-fruit trees, alſo ſuch ſtandards as are hardy; examine orchard trees, and take away ſuch branches as make confuſion; covering every conſiderable wound with a mixture of bees wax, roſin, and tar, in equal quantities, and of tallow about half the quantity of any of the others; which are to be melted together in an earthen veſſel well glazed; and, with a painting bruſh dipped into it, the wound is to be covered: deſtroy ſnails in every part of your garden; and you may, if the weather proves mild, remove or plant moſt ſorts of hardy trees that in the winter ſhed their leaves.

Kitchen-Garden.

If the ſeaſon proves mild, you may earth up thoſe artichokes which were in the former months neglected; in doing which, if the ground is not very good, bury ſome rotten dung in it, which will greatly promote the growth of your artichokes in the ſpring following.

Towards the middle of the month, make a hot-bed for aſparagus,

Fig. 1. SEA GAGE



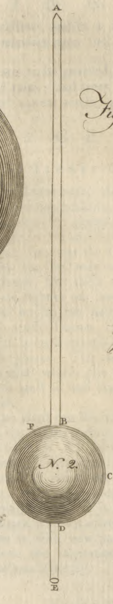
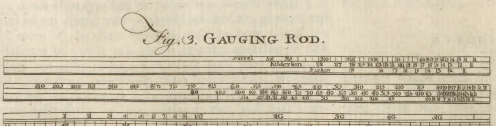


Fig. 5.
GRYLLUS LAURIFOLIUS

Fig. 4.
GRYLLUS ACUMINATUS

Fig. 6.
GRYLLUS GRYLLOTALPA

Fig. 3. GAUGING ROD.



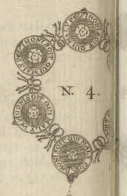
N. 1.

Fig. 2. Order of the GART

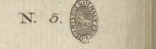
N. 2.

N. 3.

N. 4.



N. 5.



A. Bell Sc

aſparagus, in like manner as that made in November. Sow upon hot-beds, lettuce, radiſh, creſſes, muſtard, and other herbs which are hot, to cut for ſmall ſallads.

In open weather you may ſow early peas and beans of the ſame kinds, and in the ſame manner, as directed in November and the preceding months; and as vermin now very much deſtroy your roots and ſeeds, you are to ſet traps to catch them.

You ſhould, when the weather is not too ſevere, uncover the cauliflower plants every day, that they may enjoy the benefit of the air, otherwiſe they will be very weakly; and in dry weather take up ſellery, and endive to blanch.

Great care muſt now be taken of the muſhroom-beds; they ſhould be covered with freſh dry ſtraw, ſo thick as to keep out the wet; for as, where proper care is taken, there will be a conſtant ſupply of them for the table in the moſt rigorous ſeaſon, ſo, when they are neglected, the produce will be ſmall in proportion.

GARGARISM, in medicine, is ſometimes taken, in a large ſenſe, for every collution of the mouth; but, ſtrictly ſpeaking, it ſignifies a liquid medicine, appropriated to affections of the mouth, gums, fauces, larynx, and ſometimes of the head, received into the mouth, and there uſed by way of collution, without deglutition.

GARLAND, a ſort of chaplet made of flowers, feathers, and ſometimes precious ſtones, worn on the head, in manner of a crown.

GARLAND alſo denotes ornaments of flowers, fruits, and leaves, intermixed; anciently much uſed at the gates of temples, where feaſts and ſolemn rejoicings were held; or at any other place where marks of public joy or gaiety were required, as at triumphal arches, tournaments, *&c.*

GARNET, in natural hiſtory, a very beautiful gem, of a red colour, with an admixture of bluiſh.

When pure and free from blemiſhes, it is little inferior, in appearance, to the oriental ruby, though only of a middle degree of hardneſs between the ſapphire and common cryſtal. It is found of various ſizes, from that of a pin's head to an inch in diameter.

Among our lapidaries and jewellers, genuine garnets are known by different names according to their different degrees of colour. 1. The garnet, ſimply ſo called, is the fineſt and moſt valuable kind, being of a very deep blood red, with a faint admixture of blue. 2. The rock-ruby, a name very improperly given to the garnet, when it is of a very ſtrong but not deep red, and has a fairer caſt of the blue: this is a very beautiful gem. 3. The ſorane or ſerain garnet, that of a yet brighter red, approaching to the colour of native cinnabar, with a faint blue tinge. 4. The almandine, a garnet only a little paler than that called the rock-ruby.

Garnets are very properly diſtinguiſhed into the oriental and occidental kinds, as being found in Europe as well as the Eaſt Indies. The oriental ones are principally brought from Calicut, Cananor, and Cambay; and the European ones are common in Italy, Hungary, and Bohemia.

Some authors have ſuppoſed the deeper-coloured garnet to be the ſame with the carbuncle of the ancients; from which it really differs; ſince, on receiving the ſun's beams, it never gives ſo true a fire-colour as the carbuncle.

GARONNE, a large river of France, which taking its riſe in the Pyrenean mountains, runs north-weſt by the city of Tholouſe, divides the provinces of Guienne and Gaſcony, and, viſiting the city of Bordeaux, falls into the bay of Biſcay, about ſixty miles below that city. It has alſo a communication with the Mediterranean, by means of the royal canal of Lewis XIV. The tide flows up this river twenty miles above Bourdeaux.

GARTER, a ligature for tying up the ſtocking; but particularly uſed for the badge of a noble order of knights, hence denominated the

Order of the GARTER, a military order of knighthood, the moſt noble and ancient of any lay-order in the world, inſtituted by Edward III. This order conſiſts of twenty-ſix knights-companions, generally princes and peers, whereof the king of England is the ſovereign or chief. They are a college or corporation, having a great and little ſeal.

Their officers are a prelate, chancellor, regiſter, king at arms, and uſher of the black rod. They have alſo a dean with twelve canons, and petty canons, vergers, and twenty-ſix penſioners or poor knights. The prelate is the head. This office is veſted in the biſhop of Wincheſter, and has ever been ſo. Next to the prelate is the chancellor; which office is veſted in the biſhop of Saliſbury, who keeps the ſeals, *&c.* The next is the regiſter, who by his oath is to enter upon the regiſtry, the ſcrutinies, elections, penalties, and other acts of the order, with all fidelity. The fourth officer is garter, and king at arms, being two diſtinct offices united in one perſon. Garter carries the rod and ſceptre at the feaſt of St George, the protector of this order, when the ſovereign is preſent. He notifies the elections of new knights, attends the ſolemnity of their inſtallations, carries the garter to the foreign princes, *&c.* He is the principal officer within the college of arms, and chief of the heralds. See KING *at arms.*

All theſe officers, except the prelate, have fees and penſions. The college of the order is ſeated in the caſtle of Windſor, with the chapel of St George, and the charter-houſe, erected by the founder for that purpoſe. The habit and enſign of the order are, a garter, mantle, cape, george, and collar. The four firſt were aſſigned the knights-companions by the founder; and the george and collar by Henry VIII. The garter (Plate LXXXVI. fig. 2. N° 1.) challenges pre-eminence.

nence over all the other parts of the drefs, by reafon that from it the noble order is denominated; that it is the firft part of the habit prefented to foreign princes, and abfent knights, who, and all other knights-elect, are therewith firft adorned; and it is of fo great honour and grandeur, that by the bare inveftiture with this noble enfign, the knights are efteemed companions of the greateft military order in the world. It is worn on the left leg between the knee and calf, and is enamelled with this motto, HONI SOIT QVI MAL Y PENSE; i. e. *Shame to him that thinks evil hereof:* The meaning of which is, that king Edward having laid claim to the kingdom of France, retorted fhame and defiance upon him that fhould dare to think amifs of the juft enterprize he had undertaken, for recovering his lawful right to that crown; and that the bravery of thofe knights whom he had elected into this order, was fuch as would enable him to maintain the quarrel againft thofe that thought ill of it.

The mantle (*ibid.* N° 2.) is the chief of thefe veftments made ufe of upon all folemn occafions The colour of the mantle is by the ftatutes appointed to be blue. The length of the train of the mantle only diftinguifhes the fovereign from the knights-companions. To the collar of the mantle is fixed a pair of long ftrings, anciently wove with blue filk only, but now twifted round, and made of Venice gold and filk, of the colour of the robe, with knobs, or buttons, and taffels at the end. The left fhoulder of the mantle has, from the inftitution, been adorned with a large garter, with the device, HONI SOIT, *&c.* within this is the crofs of the order, which was ordained to be worn at all times by king Charles I. At length the ftar was introduced, being a fort of crofs irradiated with beams of filver. (*ibid.* N° 3.)

The collar (*ibid.* N° 4) is appointed to be compofed of pieces of gold in fafhion of garters, the ground enamelled blue, and the motto gold.

The manner of electing a knight companion into this moft noble order, and the ceremonies of inveftiture are as follow. When the fovereign defigns to elect a companion of the garter, the chancellor belonging to this order draws up the letters, which, paffing both under the fovereign's fign-manual and fignet of the order, are fent to the perfon by garter principal king at arms; and are in this manner, or to the fame effect: "We, with the companions of our moft noble "order of the garter, affembled in chapter, holden this "prefent day at our caftle at Windfor, confidering the "virtuous fidelity you have fhewn, and the honour-"able exploits you have done in our fervice, by vin-"dicating and maintaining our right, *&c.* have e-"lected and chofen you one of the companions of our "order. Therefore, we require you to make your "fpeedy repair unto us, to receive the enfigns thereof, "and be ready for your inftallation upon the — day "of this prefent month, *&c.*"

The garter, which is of blue velvet bordered with fine gold-wire, having commonly the letters of the motto of the fame, is, at the time of election, buckled upon the left leg, by two of the fenior companions, who receive it from the fovereign, to whom it was prefented upon a velvet cufhion, by garter king at arms, with the ufual reverence, whilft the chancellor reads the following admonition, enjoined by the ftatutes: "To the honour of God omnipotent, and in "memorial of the bleffed martyr St George, tie about "thy leg, for thy renown, this noble garter; wear "it as the fymbol of the moft illuftrious order, ne-"ver to be forgotten or laid afide; that thereby "thou mayeft be admonifhed to be courageous; and, "having undertaken a juft war, in which thou fhalt "be engaged, thou mayeft ftand firm, valiantly fight, "and fucceffively conquer."

The princely garter being then buckled on, and the words of its fignification pronounced, the knight elect is brought before the fovereign, who puts about his neck, kneeling, a fky-coloured ribbon, (*ibid.* N° 5.) whereunto is appendant, wrought in gold within the garter, the image of St George on horfeback, with his fword drawn, encountering with the dragon. In the mean time, the chancellor reads the following admonition: "Wear this ribbon about thy neck, adorned "with the image of the bleffed martyr and foldier of "Chrift, St George, by whofe imitation provoked, "thou mayft fo overpafs both profperous and adverfe "adventures, that having ftoutly vanquifhed thy ene-"mies, both of body and foul, thou mayft not only "receive the praife of this tranfient combat, but be "crowned with the palm of eternal victory."

Then the knight elected kiffes the fovereign's hand, thanks his majefty for the great honour done him, rifes up, and falutes all the companions feverally, who return their congratulations. N° 2. (*ibid.*) exhibits a view of a knight of the garter in the habit of this order.

Since the inftitution of this order, there have been eight emperors, and twenty-eight kings, befides numerous fovereign princes, enrolled as companions thereof. Its origin is fomewhat differently related: the common account is, that it was erected in honour of a garter of the countefs of Salifbury, which fhe dropped dancing with king Edward, and which that prince picked up: but our beft antiquaries think it was inftituted on account of the victory over the French at Creffy, where the king ordered his garter to be difplayed as a fignal of the battle.

GASCOIN, or GASCOIGN, denotes the hinder thigh of a horfe, which begins at the ftifle, and reaches to the ply or bending of the ham.

GASCONY, the moft fouth-weft province of France, bounded by Guienne, on the north; by Languedoc, on the eaft; by the Pyrenees, which feparate it from Spain, on the fouth; and by the Bay of Bifcay, on the weft.

CASSENHOVEN, or GUTZENHOVEN, a town of the Auftrian Netherlands, fifteen miles eaft of Louvain: E. long. 50°, and N. lat. 5° 55′.

GASTEROSTEUS, in ichthyology, a genus of fifhes belonging to the order of thoracici. There are three

rays

rays in the membrane of the gills; the body is carinated; and there are some distinct prickles before the back-fin. There are eleven species, distinguished by the number of prickles on the back.

GASTRIC, in general, something belonging to the stomach.

GASTROCNEMIUS, in anatomy. See ANATOMY, p. 209.

GASTROCNEMIUS is also the name of one of the extensor-muscles of the foot.

GASTROMANCY, a method of divination by water, practised by the ancient Greeks.

GASTRORAPHY, in surgery, the operation of sewing up wounds of the abdomen See SURGERY.

GATE, in architecture. See ARCHITECTURE, p. 356.

GATTON, a borough-town of Surry, sixteen miles south of London, which sends two members to parliament.

GAVEREN, or WAVEREN, a town of the Austrian Netherlands, situated on the east bank of the river Scheld: E. long. 3° 35′, N. lat. 51°.

GAUGE-POINT of a solid measure, the diameter of a circle whose area is equal to the solid content of the same measure.

GAUGER, a king's officer, who is appointed to examine all tuns, pipes, hogsheads, and barrels of wine, beer, ale, oil, honey, *&c.* and give them a mark of allowance, before they are sold in any place within the extent of his office.

GAUGING. See GEOMETRY.

GAUNT-BELLIED, in the menage, is said of a horse whose belly shrinks up towards his flanks.

GAWSE, or GAWZE, in commerce, a very slight, thin, open kind of stuff, made of silk, and sometimes of thread; there are also figured gawzes, and some with gold or silver flowers on a silk ground.

GAZELLA, in zoology. See CAPRA.

GAZETTE, a news-paper, or printed account of the transactions of all the countries in the known world, in a loose sheet, or half-sheet. This name is with us confined to that paper of news published by authority.

The word is derived from *gazetta*, a Venetian coin, which was the usual price of the first news-papers printed there, and which was afterwards given to the paper itself.

GELATINOUS, in pharmacy and medicine, any thing approaching to the glutinous consistence of a gelatina or jelly. See JELLY.

GELDERLAND, comprehending Zutphen, is a province of the United Netherlands, bounded by the Zuider-sea and Overyssel on the north, by Westphalia on the east, by Brabant on the south, and by the province of Utrecht on the west.

GELDING, the operation of castrating any animal.

GELDERS, a city of Gelderland, situated twenty-three miles south of Nimeguen: E. long. 6° 8′, and N. lat. 51° 35′.

GELENHAUSEN, an imperial city of Germany, governed by its own magistrates; it is situated nine miles north of Hanau: E. long. 8° 50′, and N. lat. 50° 15′.

GEM, in natural history, a common name for all precious stones; of which their are two classes, the pellucid and semi-pellucid.

The bodies composing the class of pellucid gems are bright, elegant, and beautiful fossils, naturally and essentially compound, ever found in small detached masses, extremely hard, pellucid, and of great lustre; composed of a very firm and pure matter, without any admixture of earthy substance, giving fire without steel, not fermenting with acid menstruums, and very difficultly calcinable in the fire.

The bodies composing the class of semi-pellucid gems are, stones naturally and essentially compound, not inflammable nor soluble in water, found in detached masses, and composed of crystalline matter, debased by earth: however, they are but slightly debased, and are of great beauty and brightness, of a moderate degree of transparency, and are usually found in small masses.

GEMARA, in Jewish antiquity, a collection of decisions and determinations on the law, written after the Misna was completed.

It was called *gemara*, or *perfection*, because it was considered as so perfect an explication of the law, that after it no further additions could be made, or any thing more desired. It is otherwise called the talmud. See TALMUD.

GEMBLOURS, a town of the Austrian Netherlands, in the province of Brabant, situated on the river Orne, ten miles north-west of Namur: E. long. 4° 30′, and N. lat. 50° 30′.

GEMELLUS, in anatomy. See ANATOMY, p. 205.

GEMINI, the TWINS, in astronomy, one of the twelve signs of the zodiac, the third in order, beginning with aries. See ASTRONOMY.

GEMMA, in natural history. See GEM.

GEMUND, a town of Germany, in the circle of Westphalia, and dukedom of Juliers, situated on the river Roer: E. long. 6° 15′, and N. lat. 50° 34′.

GEMUND, a town of Germany, in the circle of Swabia, and county of Rechsberg, situated on the river Rems: E. long. 9° 40′, and N. lat. 48° 45′.

GEMUND, a town of Germany, in the circle of Franconia, situated on the river Maine: E. long. 9° 45′, and N. lat. 50° 8′.

GENDARMES, or GENS D'ARMES, in the French armies, a denomination given to a select body of horse, on account of their succeeding the ancient gendarmes, who were thus called from their being completely clothed in armour.

The king's body-guards, the light horse of the royal house, and the musqueteers, are at present reputed to belong to the gendarmerie.

The grand gendarmes are a troop composed of about 250 gentlemen, who guard the king's person. The king himself is their captain, and one of the prime peers their captain-lieutenant, who has under him two lieutenants, three ensigns, three guidons, and other officers. There are, besides these, gendarmes of the queen, the dauphin, *&c.*

GENDER, among grammarians, a division of nouns, or names, to distinguish the two sexes.

This was the original intention of gender; but, afterwards, other words which had no proper relation, either to the one sex or the other, had genders assigned them, rather out of caprice than reason; which is at length established by custom. Hence genders vary according to the languages, or even according to the words introduced from one language into another. Thus *arbor*, in Latin, is feminine; but *arbre*, in French, is masculine: and *dens*, in Latin, is masculine; but *dent*, in French, is feminine.

GENEALOGY, an enumeration of a series of ancestors; or a summary account of the relations and alliances of a person or family, both in the direct and collateral line.

GENEP, a town in the dutchy of Cleeve, in Germany, situated on the Nierse and Maese, ten miles west of Cleeve: E. long. 5° 30′, and N. lat. 51° 40′.

GENERAL, an appellation given to whatever belongs to a whole genus. See GENUS.

GENERAL CHARGE, in law. See CHARGE *to enter heir*.

GENERAL TERMS, among logicians, those which are made the signs of general ideas.

GENERAL *of an army*, in the art of war, he who commands in chief.

The office of a general is, to regulate the march and encampment of the army; in the day of battle to chuse out the most advantageous ground; to make the disposition of the army; to post the artillery; and where there is occasion, to send his orders by his aids de camp. At a siege, he is to cause the place to be invested; to order the approaches and attacks; to visit the works; and to send out detachments to secure his convoys.

GENERATING LINE, or FIGURE, in geometry, is that which by its motion produces any other plane or solid figure.

GENERATION, in physiology, the act of procreating and producing a being similar to the parent.

According to Aristotle, the male animals contain the principle, and the female the matter of generation: for though both were furnished indeed with a seminal liquor, yet the semen of the males alone was prolific. The moderns, on the other hand, as well those who contend for the system of generation from eggs, as they who adopt that of the animalcules in the male-seed, pretend that females have no such seminal liquor at all, and that what was commonly taken for it was some other animal fluid.

Harvey is of opinion, that all females are furnished with eggs, and that the embryos, or young animals, are formed in the same manner as a chick in the egg of any bird. Generation, according to this celebrated physician, is effected wholly by means of the uterus, or womb; which conceives the fœtus by a kind of contagion communicated to it by the male-seed, much in the same way as the load-stone communicates magnetism to iron. This contagion, he thinks, acts not only on the uterus, but is communicated to the whole body of the female, which is altogether prolific; tho' the uterus, he acknowledges, is the only part that is capable of conceiving the fœtus, just as the brain is alone capable of forming ideas and notions. Agreeable to this doctrine of Harvey, Steno and other anatomists have pretended to discover certain eggs in the ovaries or testicles of women; which Mr Buffon denies to be the case, affirming, that there are no such eggs to be found in the ovaries or testicles of women.

We cannot enter into a detail of the reasonings for and against the system of generation from eggs; and shall therefore only observe, that its advocates pretend to have discovered eggs in all the females on which they made observations; that the largest of those found in women did not exceed the bigness of a pea; that they are extremely small in young girls under fourteen, but that age and commerce with men makes them grow larger; that there are more than twenty such eggs in each ovary or testicle; that they are fecundated in the ovary by the spirituous and volatile part of the male-seed; that they afterwards are detached and fall into the uterus through the Fallopian tubes; that here the fœtus is formed of the internal substance of the egg, and the placenta of the exterior part.

Leewenhoek is the author of another system of generation, from animalcules in the male seed. He tells us, he discovered many thousands of these in a drop less than a grain of sand. They are found in the semen of all males whatever, but not in that of females; and are so small, that 3,000,000,000 of them are not equal to a grain of sand, whose diameter is but the hundredth part of an inch. When any of these animalcules gets into an egg, fit to receive it, and this falls into the womb through the Fallopian tubes, the humours which distil through the vessels of the womb, penetrating the coats of the egg, swell and dilate it, as the sap of the earth does seed thrown into it. The placenta begins to appear like a little cloud, upon one side of the external coat of the egg; and, at the same time, the spine of the embryo-animalcule is grown so big, as to become visible; and a little afterwards, the cerebrum and cerebellum appear like two bladders; and the eyes stand next goggling out of the head; then the beating of the heart, or punctum saliens, is plainly to be seen; and the extremities discover themselves last of all.

These animalcules are of different figures, some like tadpoles, and others like eels. In the semen of a man, and in that of a dog, there have been discovered two different kinds of them, the one supposed to be males and the other females. Some even pretend to have seen animalcules disengage themselves from the membranes that surround them; and that they then appeared perfectly like men, with legs, arms, *&c.* like those of the human body!

All the advocates for the system of generation from animalcules strongly oppose that from eggs. They contend, that these animalcules cannot be looked upon as the inhabitants of the semen, since they were of greater extent than the liquor itself; not to mention, that no such animals are found in any other liquors of the body; and since females have nothing similar to these animals, they think it manifest that the prolific

principle

principle resides in males. When they are asked, to what purpose serves such an immense profusion of human animalcules? they answer, that it is agreeable to the ordinary course of nature, both in the animal and vegetable part of the creation. They likewise strengthen their system, by alledging the many examples we have of similar transformations in the insect-class of animals, which, from caterpillars and small worms, become winged animals of the butterfly or fly kinds.

By this system, says Mr Buffon, the first woman cannot be said to have contained the whole race of mankind, as being all, according to it, the true posterity of the first man, and in their animalcule state contained only in him. On this principle, he proceeds to invalidate the system of generation from animalcules: for supposing the size of a man to be 1, then will that of one of the spermatic animalcules be $\frac{1}{1000000000}$; and as a man is to an animalcule of the first generation in the same ratio that this animalcule is to an animalcule of the second generation, it follows, that this last will be expressed by the fraction $\frac{1}{1000000000000000000}$. In this manner he computes the size of the animalcules of several generations, all supposed to be living animals, notwithstanding that their minuteness exceeds the power of imagination to conceive; and then tells us, that the system of generation from eggs is liable to the same objections, whereof the detail may be seen in his Hist. Natur. tom. II. p. 157, *& seq.*

As to Buffon's own system, he thinks that every part, both of animals and vegetables, contains an infinite number of organic molecules; that these molecules assume successively different forms, and are put into different motions, according to the circumstances they are in; but that they are much more numerous in the seminal liquors of both sexes, and the seeds of plants, than in other parts; that these organic molcules make the matter of nutrition; that this matter is always active, and tends to organization, forming itself into different shapes, according to the moulds it meets with. When the quantity of this organic matter is but small, as in man, and most large animals, generation only takes place at the age of maturity, and even then the number of animals produced is but small. The case is just the reverse in animals which abound with this matter, as in fishes, and most birds.

With respect to the generation of mankind, the same author thinks it a certain fact, that the male-seed is received into the womb of the woman; and that, for this purpose, it is highly probable the internal orifice opens during the act of coition. The female-seed also makes its way into the womb, where, being mixed with that of the male, they both together contribute to the formation of the fœtus; which is either male or female, according as the seed of the man or woman abounds most with organic molecules; and the infant resembles either father or mother, according to the different combinations of these molecules. Both these seminal liquors he thinks equally active in the formation of the fætus, and that they fix and counterbalance each other; the molecules of each parent being thereby determined to form similar parts to those of the individual that furnished them, as the head, trunk, arms, legs, *&c.* He thinks the molecules proceeding from the genital parts fix themselves first; and that the other molecules arrange themselves successively round these, in the same order which they before occupied in the parent. When a great quantity of the seminal liquors of both sexes is received into the womb, there are formed different spheres of attraction, in different parts of these liquors; the consequence of which is, that several fœtuses are formed at the same time.

Nearly a kin to Mr Buffon's system is that of Mr Maupertuis, which he has explained in his Venus Physique. He observes, that all the variety observable among mankind, may have been accidental at first; but being once established in the constitution of the parents, they become natural to their posterity. To illustrate this, he gives an instance of a sexdigitary family at Berlin, who had six fingers, or six toes, and frequently both; and that this peculiarity was transmitted equally by the father and mother, but was lost by alliances with those who had but the usual number of fingers or toes.

He farther observes, that most animals, excepting mankind, have stated seasons for procreation; and that the females go with young some a longer, others a shorter time. Mares go from eleven to twelve months; cows and hinds go nine months, as do also women; foxes and wolves, five months; and bitches go only seven weeks; cats nine weeks; and rabbits but thirty-one days. Most birds are hatched in twenty-one days; the canary birds, and some others, are hatched in thirteen or fourteen days. It appears, therefore, that there is an endless variety in the time and manner of the generation of animals.

Whoever reads this short sketch of the different theories of generation that have hitherto been invented, will probably require no other arguments to convince him, that physicians and philosophers are still as ignorant of the nature of this mysterious operation as they were in the days of Noah.

Parts of GENERATION. See ANATOMY, p. 270.

GENERATION *of Plants*. See BOTANY, p. 643.

GENESIS, among mathematicians, signifies the formation or production of some figure or quantity.

GENESIS, among divines, a canonical book of the Old Testament, and the first of the pentateuch or five books of Moses. The Hebrews call it Bereschith, or, In the beginning, these being the first words in the book. The Greeks gave it the name of Genesis, from its beginning with the history of the creation of the world. See BIBLE.

GENET, GENNET, or JENNET, in the menage, denotes a small-sized well-proportioned Spanish horse.

To ride *a la genette*, is to ride after the Spanish fashion: so short, that the spurs bear upon the horse's flank.

GENEVA, a city near the confines of France and Switzerland, on the river Rhone, about sixty miles north-west of Lyons: E. long. 6°, N. lat. 46° 20′.

Geneva is a fortified town, about two miles in circumference, situated at the west end of a lake sixty miles long, and twelve broad, called the lake of Geneva.

neva. It is a republic, governed by a council of 200, and a fenate of twenty five members; and is faid to contain 30,000 inhabitants.

GENEVA, or GIN, among diftillers, an ordinary malt fpirit, diftilled a fecond time, with the addition of fome juniper-berries.

Originally, the berries were added to the malt in the grinding; fo that the fpirit thus obtained was flavoured with the berries from firft, and exceeded all that could be made by any other method. At prefent, they leave out the berries entirely, and give their fpirits a flavour by diftilling them with a proper quantity of oil of turpentine; which, though it nearly refembles the flavour of juniper-berries, has none of their valuable virtues.

GENIAL, an epithet given by the Pagans to certain gods who were fuppofed to prefide over generation.

The genial gods, fays Feftus, were earth, air, fire, and water. The twelve figns, together with the fun and moon, were fometimes alfo ranked in the number.

GENICULI, among botanifts, the knots or joints in the ftalks of plants; whence they are denominated geniculate plants.

GENIOGLOSSI, in anatomy. See ANATOMY, p. 304.

GENIOHYOIDÆUS, in anatomy. See ANATOMY, p. 304.

GENIS, a town of Savoy, fituated on the river Guier, twelve miles weft of Chambery.

GENISTA, GREEN-WEED, or DYER'S WEED, a genus of the diadelphia decandria clafs. The calix is bilabiated; the vexillum is oblong, and reflected. There are 14 fpecies, two of which are natives of Britain, *viz.* the tinctoria, or dyer's weed; and the anglica, or needle-furze.

GENITAL, an appellation given to whatever belongs to the parts of generation. See GENERATION.

GENITES, among the Hebrews, thofe defcended from Abraham, without any mixture of foreign blood.

The Greeks diftinguifhed by the name of genites fuch of the Jews as were iffued from parents, who, during the Babylonifh captivity, had not allied with any gentile family.

GENITIVE, in grammar, the fecond cafe of the declenfion of nouns. The relation of one thing confidered as belonging in fome manner to another, has occafioned a peculiar termination of nouns, called the genitive cafe: But in the vulgar tongues, they make ufe of a fign to exprefs the relation of this cafe. In Englifh they prefix the particle *of*, in French *de* or *du*, *&c.* Though in ftrictnefs there are no cafes in either of thefe languages; inafmuch as they do not exprefs the different relations of things by different terminations, but by additional prepofitions, which is otherwife in the Latin.

GENIUS, a good or evil fpirit, or dæmon, whom the ancients fuppofed fet over each perfon, to direct his birth, accompany him in life, and be his guard. See DÆMON.

The rank and office of the genii were inferior to thofe of the lares; for the latter were the tutelar gods of a family, whereas the genii had the care or government only of fingle perfons, or places.

GENIUS, in matters of literature, *&c.* a natural talent or difpofition to do one thing more than another; or the aptitude a man has received from nature to perform well and eafily that which others can do but indifferently and with a great deal of pains.

To know the bent of nature is the moft important concern. Men come into the world with a genius determined not only to a certain art, but to certain parts of that art, in which only they are cabable of fuccefs. If they quit their fphere, they fall even below mediocrity in their profeffion. Art and induftry add much to natural endowments, but cannot fupply them where they are wanting. Every thing depends on genius. A painter often pleafes without obferving rules, whilft another difpleafes though he obferves them, becaufe he has not the happinefs of being born with a genius for painting.

GENOA, a city and archbifhop's fee of Italy, and capital of a republic of the fame name, is built on a ftrand near the fea, and rifes gradually to the top of a hill; the houfes, which are lofty and well built, rifing like the feats of a theatre, afford a fine profpect at fea. The harbour is large and deep, and the principal ftreet, from one end to the other, refembles a double row of palaces: E. long. 9° 30′, and N. lat. 44° 30.

GENTIANA, in botany, a genus of the pentandria digynia clafs. The corolla confifts of one petal; the capfule has two valves, and one cell. There are twenty-eight fpecies, five of which are natives of Britain, *viz.* the pneumoanthe, or calathian violet; the amarella, or autumnal gentian; the centaurium, or leffer centaury; the campeftris, or vernal dwarf gentian; and the filiformis, or marfh century.

The root of this plant is large, remarkably tough, and of a firm texture. It is brought to us from Germany, where it is in many places cultivated as liquorice is amongft us; and it is to be chofen frefh, tough, of a middle fize, free from the fmall fibres, and well dried; tho' if it be fcorched, it is to be rejected This root is one of the beft ftomachics.

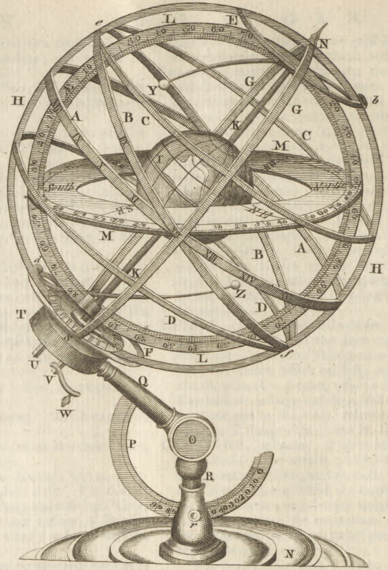
GENTILE, in matters of religion, a pagan, or worfhipper of falfe gods.

GENTILE, in the Roman law and hiftory, a name which fometimes expreffes what the Romans otherwife called barbarians, whether they were allies of Rome or not: but this word was ufed in a more particular fenfe for all ftrangers and foreigners not fubject to the Roman empire.

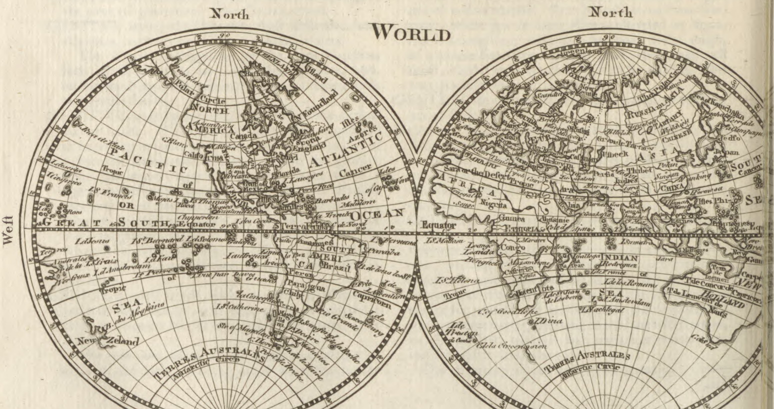
GENTLEMAN-USHER *of the black rod.* See ROD.

GENTLEMEN *of the chapel*, officers whofe duty and attendance is in the royal chapel, being in number thirty-two, whereof twelve are priefts; the other twenty, commonly called clerks of the chapel, affift in the performance of divine fervice. One of the firft twelve is chofen for confeffor of the houfhold, whofe office it is to read prayers every morning to the houfhold fervants, to vifit the fick, examine and prepare communicants, and adminifter the facrament.

One of twenty clerks, well verfed in mufic, is chofen firft



ARMILLARY SPHERE



WORLD

A Bell

firſt organiſt, who is maſter of the children, to inſtruct them in muſic, and whatever elſe is neceſſary for the ſervice of the chapel; a ſecond is likewiſe an organiſt; a thirſt, a lutaniſt; and a fourth, a violiſt.

There are likewiſe three vergers, ſo called from the ſilver-rods they carry in their hands; being a ſerjeant, a yeoman, and groom of the veſtry; the firſt attends the dean and ſub-dean, and finds ſurplices and other neceſſaries for the chapel; the ſecond has the whole care of the chapel, keeps the pews, and ſeats the nobility and gentry; the groom has his attendance within the chapel-door, and looks after it.

GENUS, among metaphyſicians and logicians, denotes a number of beings, which agree in certain general properties common to them all; ſo that a genus is nothing elſe but an abſtract idea, expreſſed by ſome general name or term.

It is plain, therefore, that by a genus we do not barely ſignify one particular thing, nor yet a plurality of things; but a ſort or kind of things, all agreeing in certain general properties.

Thus animal is ſaid to be a genus in reſpect of man and brute, in regard man and brute agree in the common nature and character of animal: ſo a right-lined figure of four ſides, is a genus in reſpect of a parallelogram, and a trapezium; and ſo likewiſe is ſubſtance, in reſpect of ſubſtance extended which is body, and thinking ſubſtance which is mind.

GENUS is alſo uſed for a character or manner applicable to every thing of a certain nature or condition: in which ſenſe it ſerves to make capital diviſions in divers ſciences, as rhetoric, anatomy, and natural hiſtory.

GENUS, in rhetoric. Authors diſtinguiſh the art of rhetoric, as alſo orations or diſcourſes produced thereby, into three genera or kinds, demonſtrative, deliberative, and judiciary.

To the demonſtrative kind belong panegyrics, genethliacons, epithalamiums, funeral harangues, *&c.*

To the deliberative kind belong perſuaſions, diſſuaſions, commendations, *&c.* To the judiciary kind belong defences and accuſations.

GENUS, in natural hiſtory, a ſub-diviſion of any claſs or order of natural beings, whether of the animal, vegetable, or mineral kingdoms, all agreeing in certain common characters. See NATURAL HISTORY.

GEOCENTRIC, in aſtronomy, is applied to a planet or its orbit, to denote it concentric with the earth, or as having the earth for its centre, or the ſame centre with the earth.

GEOGRAPHICAL MILE, the ſame with the ſea-mile; being one minute, or the ſixtieth part of a degree of a great circle on the earth's ſurface.

GEOGRAPHY.

GEOGRAPHY, the doctrine or knowledge of the terreſtrial globe; or the ſcience that teaches and explains the properties of the earth, and the parts thereof which depend upon quantity.

THE DESCRIPTION AND USE OF THE GLOBES AND ARMILLARY SPHERE.

IF a map of the world be accurately delineated on a ſpherical ball, the ſurface thereof will repreſent the ſurface of the earth: for the higheſt hills are ſo inconſiderable with reſpect to the bulk of the earth, that they take off no more from its roundneſs than grains of ſand do from the roundneſs of a common globe; for the diameter of the earth is 8000 miles, in round numbers, and no known hill upon it is three miles in perpendicular height.

For the proof of the earth's being ſpherical, ſee ASTRONOMY, p. 440.

With regard to what we call *up* and *down*, ſee ASTRONOMY, p. 445.

To an obſerver placed any where in the indefinite ſpace, where there is nothing to limit his view, all remote objects appear equally diſtant from him; and ſeem to be placed in a vaſt concave ſphere, of which his eye is the centre. The moon is much nearer to us than the ſun; ſome of the planets are ſometimes nearer, and ſometimes farther from us, than the ſun; others of them never come ſo near us as the ſun always is; the remoteſt planet in our ſyſtem, is beyond compariſon nearer to us than any of the fixed ſtars are. And yet all theſe celeſtial objects appear equally diſtant from us. Therefore, if we imagine a large hollow ſphere of glaſs to have as many bright ſtuds fixed to its inſide, as there are ſtars viſible in the heaven, and theſe ſtuds to be of different magnitudes, and placed at the ſame angular diſtances from each other as the ſtars are; the ſphere will be a true repreſentation of the ſtarry heaven, to an eye ſuppoſed to be in its centre, and viewing it all around. And if a ſmall globe, with a map of the earth upon it, be placed on an axis in the centre of this ſtarry ſphere, and the ſphere be made to turn round on this axis, it will repreſent the apparent motion of the heavens round the earth.

If a great circle be ſo drawn upon this ſphere, as to divide it into two equal parts or hemiſpheres, and the plane of the circle be perpendicular to the axis of the ſphere, this circle will repreſent the *equinoctial*, which divides the heaven into two equal parts, called the *northern* and the *ſouthern hemiſpheres*; and every point of that circle will be equally diſtant from the *poles*, or ends of the axis in the ſphere. That pole which is in the middle of the northern

northern hemiſphere, will be called the *north pole of the ſphere*; and that which is in the middle of the ſouthern hemiſphere, the *ſouth pole*.

If another great circle be drawn upon the ſphere, in ſuch a manner as to cut the equinoctial at an angle of $23\frac{1}{2}$ degrees in two oppoſite points, it will repreſent the *ecliptic*, or circle of the ſun's apparent annual motion: one half of which is on the north ſide of the equinoctial, and the other half on the ſouth.

If a large ſtud be made to move eaſtward in this ecliptic, in ſuch a manner as to go quite round it, in the time that the ſphere is turned round weſtward 366 times upon its axis; this ſtud will repreſent the *ſun*, changing his place every day a 365th part of the ecliptic; and going round weſtward, the ſame way as the ſtars do; but with a motion ſo much ſlower than the motion of the ſtars, that they will make 366 revolutions about the axis of the ſphere, in the time that the ſun makes only 365. During one half of theſe revolutions, the ſun will be on the north ſide of the equinoctial; during the other half, on the ſouth; and at the end of each half, in the equinoctial.

If we ſuppoſe the terreſtrial globe in this machine to be about one inch in diameter, and the diameter of the ſtarry ſphere to be about five or ſix feet, a ſmall inſect on the globe would ſee only a very little portion of its ſurface; but it would ſee one half of the ſtarry ſphere; the convexity of the globe hiding the other half from its view. If the ſphere be turned weſtward round the globe, and the inſect could judge of the appearances which ariſe from that motion, it would ſee ſome ſtars riſing to its view in the eaſtern ſide of the ſphere, whilſt others were ſetting on the weſtern: but as all the ſtars are fixed to the ſphere, the ſame ſtars would always riſe in the ſame points of view on the eaſt ſide, and ſet in the ſame points of view on the weſt ſide. With the ſun it would be otherwiſe, becauſe the ſun is not fixed to any point of the ſphere, but moves ſlowly along an oblique circle in it. And if the inſect ſhould look towards the ſouth, and call that point of the globe, where the equinoctial in the ſphere ſeems to cut it on the left ſide, the *eaſt point*; and where it cuts the globe on the right ſide, the *weſt point*; the little animal would ſee the ſun riſe north of the eaſt, and ſet north of the weſt, for $182\frac{1}{2}$ revolutions; after which, for as many more, the ſun would riſe ſouth of the eaſt, and ſet ſouth of the weſt. And in the whole 365 revolutions, the ſun would riſe only twice in the eaſt point, and ſet twice in the weſt. All theſe appearances would be the ſame, if the ſtarry ſphere ſtood ſtill (the ſun only moving in the ecliptic) and the earthly globe were turned round the axis of the ſphere eaſtward. For, as the inſect would be carried round with the globe, he would be quite inſenſible of its motion; and the ſun and ſtars would appear to move weſtward.

We may imagine as many circles deſcribed upon the earth as we pleaſe; and we may imagine the plane of any circle deſcribed upon the earth to be continued, until it marks a circle in the concave ſphere of the heavens.

The *horizon* is either *ſenſible* or *rational*. The *ſenſible* horizon is that circle which a man ſtanding upon a large plane obſerves to terminate his view all around, where the heaven and earth ſeem to meet. The plane of our ſenſible horizon continued to the heaven, divides it into two hemiſpheres; one viſible to us, the other hid by the convexity of the earth.

The plane of the *rational horizon*, is ſuppoſed parallel to the plane of the ſenſible; to paſs through the centre of the earth, and to be continued to the heavens. And although the plane of the ſenſible horizon touches the earth in the place of the obſerver, yet *this* plane, and that of the rational horizon, will ſeem to coincide in the heaven, becauſe the whole earth is but a point compared to the ſphere of the heaven.

The earth being a ſpherical body, the horizon, or limit of our view, muſt change as we change our place.

The *poles of the earth*, are thoſe two points on its ſurface in which its axis terminates. The one is called the *north pole*, and the other the *ſouth pole*.

The *poles of the heaven*, are thoſe two points in which the earth's axis produced terminates in the heaven; ſo that the *north pole* of the heaven is directly over the north pole of the earth; and the *ſouth pole* of the heaven is directly over the ſouth pole of the earth.

The *equator* is a great circle upon the earth, every part of which is equally diſtant from either of the poles. It divides the earth into two equal parts, called the *northern* and *ſouthern hemiſpheres*. If we ſuppoſe the plane of this circle to be extended to the heaven, it will mark the *equinoctial* therein, and will divide the heaven into two equal parts, called the *northern* and *ſouthern* hemiſpheres of the heaven.

The *meridian* of any place is a great circle paſſing through that place and the poles of the earth We may imagine as many ſuch meridians as we pleaſe, becauſe any place that is ever ſo little to the eaſt or weſt of any other place, has a different meridian from that place; for no one circle can paſs through any two ſuch places and the poles of the earth.

The *meridian* of any place is divided by the poles into two ſemicircles: that which paſſes through the place is called the *geographical*, or *upper meridian*; and that which paſſes through the oppoſite place, is called the *lower meridian*.

When the rotation of the earth brings the plane of the geographical meridian to the ſun. it is *noon* or *mid-day* to that place; and when the lower meridian comes to the ſun, it is *mid-night*.

All places lying under the ſame geographical meridian, have their noon at the ſame time, and conſequently all the other hours. All thoſe places are ſaid to have the ſame *longitude*, becauſe no one of them lies either eaſtward or weſtward from any of the reſt.

If we imagine 24 ſemicircles, one of which is the geographical meridian of a given place, to meet at the poles, and to divide the equator into 24 equal parts; each of theſe meridians will come round to the ſun in 24 hours, by the earth's equable motion round its axis in that time. And, as the equator contains 360 degrees, there will be 15 degrees contained between any two of theſe meridians which are neareſt to one another: for 24 times 15 is 360. And as the earth's motion is eaſtward, the ſun's apparent motion will be weſtward, at the rate of 15 degrees each hour. Therefore,

They whoſe geographical meridian is 15 degrees eaſtward

ward from us, have noon, and every other hour, an hour fooner than we have. They whofe meridian is fiftcen degrees weftward from us, have noon, and every other hour, an hour later than we have: and fo on in proportion, reckoning one hour for every fifteen degrees.

For the ecliptic circle, figns, and degrees, fee ASTRONOMY, p. 435.

The *tropics* are leffer circles in the heaven, parallel to the equinoctial; one on each fide of it, touching the ecliptic in the points of its greateft declination; fo that each tropic is $23\frac{1}{2}$ degrees from the equinoctial, one on the north fide of it, and the other on the fouth. The northern tropic touches the ecliptic at the beginning of Cancer, the fouthern at the beginning of Capricorn; for which reafon the former is called the *tropic of Cancer*, and the latter the *tropic of Capricorn*.

The *polar circles* in the heaven, are each $23\frac{1}{2}$ degrees from the poles, all around. That which goes round the north pole, is called the *arctic circle*. The fouth polar circle, is called the *antarctic circle*, from its being oppofite to the arctic.

The ecliptic, tropics, and polar circles, are drawn upon the terreftrial globe, as well as upon the celeftial. But the ecliptic, being a great fixed circle in the heavens, cannot properly be faid to belong to the terreftrial globe; and is laid down upon it only for the conveniency of folving fome problems. So that, if this circle on the terreftrial globe was properly divided into the months and days of the year, it would not only fuit the globe better, but would alfo make the problems thereon much eafier.

For the earth's motion round its axis every 24 hours; its motion in the ecliptic round the fun every year; and the viciffitude of feafons; fee ASTRONOMY, p. 452.

Defcription of the Terreftrial Globe. [See Plate XLIV. fig. 2.]

The equator, ecliptic, and tropics, polar circles, and meridians, are laid down upon the globe in the manner already defcribed. The ecliptic is divided into 12 figns, and each fign into 30 degrees. Each tropic is $23\frac{1}{2}$ degrees from the equator, and each polar circle $23\frac{1}{2}$ degrees from its refpective pole. Circles are drawn parallel to the equator, at every ten degrees diftance from it on each fide to the poles: thefe circles are called *parallels of latitude*. On large globes there are circles drawn perpendicularly through every tenth degree of the equator, interfecting each other at the poles: but on globes of or under a foot diameter, they are only drawn through every fifteenth degree of the equator; thefe circles are generally called *meridians*, fometimes *circles of longitude*, and at other times *hour-circles*.

The globe is hung in a brafs-ring, called the *brazen meridian*; and turns upon a wire in eace pole funk half its thicknefs into one fide of the meridian ring; by which means, *that* fide of the ring divides the globe into two equal parts, called the *eaftern* and *weftern hemifpheres*; as the equator divides it into two equal parts, called the *northern* and *fouthern hemifpheres*. The ring is divided into 360 equal parts or degrees, on the fide wherein the axis of the globe turns. One half of thefe degrees are numbered, and reckoned, from the equator to the poles, where they end at 90: their ufe is to fhew the latitudes of places. The degrees on the other half of the meridian ring are numbered from the poles to the equator, where they end at 90: their ufe is to fhew how to elevate either the north or fouth pole above the horizon, according to the latitude of any given place, as it is north or fouth of the equator.

The brazen meridian is let into two notches made in a broad flat ring, called the *wooden horizon*; the upper furface of which divides the globe into two equal parts, called the *upper* and *lower hemifpheres*. One notch is in the north point of the horizon, and the other in the fouth. On this horizon are feveral concentric circles, which contain the months and days of the year, the figns and degrees anfwering to the fun's place for each month and day, and the 32 points of the compafs.—The graduated fide of the brafs meridian lies towards the eaft fide of the horizon, and fhould be generally kept towards the perfon who works problems by the globes.

There is a fmall *horary circle*, fo fixed to the north part of the brazen meridian, that the wire in the north pole of the globe is in the centre of that circle; and on the wire is an *index*, which goes over all the 24 hours of the circle, as the globe is turned round its axis. Sometimes there are two horary circles, one between each pole of the globe and the brazen meridian.

There is a thin flip of brafs, called the *quadrant of altitude*, which is divided into 90 equal parts or degrees, anfwering exactly to fo many degrees of the equator. It is occafionally fixed to the uppermoft point of the brazen meridian by a nut and fcrew. The divifions end at the nut, and the quadrant is turned round upon it.

The Defcription and Ufe of the Armillary Sphere. [See Plate LXXXVII. Fig. 1.]

THE exterior parts of this machine are, a compages of brafs rings, which reprefent the principal circles of the heaven, *viz.* 1. The equinoctial *AA*, which is divided into 360 degrees (beginning at its interfection with the ecliptic in Aries) for fhewing the fun's right afcenfion in degrees; and alfo into 24 hours, for fhewing his right afcenfion in time. 2. The ecliptic *BB*, which is divided into 12 figns, and each fign into 30 degrees, and alfo into the months and days of the year; in fuch a manner, that the degree or point of the ecliptic in which the fun is, on any given day, ftands over that day in the circle of months. 3. The tropic of Cancer *CC*, touching the ecliptic at the beginning of Cancer in *e*, and the tropic of Capricorn *DD*, touching the ecliptic at the beginning of Capricorn in *f*; each $23\frac{1}{2}$ degrees from the equinoctial circle. 4. The arctic circle *E*, and the antarctic circle *F*, each $23\frac{1}{2}$ degrees from its refpective pole at *N* and *S*. 5. The equinoctial colure *GG*, paffing through the north and fouth poles of the heaven at *N* and *S*, and through the equinoctial points Aries and Libra, in the ecliptic. 6. The folftitial colure *HH*, paffing through the poles of the heaven,

heaven, and through the folftitial points Cancer and Capricorn, in the ecliptic. Each quarter of the former of thefe colures is divided into 90 degrees, from the equinoctial to the poles of the world, for fhewing the declination of the fun, moon, and ftars; and each quarter of the latter, from the ecliptic at *e* and *f*, to its poles *b* and *d*, for fhewing the latitude of the ftars.

In the north pole of the ecliptic is a nut *b*, to which is fixed one end of a quadrantal wire, and to the other end a fmall fun *Y*, which is carried round the ecliptic *B B*, by turning the nut: and in the fouth pole of the ecliptic is a pin *d*, on which is another quadrantal wire, with a fmall moon Z upon it, which may be moved round by hand: but there is a particular contrivance for caufing the moon to move in an orbit which croffes the ecliptic at an angle of $5\frac{1}{3}$ degrees, in two oppofite points called the *moon's nodes*; and alfo for fhifting thefe points backward in the ecliptic, as the *moon's nodes* fhift in the heaven.

Within thefe circular rings is a fmall terreftrial globe *J*, fixt on an axis *K K*, which extends from the north and fouth poles of the globe at *n* and *s*, to thofe of the celeftial fphere at *N* and *S*. On this axis is fixt the flat celeftial meridian *L L*, which may be fet directly over the meridian of any place on the globe, and then turned round with the globe, fo as to keep over the fame meridian upon it. This flat meridian is graduated the fame way as the brafs meridian of a common globe, and its ufe is much the fame. To this globe is fitted the moveable horizon *M M*, fo as to turn upon two ftrong wires proceeding from its eaft and weft points to the globe, and entering the globe at the oppofite points of its equator, which is a moveable brafs ring let into the globe in a groove all around its equator. The globe may be turned by hand within this ring, fo as to place any given meridian upon it, directly under the celeftial meridian *L L*. The horizon is divided into 360 degrees all around its outermoft edge, within which are the points of the compafs, for fhewing the amplitude of the fun and moon, both in degrees and points. The celeftial meridian *L L* paffes through two notches in the north and fouth points of the horizon, as in a common globe: but here, if the globe be turned round, the horizon and meridian turn with it. At the fouth pole of the fphere is a circle of 24 hours, fixt to the rings, and on the axis is an index which goes round that circle, if the globe be turned round its axis.

The whole fabric is fupported on a pedeftal *N*, and may be elevated or depreffed upon the joint *O*, to any number of degrees from 0 to 90, by means of the arc *P*, which is fixed in the ftrong brafs arm *Q*, and flides in the upright piece *R*, in which is a fcrew at *r*, to fix it at any proper elevation.

In the box *T* are two wheels (as in Dr Long's fphere) and two pinions, whofe axes come out at *V* and *U*; either of which may be turned by the fmall winch *W*. When the winch is put upon the axis *V*, and turn backward, the terreftrial globe, with its horizon and celeftial meridian, keep at reft; and the whole fphere of circles turns round from eaft, by fouth, to weft, carrying the fun *Y*, and moon *Z*, round the fame way, and caufing them to rife above and fet below the horizon. But when the winch is put upon the axis *U*, and turned forward, the fphere with the fun and moon keep at reft; and the earth, with its horizon and meridian, turn round from weft, by fouth, to eaft; and bring the fame points of the horizon to the fun and moon, to which thefe bodies came when the earth kept at reft, and they were carried round it; fhewing that they rife and fet in the fame points of the horizon, and at the fame times in the hour circle, whether the motion be in the earth or in the heaven. If the earthly globe be turned, the hour-index goes round its hour-circle; but if the fphere be turned, the hour-circle goes round below the index.

And fo, by this conftruction, the machine is equally fitted to fhew either the real motion of the earth, or the apparent motion of the heaven.

To rectify the fphere for ufe, firft flacken the fcrew *r* in the upright ftem *R*, and taking hold of the arm *Q*, move it up or down until the given degree of latitude for any place be at the fide of the ftem *R*; and then the axis of the fphere will be properly elevated, fo as to ftand parallel to the axis of the world, if the machine be fet north and fouth by a fmall compafs: this done, count the latitude from the north pole, upon the celeftial meridian *L L*, down towards the north notch of the horizon, and fet the horizon to that latitude; then, turn the nut *b* until the fun *Y* comes to the given day of the year in the ecliptic, and the fun will be at its proper place for that day: find the place of the moon's afcending node, and alfo the place of the moon, by an Ephemeris, and fet them right accordingly: laftly, turn the winch *W*, until either the fun comes to the meridian *L L*, or until the meridian comes to the fun (according as you want the fphere or earth to move) and fet the hour-index to the XII, marked noon, and the whole machine will be rectified.———Then turn the winch, and obferve when the fun or moon rife and fet in the horizon, and the hour-index will fhew the times thereof for the given day.

As thofe who underftand the ufe of the globes will be at no lofs to work many other problems by this fphere, it is needlefs to enlarge any farther upon it.

Directions for ufing Globes.

In ufing globes, keep the eaft fide of the horizon towards you (unlefs your problem require the turning of it), which fide you may know by the word Eaft upon the horizon; for then you have the graduated fide of the meridian towards you, the quadrant of altitude before you, and the globe divided exactly into two equal parts, by the graduated fide of the meridian.

In working fome problems, it will be neceffary to turn the whole globe and horizon about, that you may look on the weft fide thereof; which turning will be apt to jog the ball fo, as to fhift away that degree of the globe which was before fet to the horizon or meridian: to avoid which inconvenience, you may thruft in the feather-end of a quill between the ball of the globe and the brazen meridian; which, without hurting the ball, will keep it

it from turning in the meridian, whilst you turn the west side of the horizon towards you.

PROB. I. *To find the latitude and longitude of any given place upon the globe.*—Turn the globe on its axis, until the given place comes exactly under that graduated side of the brasen meridian, on which the degrees are numbered from the equator; and observe what degree of the meridian the place then lies under; which is its latitude, north or south, as the place is north or south of the equator.

The globe remaining in this position, the degree of the equator, which is under the brasen meridian, is the longitude of the place which is east or west, as the place lies on the east or west side of the first meridian of the globe. —All the Atlantic Ocean, and America, is on the west side of the meridian of London; and the greatest part of Europe, and of Africa, together with all Asia, is on the east side of the meridian of London, which is reckoned the *first meridian* of the globe by the British geographers and astronomers.

PROB. II. *The longitude and latitude of a place being given, to find that place on the globe.*—Look for the given longitude in the equator (counting it eastward or westward from the first meridian, as it is mentioned to be east or west;) and bring the point of longitude in the equator to the brasen meridian, on that side which is above the south point of the horizon: then count from the equator, on the brasen meridian, to the degree of the given latitude, towards the north or south pole, according as the latitude is north or south; and under that degree of latitude on the meridian, you will have the place required.

PROB. III. *To find the difference of longitude, or difference of latitude, between any two given places.*—Bring each of these places to the brasen meridian, and see what its latitude is: the lesser latitude subtracted from the greater, if both places are on the same side of the equator, or both latitudes added together, if they are on different sides of it, is the difference of latitude required. And the number of degrees contained between these places, reckoned on the equator, when they are brought separately under the brasen meridian, is their difference of longitude; if it be less than 180: but if more, let it be subtracted from 360, and the remainder is the difference of longitude required. Or,

Having brought one of the places to the brasen meridian, and set the hour-index to XII, turn the globe until the other place comes to the brasen meridian, and the number of hours and parts of an hour, past over by the index, will give the longitude in time; which may be easily reduced to degrees, by allowing 15 degrees for every hour, and one degree for every four minutes.

N B. When we speak of bringing any place to the brasen meridian, it is the graduated side of the meridian that is meant.

PROB. IV. *Any place being given, to find all those places that have the same longitude or latitude with it.* —Bring the given place to the brasen meridian, then all those places which lie under that side of the meridian, from pole to pole, have the same longitude with the given place. Turn the globe round its axis, and all those places which pass under the same degree of the meridian that the given place does, have the same latitude with that place.

Since all latitudes are reckoned from the equator, and all longitudes are reckoned from the first meridian, it is evident, that the point of the equator which is cut by the first meridian, has neither latitude nor longitude.—The greatest latitude is 90 degrees, because no place is more than 90 degrees from the equator. And the greatest longitude is 180 degrees, because no place is more than 180 degrees from the first meridian.

PROB. V. *To find the* antœci, periœci, *and* antipodes, *of any given place.*—Bring the given place to the brasen meridian; and having found its latitude, keep the globe in that situation, and count the same number of degrees of latitude from the equator towards the contrary pole; and where the reckoning ends, you have the *antœci* of the given place upon the globe. Those who live at the equator have no *antœci*.

The globe remaining in the same position, set the hour-index to the upper XII on the horary circle, and turn the globe until the index comes to the lower XII; then, the place which lies under the meridian, in the same latitude with the given place, is the *periœci* required. Those who live at the poles have no *periœci*.

As the globe now stands (with the index at the lower XII) the *antipodes* of the given place will be under the same point of the brasen meridian where its *antœci* stood before. Every place upon the globe has its *antipodes*.

PROB. VI. *To find the distance between any two places on the globe.*—Lay the graduated edge of the quadrant of altitude over both the places, and count the number of degrees intercepted between them on the quadrant; then multiply these degrees by 60, and the product will give the distance in geographical miles: but to find the distance in miles, multiply the degrees by 69½, and the product will be the number of miles required. Or, take the distance betwixt any two places with a pair of compasses, and apply that extent to the equator; the number of degrees, intercepted between the points of the compasses, is the distance in degrees of a great circle; which may be reduced either to geographical miles, or to English miles, as above.

PROB. VII. *A place on the globe being given, and its distance from any other place, to find all the other places upon the globe which are at the same distance from the given place.*—Bring the given place to the brasen meridian, and screw the quadrant of altitude to the meridian, directly over that place; then keeping the globe in that position, turn the quadrant quite round upon it, and the degree of the quadrant that touches the second place will pass over all the other places which are equally distant with it from the given place.

This is the same as if one foot of a pair of compasses was set in the given place, and the other foot extended to the second place, whose distance is known; for if the compasses be then turned round the first place as a centre, the moving foot will go over all those places which are at the same distance with the second from it.

PROB. VIII. *The hour of the day at any place being given, to find all those places where it is noon at that time.*

time.—Bring the given place to the brasen meridian, and set the index to the given hour; this done, turn the globe until the index points to the upper XII, and then all the places that lie under the brasen meridian have noon at that time.

N. B. The upper XII always stands for noon; and when the bringing of any place to the brasen meridian is mentioned, the side of that meridian on which the degrees are reckoned from the equator is meant, unless the contrary side be mentioned.

PROB. IX. *The hour of the day at any place being given, to find what o'clock it then is at any other place.*—Bring the given place to the brasen meridian, and set the index to the given hour; then turn the globe, until the place where the hour is required comes to the meridian, and the index will point out the hour at that place.

PROB. X. *To find the sun's place in the ecliptic, and his declination, for any given day of the year.*—Look on the horizon for the given day, and right against it you have the degree of the sign in which the sun is (or his place) on that day at noon. Find the same degree of that sign in the ecliptic line upon the globe, and having brought it to the brasen meridian, observe what degree of the meridian stands over it; for that is the sun's declination, reckoned from the equator.

PROB. XI. *The day of the month being given, to find all those places of the earth over which the sun will pass vertically on that day.*—Find the sun's place in the ecliptic for the given day, and having brought it to the brasen meridian, observe what point of the meridian is over it; then, turning the globe round its axis, all those places which pass under that point of the meridian, are the places required; for as their latitude is equal, in degrees and parts of a degree, to the sun's declination, the sun must be directly over head to each of them at its respective noon.

PROB. XII. *A place being given in the torrid zone, to find those two days of the year on which the sun shall be vertical to that place.*—Bring the given place to the brasen meridian, and mark the degree of latitude that is exactly over it on the meridian; then turn the globe round its axis, and observe the two degrees of the ecliptic which pass exactly under that degree of latitude: lastly, find on the wooden horizon, the two days of the year in which the sun is in those degrees of the ecliptic, and they are the days required: for on them, and none else, the sun's declination is equal to the latitude of the given place; and consequently, he will then be vertical to it at noon.

PROB. XIII. *To find all those places of the north frigid zone, where the sun begins to shine constantly without setting, on any given day, from the 21st of March to the 23d of September.*—On these two days, the sun is in the equinoctial, and enlightens the globe exactly from pole to pole: therefore, as the earth turns round its axis, which terminates in the poles, every place upon it will go equally through the light and the dark, and so make equal day and night to all places of the earth. But as the sun declines from the equator, towards either pole, he will shine just as many degrees round that pole, as are equal to his declination from the equator; so that no place within that distance of the pole will then go through any part of the dark, and consequently the sun will not set to it. Now, as the sun's declination is northward, from the 21st of March to the 23d of September, he must constantly shine round the north pole all that time; and on the day that he is in the northern tropic, he shines upon the whole north frigid zone; so that no place within the north polar circle goes through any part of the dark on that day. Therefore,

Having brought the sun's place for the given day to the brasen meridian, and found his declination (by Prob. IX.) count as many degrees on the meridian, from the north pole, as are equal to the sun's declination from the equator, and mark that degree from the pole where the reckoning ends: then, turning the globe round its axis, observe what places in the north frigid zone pass directly under that mark; for they are the places required.

The like may be done for the south frigid zone, from the 23d of September to the 21st of March, during which time the sun shines constantly on the south pole.

PROB. XIV. *To find the place over which the sun is vertical at any hour of a given day.*—Having found the sun's declination for the given day (by Prob. IX.) mark it with a chalk on the brasen meridian: then bring the place where you are (suppose Edinburgh) to the brasen meridian, and set the index to the given hour; which done, turn the globe on its axis, until the index points to XII at noon; and the place on the globe, which is then directly under the point of the sun's declination marked upon the meridian, has the sun that moment in the zenith, or directly over head.

PROB. XV. *The day and hour of a lunar eclipse being given; to find all those places of the earth to which it will be visible.*—The moon is never eclipsed but when she is full, and so directly opposite to the sun, that the earth's shadow falls upon her. Therefore, whatever place of the earth the sun is vertical to at that time, the moon must be vertical to the antipodes of that place: so that the sun will be then visible to one half of the earth, and the moon to the other.

Find the place to which the sun is vertical at the given hour (by Prob. XIV.) elevate the pole to the latitude of that place, and bring the place to the upper part of the brasen meridian, as in the former problem: then, as the sun will be visible to all those parts of the globe which are above the horizon, the moon will be visible to all those parts which are below it, at the time of her greatest obscuration.

PROB. XVI. *To rectify the globe for the latitude, the zenith, and the sun's place.*—Find the latitude of the place (by Prob. I.) and if the place be in the northern hemisphere, raise the north pole above the north point of the horizon, as many degrees (counted from the pole upon the brasen meridian) as are equal to the latitude of the place. If the place be in the southern hemisphere, raise the south pole above the south point of the horizon, as many degrees as are equal to the latitude. Then, turn the globe till the place comes under its latitude on the brasen meridian, and fasten the quadrant of altitude so, that the chamfered edge of its nut (which is even with the graduated edge) may be joined to the zenith, or

or point of latitude. This done, bring the ſun's place in the ecliptic for the given day (found by Prob X.) to the graduated ſide of the braſen meridian, and ſet the hour-index to XII at noon, which is the uppermoſt XII on the hour-circle; and the globe will be rectified.

PROB. XVII. *The latitude of any place, not exceeding* $66\frac{1}{2}$ *degrees, and the day of the month, being given; to find the time of ſun riſing and ſetting, and conſequently the length of the day and night.*—Having rectified the globe for the latitude, and for the ſun's place on the given day (as directed in the preceding problem) bring the ſun's place in the ecliptic to the eaſtern ſide of the horizon, and the hour-index will ſhew the time of ſun riſing; then turn the globe on its axis, until the ſun's place comes to the weſtern ſide of the horizon, and the index will ſhew the time of ſun-ſetting.

The hour of ſun-ſetting doubled, gives the length of the day; and the hour of ſun-riſing doubled, gives the length of the night.

PROB. XVIII. *The latitude of any place, and the day of the month being given; to find when the morning twilight begins, and the evening twilight ends, at that place.*—This problem is often limited: for, when the ſun does not go 18 degrees below the horizon, the twilight continues the whole night; and for ſeveral nights together in ſummer, between 49 and $66\frac{1}{2}$ degrees of latitude; and the nearer to $66\frac{1}{2}$, the greater is the number of theſe nights. But when it does begin and end, the following method will ſhew the time for any given day.

Rectify the globe, and bring the ſun's place in the ecliptic to the eaſtern ſide of the horizon; then mark that point of the ecliptic with a chalk which is in the weſtern ſide of the horizon, it being the point oppoſite to the ſun's place: this done, lay the quadrant of altitude over the ſaid point, and turn the globe eaſtward, keeping the quadrant at the chalk mark, until it be juſt 18 degrees high on the quadrant; and the index will point out the time when the morning twilight begins: for the ſun's place will then be 18 degrees below the eaſtern ſide of the horizon. To find the time when the evening twilight ends, bring the ſun's place to the weſtern ſide of the horizon, and the point oppoſite to it, which was marked with the chalk, will be riſing in the eaſt: then, bring the quadrant over that point, and keeping it thereon, turn the globe weſtward, until the ſaid point be 18 degrees above the horizon on the quadrant, and the index will ſhew the time when the evening twilight ends; the ſun's place being then 18 degrees below the weſtern ſide of the horizon.

PROB. XIX. *To find on what day of the year the ſun begins to ſhine conſtantly without ſetting, on any given place in the north frigid zone; and how long he continues to do ſo.*—Rectify the globe to the latitude of the place, and turn it about until ſome point of the ecliptic, between aries and cancer, coincides with the north point of the horizon where the braſen meridian cuts it: then find, on the wooden horizon, what day of the year the ſun is in that point of the ecliptic; for that is the day on which the ſun begins to ſhine conſtantly on the given place, without ſetting. This done, turn the globe untill ſome point of the ecliptic, between cancer and libra, coincides with the north point of the horizon, where the braſen meridian cuts it; and find, on the wooden horizon, on what day the ſun is in that point of the ecliptic; which is the day that the ſun leaves off conſtantly ſhining on the ſaid place, and riſes and ſets to it as to other places on the globe. The number of natural days, or compleat revolutions of the ſun about the earth, between the two days above found, is the time that the ſun keeps conſtantly above the horizon without ſetting: for all that portion of the ecliptic, which lies between the two points which interſect the horizon in the very north, never ſets below it: and there is juſt as much of the oppoſite part of the ecliptic that never riſes; therefore, the ſun will keep as long conſtantly below the horizon in winter, as above it in ſummer.

PROB. XX. *To find in what latitude the ſun ſhines conſtantly without ſetting, for any length of time leſs than* $182\frac{1}{2}$ *of our days and nights.*—Find a point in the ecliptic half as many degrees from the beginning of cancer (either toward aries or libra) as there are natural days in the time given; and bring that point to the north ſide of the braſen meridian, on which the degrees are numbered from the pole towards the equator: then, keep the globe from turning on its axis, and ſlide the meridian up or down, until the foreſaid point of the ecliptic comes to the north point of the horizon, and then the elevation of the pole will be equal to the latitude required.

PROB. XXI. *The latitude of a place, not exceeding* $66\frac{1}{2}$ *degrees, and the day of the month being given; to find the ſun's amplitude, or point of the compaſs on which he riſes or ſets.*—Rectify the globe, and bring the ſun's place to the eaſtern ſide of the horizon; then obſerve what point of the compaſs on the horizon ſtands right againſt the ſun's place, for that is his amplitude at riſing. This done, turn the globe weſtward, until the ſun's place comes to the weſtern ſide of the horizon, and it will cut the point of his amplitude at ſetting. Or, you may count the riſing amplitude in degrees, from the eaſt point of the horizon, to that point where the ſun's place cuts it; and the ſetting amplitude, from the weſt point of the horizon, to the ſun's place at ſetting.

PROB. XXII. *The latitude, the ſun's place, and his altitude, being given; to find the hour of the day, and the ſun's azimuth, or number of degrees that he is diſtant from the meridian.*—Rectify the globe, and bring the ſun's place to the given height upon the quadrant of altitude; on the eaſtern ſide of the horizon, if the time be in the forenoon; or the weſtern ſide, if it be in the afternoon: then the index will ſhew the hour; and the number of degrees in the horizon, intercepted between the quadrant of altitude and the ſouth point, will be the ſun's true azimuth at that time.

PROB. XXIII. *The latitude, hour of the day, and the ſun's place, being given; to find the ſun's altitude and azimuth.*—Rectify the globe, and turn it until the index points to the given hour; then lay the quadrant of altitude over the ſun's place in the ecliptic, and the degree of the quadrant cut by the ſun's place is his altitude at that time above the horizon; and the degree of the horizon cut by the quadrant is the ſun's azimuth, reckoned from the ſouth.

PROB. XXIV. *The latitude, the ſun's altitude, and his*

his azimuth being given; *to find his place in the ecliptic, the day of the month, and hour of the day, though they had all been lost.*—Rectify the globe for the latitude and zenith, and set the quadrant of altitude to the given azimuth in the horizon; keeping it there, turn the globe on its axis until the ecliptic cuts the quadrant in the given altitude: that point of the ecliptic which cuts the quadrant there, will be the sun's place; and the day of the month answering thereto, will be found over the like place of the sun on the wooden horizon. Keep the quadrant of altitude in that position; and, having brought the sun's place to the brasen meridian, and the hour-index to XII at noon, turn back the globe, until the sun's place cuts the quadrant of altitude again, and the index will shew the hour.

Any two points of the ecliptic, which are equidistant from the beginning of Cancer or of Capricorn, will have the same altitude and azimuth at the same hour, though the months be different; and therefore it requires some care in this problem, not to mistake both the month and the day of the month; to avoid which, observe, that from the 20th of March to the 21st of June, that part of the ecliptic which is between the beginning of Aries and beginning of Cancer is to be used: from the 21st of June to the 23d of September, between the beginning of Cancer and beginning of Libra: from the 23d of September to the 21st of December, between the beginning of Libra and the beginning of Capricorn; and from the 21st of December to the 20th of March, between the beginning of Capricorn and beginning of Aries. And as one can never be at a loss to know in what quarter of the year he takes the sun's altitude and azimuth, the above caution with regard to the quarters of the ecliptic will keep him right as to the month and day thereof.

PROB. XXV. *To find the length of the longest day at any given place.*—If the place be on the north side of the equator (find its latitude by Prob. I.) and elevate the north pole to that latitude; then, bring the beginning of Cancer to the brazen meridian, and set the hour-index to XII at noon. But if the given place be on the south side of the equator, elevate the south pole to its latitude, and bring the beginning of Capricorn to the brass meridian, and the hour-index to XII. This done, turn the globe westward, until the beginning of Cancer or Capricorn (as the latitude is north or south) comes to the horizon; and the index will then point out the time of sun-setting, for it will have gone over all the afternoon hours, between mid-day and sun set; which length of time being doubled, will give the whole length of the day from sun-rising to sun-setting. For, in all latitudes, the sun rises as long before mid day, as he sets after it.

PROB. XXVI. *To find in what latitude the longest day is, of any given length, less than 24 hours.*—If the latitude be north, bring the beginning of Cancer to the brasen meridan, and elevate the north pole to about $66\frac{1}{2}$ degrees; but if the latitude be south, bring the beginning of Capricorn to the meridian, and elevate the south pole to about $66\frac{1}{2}$ degrees; because the longest day in north latitude is, when the sun is in the first point of Cancer; and in south latitude, when he is in the first point of Capricorn. Then set the hour-index to XII at noon, and turn the globe westward, until the index points at half the number of hours given; which done, keep the globe from turning on its axis, and slide the meridian down in the notches, until the aforesaid point of the ecliptic (*viz.* Cancer or Capricorn) comes to the horizon; then, the elevation of the pole will be equal to the latitude required.

PROB. XXVII. *The latitude of any place, not exceeding $66\frac{1}{2}$ degrees, being given; to find in what climate the place is.*—Find the length of the longest day at the given place, by Prob. XXV. and whatever be the number of hours whereby it exceedeth twelve, double that number, and the sum will give the climate in which the place is.

PROB. XXVIII. *The latitude, and the day of the month, being given; to find the hour of the day when the sun shines.*—Set the wooden horizon truly level, and the brasen meridian due north and south by a mariner's compass: then, having rectified the globe, stick a small sewing-needle into the sun's place in the ecliptic, perpendicular to that part of the surface of the globe: this done, turn the globe on its axis, until the needle comes to the brasen meridian, and set the hour-index to XII at noon; then, turn the globe on its axis, until the needle points exactly towards the sun (which it will do when it casts no shadow on the globe), and the index will shew the hour of the day.

The Use of the Celestial Globe.

HAVING done for the present with the terrestrial globe, we shall proceed to the use of the celestial; first premising, that as the equator, ecliptic, tropics, polar-circles, horizon, and brasen meridian, are exactly alike on both globes, all the former problems concerning the sun are solved the same way by both globes. The method also of rectifying the celestial globe is the same as rectifying the terrestrial.

N. B. The sun's place for any day of the year stands directly over that day on the horizon of the celestial globe, as it does on that of the terrestrial.

The *latitude* and *longitude* of the stars, or of all other celestial phenomena, are reckoned in a very different manner from the latitude and longitude of places on the earth: for all terrestrial latitudes are reckoned from the equator; and longitudes from the meridian of some remarkable place, as of London by the British, and of Paris by the French. But the astronomers of all nations agree in reckoning the latitudes of the moon, stars, planets, and comets, from the ecliptic; and their longitudes from the equinoctial colure, in that semi circle of it which cuts the ecliptic at the beginning of Aries; and thence eastward, quite round, to the same semi-circle again. Consequently those stars which lie between the equinoctial and the northern half of the ecliptic, have north declination and south latitude; those which lie between the equinoctial and the southern half of the ecliptic, have south declination and north latitude; and all those which lie between the tropics and poles, have their declinations and latitudes of the same denomination.

There are six great circles on the celestial globe, which cut

cut the ecliptic perpendicularly, and meet in two opposite points in the polar circles; which points are each ninety degrees from the ecliptic, and are called its poles. These polar points divide those circles into 12 semicircles; which cut the ecliptic at the beginnings of the 12 signs. They resemble so many meridians on the terrestrial globe; and as all places which lie under any particular meridian-semicircle on that globe, have the same longitude, so all those points of the heaven, through which any of the above semicircles are drawn, have the same longitude.—And as the greatest latitudes on the earth are at the north and south poles of the earth, so the greatest latitudes in the heaven are at the north and south poles of the ecliptic.

For the division of the stars into constellations, &c. see ASTRONOMY, p. 486.

PROB. I. *To find the right ascension and declination of the sun, or any fixed star.*—Bring the sun's place in the ecliptic to the brasen meridian; then that degree in the equinoctial which is cut by the meridian, is the sun's *right ascension;* and that degree of the meridian which is over the sun's place, is his *declination*. Bring any fixed star to the meridian, and its right ascension will be cut by the meridian in the equinoctial; and the degree of the meridian that stands over it, is its declination.

So that the right ascension and declination, on the celestial globe, are found in the same manner as longitude and latitude on the terrestrial.

PROB. II. *To find the latiude and longitude of any star.*—If the given star be on the north side of the ecliptic, place the 90th degree of the quadrant of altitude on the north pole of the ecliptic, where the twelve semicircles meet, which divide the ecliptic into the 12 signs: but if the star be on the south side of the ecliptic, place the 90th degree of the quadrant on the south pole of the ecliptic: keeping the 90th degree of the quadrant on the proper pole, turn the quadrant about, until its graduated edge cuts the star: then, the number of degrees in the quadrant, between the ecliptic and the star, is its latitude; and the degree of the ecliptic, cut by the quadrant, is the star's longitude, reckoned according to the sign in which the quadrant then is.

PROB. III. *To represent the face of the starry firmament, as seen from any given place of the earth, at any hour of the night.*—Rectify the celestial globe for the given latitude, the zenith, and sun's place, in every respect, as taught by the XVIth problem, for the terrestrial; and turn it about, until the index points to the given hour: then, the upper hemisphere of the globe will represent the visible half of the heaven for that time: all the stars upon the globe being then in such situations, as exactly correspond to those in the heaven. And if the globe be placed duly north and south, by means of a small sea-compass, every star in the globe will point toward the like star in the heaven: by which means, the constellations and remarkable stars may be easily known. All those stars which are in the eastern side of the horizon, are then rising in the eastern side of the heaven; all in the western, are setting in the western side; and all those under the upper part of the brasen meridian, between the south point of the horizon and the north pole, are at their greatest altitude, if the latitude of the place be north: but if the latitude be south, those stars which lie under the upper part of the meridian, between the north point of the horizon and the south pole, are at their greatest altitude.

PROB. IV. *The latitude of the place, and day of the month, being given; to find the time when any known star will rise, or be upon the meridian, or set.*—Having rectified the globe, turn it about until the given star comes to the eastern side of the horizon, and the index will shew the time of the star's rising; then turn the globe westward, and when the star comes to the brasen meridian, the index will shew the time of the star's coming to the meridian of your place; lastly, turn on, until the star comes to the western side of the horizon, and the index will shew the time of the star's setting.

N. B. In northern latitudes, those stars which are less distant from the north pole, than the quantity of its elevation above the north point of the horizon, never set; and those which are less distant from the south pole, than the number of degrees by which it is depressed below the horizon, never rise: and *vice versa* in southern latitudes.

PROB. V. *To find at what time of the year a given star will be upon the meridian, at a given hour of the night.*—Bring the given star to the upper semicircle of the brass meridian, and set the index to the given hour; then turn the globe, until the index points to XII at noon, and the upper semicircle of the meridian will then cut the sun's place, answering to the day of the year sought; which day may be easily found against the like place of the sun among the signs on the wooden horizon.

PROB. VI. *The latitude, day of the month, and azimuth of any known star, being given; to find the hour of the night.*—Having rectified the globe for the latitude, zenith, and sun's place, lay the quadrant of altitude to the given degree of azimuth in the horizon: then turn the globe on its axis, until the star comes to the graduated edge of the quadrant; and when it does, the index will point out the hour of the night.

PROB. VII. *The latitude of the place, the day of the month, and altitude of any known star, being given; to find the hour of the night.*—Rectify the globe as in the former problem, guess at the hour of the night, and turn the globe until the index points at the supposed hour; then lay the graduated edge of the quadrant of altitude over the known star, and if the degree of the star's height in the quadrant upon the globe, answers exactly to the degree of the star's observed altitude in the heaven, you have guessed exactly: but if the star on the globe is higher or lower than it was observed to be in the heaven, turn the globe backwards or forwards, keeping the edge of the quadrant upon the star, until its centre comes to the observed altitude in the quadrant; and then, the index will shew the true time of the night.

PROB. VIII. *An easy method for finding the hour of the night by any two known stars, without knowing either their altitude or azimuth; and then, of finding both their altitude and azimuth, and thereby the true meridian.*—Tie one end of a thread to a common musket-bullet; and, having rectified the globe as above, hold the other end of the thread in your hand, and carry it

ſlowly round betwixt your eye and the ſtarry heaven, until you find it cuts any two known ſtars at once. Then gueſſing at the hour of the night, turn the globe until the index points to that time in the hour circle; which done, lay the graduated edge of the quadrant over any one of theſe two ſtars on the globe, which the thread cut in the heaven. If the ſaid edge of the quadrant cuts the other ſtar alſo, you have gueſſed the time exactly; but if it does not, turn the globe ſlowly backwards or forwards, until the quadrant (kept upon either ſtar) cuts them both through their centres: and then, the index will point out the exact time of the night; the degree of the horizon, cut by the quadrant, will be the true azimuth of both theſe ſtars from the ſouth; and the ſtars themſelves will cut their true altitude in the quadrant. At which moment, if a common azimuth-compaſs be ſo ſet upon a floor or level pavement, that theſe ſtars in the heaven may have the ſame bearing upon it (allowing for the variation of the needle) as the quadrant of altitude has in the wooden horizon of the globe, a thread extended over the north and ſouth points of that compaſs will be directly in the plane of the meridian: and if a line be drawn upon the floor or pavement, along the courſe of the thread, and an upright wire be placed in the ſouthmoſt end of the line, the ſhadow of the wire will fall upon that line, when the ſun is on the meridian, and ſhines upon the pavement.

PROB. IX. *To find the place of the moon, or of any planet; and thereby to ſhew the time of its riſing, ſouthing, and ſetting.*—Seek in Parker's or Weaver's ephemeris the geocentric place of the moon or planet in the ecliptic, for the given day of the month; and, according to its longitude and latitude, as ſhewn by the ephemeris, mark the ſame with a chalk upon the globe. Then, having rectified the globe, turn it round its axis weſtward; and as the ſaid mark comes to the eaſtern ſide of the horizon, to the braſen meridian, and to the weſtern ſide of the horizon, the index will ſhew at what time the planet riſes, comes to the meridian, and ſets, in the ſame manner as it would do for a fixed ſtar.

For an explanation of the harveſt-moons by a globe, ſee ASTRONOMY, p. 463.

For the deſcription and uſe of a planetary globe, ſee ASTRONOMY, p. 498.

For the equation of time, ſee ASTRONOMY, p. 458.

HAVING thus explained the uſe of the globes, and general principles of geography, we muſt refer to the maps for the ſituation of each particular country, with regard to longitude, latitude, *&c.* The uſe of maps is obvious from their conſtruction. The degrees of the meridian, and parallels, ſhew the longitudes and latitudes of places; and the ſcale of miles annexed, their diſtances. The ſituation of places, with regard to each other, as well as the cardinal points, appears by inſpection; the top of the map being always the *north*, the bottom the *ſouth*, the right-hand the *eaſt*, and the left the *weſt*, unleſs the compaſs uſually annexed ſhew the contrary.

The brevity, which we are neceſſarily obliged to obſerve, prevents us from taking any notice of many particulars, which are to be found in large treatiſes on this ſubject. A general account of countries, cities, rivers, mountains, *&c.* is given under their reſpective names, as they occur in the order of the alphabet. We ſhall therefore conclude this article with the following table, which will ſerve to give an idea of the general diviſion of the habitable earth; and at the ſame time ſerve to explain the maps in Plates 87. 88. 89. 90. 91. and 92.

The Diviſion of the Habitable Earth, the ſquare Miles of each Diviſion and Subdiviſion, Capital Cities, with the Diſtance and Bearing of each from London; alſo the Time of each Country compared with that of England.

THE terraqueous globe is divided into	I. EUROPE	2,749,349	Square miles, 60 miles in length to a degree.
	II. ASIA	10,257,487	
	III. AFRICA	8,506,208	
	IV. AMERICA	9,153,762	
	Habitable earth	30,666,806	
	Seas, and unknown parts	117,843,821	
	Superficies of the whole globe	148,510,627	

Diviſion and ſubdiviſion.	Square miles.	Capital cities.	Diſtance and bearing from London.	Diff. of time from London.
I. EUROPE.				*H.M.
1. *Spain*	150,243	*Madrid*	690 S	0 16 W
2. *Portugal*	27,851	*Liſbon*	840 S W	0 38 W
3. *France*	138,837	*Paris*	203 E	0 9 E

4. *Italy*

* A degree of longitude being 4 minutes in time, therefore by having the longitude we have the time. A watch that is ſet to time at London would be 16 minutes too faſt at Madrid, as it lies to the weſt of the meridian at London: and Vienna being 16 degrees and 20 minutes to the eaſt of the meridian of London, conſequently a watch ſet at London would be 1 hour and 5 minutes too ſlow at Vienna.

Plate LXXXVIII.


Asia
PART of EUROPE
RUSSIAN EMPIRE
SIBERIA
TURKY
BLACK SEA
CASPIAN SEA
MEDITERRANIAN SEA
ASTRACHAN
CALMUCKS
INDEPENDENT TARTARY
ELUTH
CHINESE TARTARY
MANCHEWS
BUKARIA
TIBET
CHINA
PERSIA
ARABIA
RED SEA
MOGUL EMPIRE
INDIA
BAY OF BENGAL
ARABIAN SEA
THE INDIAN OR EASTERN OCEAN
SUNDA ISLANDS
PHILIPINE ISLANDS
MOLUCCA ISLANDS
COREA
JAPAN
SEA OF COREA
YEDSO
DE GAMA'S LAND
Companys Land
NEW GUINEA
BORNEO
SUMATRA
JAVA
CELEBES
Ladrone Iles
New Philippines
New Britain
Tropic of Cancer
Arctic Circle
Equinoctial Line
Formosa
Ceylon I
Maldive Island
Socotra I
Tobolsk
Irkutzki
Kamtzatka
Nova Zembla
Arch angel
Constantinople
Ispahan
Agra
Golconda
Samerkand
Pegu
Siam
Malacca
Nangasak
Meaco
LUCONIA
Guam
Timor
Gilolo
OF AFRICA

Plate XC.

A. Bell Sculp.t


N. America
Longitude from London
Arctic Circle
PARTS UNDISCOVERED
NEW FRANCE
LOUISIANA
CANADA or
LABRADOR or NEW BRITAIN
NEW FOUNDLAND
CALIFORNIA
New Mexico
MEXICO or NEW SPAIN
GULF OF MEXICO
Hudsons Bay
Davis Straits
Greenland
Iceland
IRELAND
GREAT BRITAIN
FRANCE
SPAIN
PORTUGAL
GERMANY
EUROPE
ATLANTIC OR WESTERN OCEAN
Tropic of Cancer
Antiles or Caribbe Is
Bahama Is
Cuba
Jamaica
Hispaniola
Azores
Canary Islands
Cape Verd Islands
Bermudas or Sommers Ids
The Great Fishing Bank
TERRA FIRMA
P OF SOUTH AMERICA
SOUTH SEA

Plate XCII.


S. America
PACIFIC
OCEAN
OR GREAT
SOUTH
SEA
ATLANTIC
OCEAN
THE
SOUTHERN
OCEAN
NORTH SEA
NEW SPAIN
TERRA FIRMA
AMAZONS
PERU
PARA
BRASIL
GUAY
CHILI
TERRA MAGELLANICA
Pampas
Rio de la Plata
Tropic of Capricorn
Equinoctial
Line
Cape Verd Is.
Land seen by an Englishman in 1686
Easter I.
Port discovered by Sir Fra. Drake
C. Horn
Str. of Magallen
Str. of La Maire
New Isle
Tristan de Cunha
Ascension I.
R. of Amazons
Longitude from London

Division and subdivision.	Square miles.	Capital cities.	Distance and bearing from London.	Difference of time from London.
				H. M.
4. *Italy*	75,576	*Rome*	780 S E	0 52 E
5. *Germany*	181,631	*Vienna*	650 E	1 5 E
6. *Holland*	9,540	*Amsterdam*	132 E	0 18 E
7. *Denmark*	163,001	*Copenhagen*	480 N E	0 50 E
8. *Sweden*	228,715	*Stockholm*	720 N E	1 10 E
9. *Russia*	1,103,485	*Petersburgh*	1080 N E	2 2 E
10. *Poland*	226,414	*Warsaw*	766 S E	1 23 E
11. *Turkey* in *Europe*	212,240	*Constantinople*	1300 S E	1 56 E
12. *British isles*	105,634	*London*	First meridian.	
II. ASIA.				
1. *Turkey* in *Asia*	510,717	*Bursa*	1396 S E	1 58 E
2. *Arabia*	700,000	*Mecca*	2240 S E	
3. *Persia*	800,000	*Ispahan*	2550 E	3 21 E
4. *India*	1,857,500	*Agra*	3780 E	5 15 E
5. *China*	1,105,000	*Pekin*	4380 N E	7 24 E
6. *Asiatic isles*	811,980			
7. *Tartary*				
1. *Chinese*	644,000	*Chinyan*	4480 N E	8 4 E
2. Independent	778,290	*Samarchand*	2800 E	4 26 E
3. *Muscovite*	3,050,000	*Tobolsky*	2412 N E	4 10 E
III. AFRICA.				
1. *Egypt*	140,700	*Grand Cairo*	1920 S E	2 10 E
2. *Barca*	66,400	*Tolemeta*	1440 S E	1 26 E
3. *Abex*	30,000	*Erquicko*	3590 S E	2 36 E
4. *Fez* and *Morocco*	111,800	*Fez* and *Morocco*	{1080 S 1290 S	0 21 0 30} W
5. *Taflet* and *Segelmesse*	100,600	*Taflet* and *Segelmesse*	{1376 S 1240 S	0 30 0 18} W
6. *Algier*	143,600	*Algier*	920 S	0 13 E
7. *Tunis*	54,400	*Tunis*	990 S E	0 39 E
8. *Tripoli*	75,000	*Tripoli*	1260 S E	0 66 E
9. *Biledulgerid*	485,000	*Dara*	1565 S	0 36 W
10. *Zaara*	739,200	*Tegassa*	1840 S	0 24 W
11. *Negroland*	1,026,000	*Madinga*	2500 S	0 38 W
12. *Guinea*	510,000	*Benin*	2700 S	0 20 E
13. *Loango*	49,400	*Loango*	3300 S	0 43 E
14. *Congo*	172,800	*St Salvador*	3480 S	1 0 E
15. *Angola*	38,400	*Mocbina*	3750	0 58 E
16. *Benguela*	64,000	*Benguela*	3900 S	0 58 E
17. *Mataman*	144,000			
18. *Monomotapa*	222,500	*Monomotapa*	4500 S	1 18 E
19. *Monoemugi*	310,000	*Chicova*	4260 S	1 44 E
20. *Caffers*	200,340	Cape of *Good Hope*	5200 S	1 4 E
21. *Saffala*	27,500	*Saffala*	4600 S E	2 17 E
22. *Zanguebar*	275,000	*Mozambique*	4440 S E	2 38 E
23. *Anian*	234,000	*Brava*	3702 S E	2 40 E
24. *Abyssinia*	378,000	*Caxuma*		
25. *Nubia*	264,000	*Dancala*	2418 S E	2 13 E
26. Desart of *Barca*	184,900	*Angela*	1680 S E	1 33 E
27. *Ethiopia*	1,200,000			
28. *African isles*	181,668			
IV. AMERICA.				
1. BRITISH empire				
1. *Carolina*	57,500	*Charles-Town*	3450 W	5 2 W
2. *Virginia*	20,750	*James-Town*	3210 W	5 W
3. *Maryland*	12,260	*Baltimore*	3000 W	4 45 W

4. *Pensilvania*

Division and subdivision.	Square miles.	Capital cities.	Distance and bearing from London.	Difference of time from London.
				H. M.
4. *Pensilvania*	12,500	*Philadelphia*	3100 W	4 55 W
5. *New-Jersey*	10,000	*Elizabeth-Town*	3040 W	4 50 W
6. *New-York*	8,100	*New-York*	3000 W	4 53 W
7. *New England* and *Scotland*	115,000	*Boston*	2790 W	4 40 W
		Annapolis	2580 W	4 24 W
8. Isles	42,972	*Kingston*	4080 W	5 6 W
2. SPANISH empire				
1. *Old Mexico*	571,240	*Mexico*	4800 N W	6 54 W
2. *New Mezico*	300,000	*Sancta Fe*	4320 N W	7 17 W
3. *Florida*	113 000	*St Augustine*	3690 W	5 25 W
4. *Terra Firma*	828,000	*Carthagena*	4320 W	5 6 W
5. *Peru*	970,000	*Lima*	5700 S W	5 4 W
6. *Chili*	206,000	*St Jago*	7200 S W	5 6 W
7. *Paragua*	1,150,000	*Assumption*	5460 S W	3 52 W
8. Land of *Amazons*	993,600	Unknown		
9. *Magellanica*	325,000	Unknown		
10. *California*	240,000	Unknown		
11. Isles	143,196	*Havanna*		5 26 W
3. FRENCH empire				
1. *Louisiana*	516,000	*Port Louis*	4080 N W	6 5 W
2. *Canada* and *New France*	1,059,100	*Quebec*		5 46 W
3. *French isles*	21,520			
4. DUTCH dominions				
1. *Curassow*	342			
2. *Bonair*	168			
5. PORTUGUESE dominions are				
Brasil	940,000	*St Salvador*	2260 S W	4 42 W
6. *Ter de Labrador*	318,750	Unknown		

GEOMETRY.

GEOMETRY originally signified no more than the art of measuring the earth, or any distances or dimensions within it: but at present, it denotes the science of magnitude in general; comprehending the doctrine and relations of whatever is susceptible of augmentation or diminution, considered in that light.

Hence to geometry may be referred the consideration not only of lines, surfaces, and solids; but also of time, velocity, number, weight, *&c.*

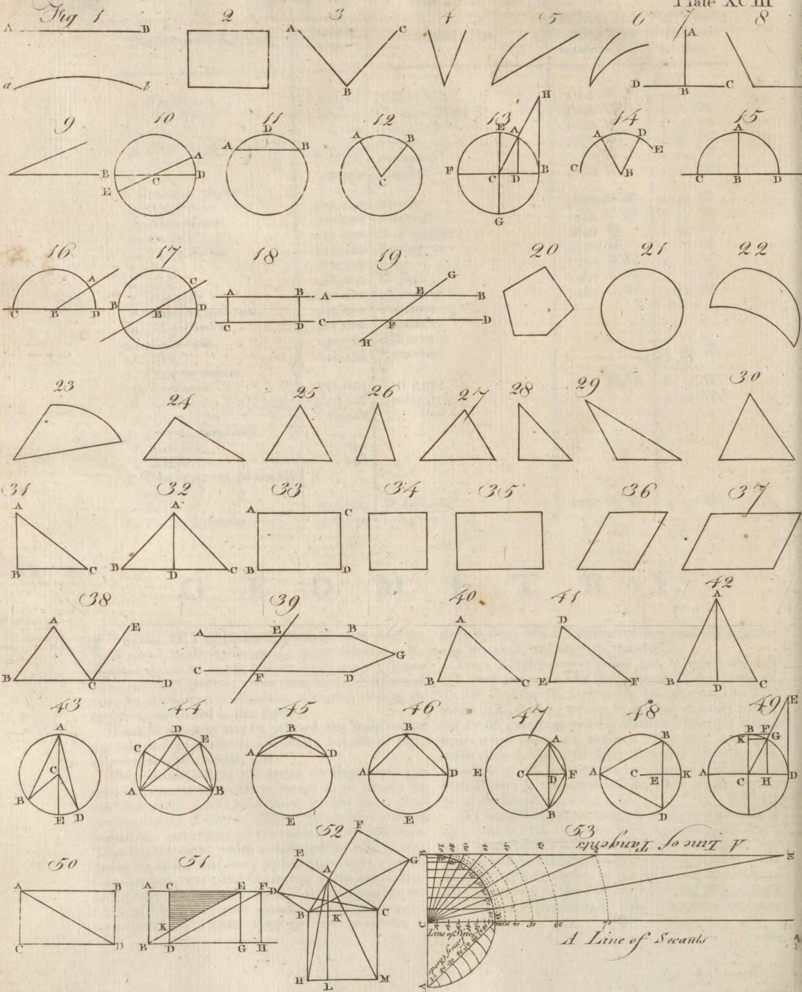
This science had its rise among the Egyptians, who were in a manner compelled to invent it, to remedy the confusion which generally happened in their lands, from the inundations of the river Nile, which carried away all boundaries, and effaced all the limits of their possessions. Thus this invention, which at first consisted only in measuring the lands, that every person might have what belonged to him, was called Geometry, or the art of measuring land; and it is probable that the draughts and schemes, which they were annually compelled to make, helped them to discover many excellent properties of these figures; which speculations continued to be gradually improved, and are so to this day.

From Egypt geometry passed into Greece; where it continued to receive new improvements in the hands of Thales, Pythagoras, Archimedes, Euclid, *&c.* The Elements of Geometry, written by this last in fifteen books, are a most convincing proof to what perfection this science was carried among the ancients. However, it must be acknowledged, that it fell short of modern geometry; the bounds of which, what by the invention of fluxions, and the discovery of the almost infinite orders of curves, are greatly enlarged.

We may distinguish the progress of geometry into three ages; the first of which was in its meridian glory at the time when Euclid's Elements appeared; the second, beginning with Archimedes, reaches to the time of Des Cartes, who, by applying algebra to the elements of geometry, gave a new turn to this science, which has been carried to its utmost perfection by Sir Isaac Newton and Mr Leibnitz.

In

Plate XCIII



A.B. Sc.

In treating this useful subject, we shall divide it into two parts; the first containing the general principles; and the second, the application of these principles to the mensuration of surfaces, solids, *&c.*

PART I.

GENERAL PRINCIPLES OF GEOMETRY.

Art. 1. A point is that which is not made up of parts, or which is of itself indivisible.

2. A line is a length without breadth, as B——

3 The extremities of a line are points; as the extremities of the line AB, are the points A and B, fig. 1. Plate XCIII.

4. If the line AB be the nearest distance between its extremes A and B, then it is called a *strait line*, as A B; but if it be not the nearest distance, then it is called a *curve line*, as AB; fig. 1.

5. A surface is that which is considered as having only length and breadth, but no thickness, as B, fig. 2.

6. The terms or boundaries of a surface are lines.

7. A plain surface is that which lies equally between its extremes.

8. The inclination between two lines meeting one another (provided they do not make one continued line,) or the opening between them, is called an *angle*; thus the inclination of the line AB to the line CB (fig. 3) meeting one another at B, or the opening between the two lines AB and CB, is called an angle.

9. When the lines forming the angle are right lines, then it is called a *right-lined angle*, as A, fig. 4. if one of them be right and the other curved, it is called a *mixed angle*, as B, fig 5. if both if them be curved, it is called a *curve-lined angle*, as C, fig. 6.

10. If a right line AB fall upon another DC, (fig. 7.) so as to incline neither to one side nor to the other; but make the angles ABD, ABC, on each side equal to one another; then the line AB is said to be *perpendicular* to the line DC, and the two angles are called *right-angles*.

11. An obtuse angle is that which is greater than a right one, as A, fig. 8; and an acute angle, that which is less than a right one, as B, fig. 9.

12. If a right line DC be fastened at one of its ends C, and the other end D be carried quite round, then the space comprehended is called a *circle*; the curve line described by the point D, is called the *periphery* or *circumference* of the circle; the fixed point C is called the *centre* of it. Fig. 10.

13. The describing line CD is called the *radius*, *viz.* any line drawn from the centre to the circumference; whence all radii of the same or equal circles are equal.

14. Any line drawn through the centre, and terminated both ways by the circumference, is called a *diameter*, as BD is a diameter of the circle BADE. And the diameter divides the circle and circumference into two equal parts, and is double the radius.

15. The circumference of every circle is supposed to be divided into 360 equal parts, called *degrees*; and each degree is divided into 60 equal parts, called *minutes*; and each minute into 60 equal parts called, *seconds*; and these into *thirds*, *fourths*, &c these parts being greater or less according as the radius is.

16. Any part of the circumference is called an *arch*, or *arc*; and is called an arc of as many degrees as it contains parts of the 360, into which the circumference was divided: Thus if AD be the $\frac{1}{8}$ of the circumference, then the arc AD is an arc of 45 degrees.

17. A line drawn from one end of an arc to the other, is called a *chord*, and is the measure of the arc; thus the right line AB is the chord of the arc ADB, fig. 11.

18. Any part of a circle cut off by a chord, is called a *segment*; thus the space comprehended between the chord AB and circumference ADB (which is cut off by the chord AB) is called a segment. Whence it is plain,

1st, That all chords divide the circle into two segments.

2dly, The less the chord is, the more unequal are the segments, and *e contra*.

3dly, When the chord is greatest, *viz.* when it is a diameter, then the segments are equal, *viz.* each a semicircle.

19. Any part of a circle (less than a semicircle) contained between two radii and an arc, is called a *sector*; thus the space contained between the two radii, AC, BC, and the arc AB, is called the sector; fig. 12.

20. The right sine of any arc, is a line drawn perpendicular from one end of the arc, to a diameter drawn through the other end of the same arc; thus (fig. 13.) AD is the right sine of the arc AB, it being a line drawn from A, the one end of the arc AB, perpendicular to CB, a diameter passing through B, the other end of the arc AB.

Now the sines standing on the same diameter, still increase till they come to the centre, and then becoming the radius, it is plain that the radius EC is the greatest possible sine, and for that reason it is called the *whole sine*.

Since the whole-sine EC must be perpendicular to the a diameter FB (by def. 20.) therefore producing the diameter EG, the two diameters FB, EG, must cross one another at right angles, and so the circumference of the circle must be divided by them into four parts EB, BG, GF, and FE, and these four parts are equal to one another (by def. 10.) and so EB a quadrant, or fourth part of the circumference; therefore the radius EC is always the sine of the quadrant, or fourth part of the circle EB.

Sines are said to be of so many degrees, as the arc contains parts of the 360, into which the circumference is supposed to be divided; so the radius being the sine of a quadrant, or fourth part of the circumference, which contains 90 degrees (the fourth part of 360), therefore the radius must be the sine of 90 degrees.

21. The part of the radius comprehended between the extremity of the right ſine and the lower end of the arc, *viz.* DB, is called the verſed ſine of the arc AB.

22. If to any point in the circumference, *viz.* B, there be drawn a diameter FCB, and from the point B, perpendicular to that diameter, there be drawn the line BH; that line is called a *tangent* to the circle in the point B; which tangent can touch the circle only in one point B, elſe if it touched it in more, it would go within it, and ſo not be a tangent but a chord, (by art. 17.)

23. The tangent of any arc AB, is a right line drawn perpendicular to a diameter through the one end of the arc B, and terminated by a line CAH, drawn from the centre through the other end A; thus BH is the tangent of the arch AB.

24. And the line which terminates the tangent, *viz.* CH, is called the ſecant of the arc AB.

25. What an arc wants of a quadrant is called the *complement* of that arc; thus AE, being what the arc AB wants of the quadrant EB, is called the complement of the arc AB.

26. And what an arc wants of a ſemicircle is called the *ſupplement* of that arc; thus ſince AF is what the arc AB wants of the ſemicircle BAF, it is the ſupplement of the arc AB.

27. The ſine, tangent, *&c.* of the complement of any arc, is called the *co-ſine*, *co-tangent*, *&c.* of that arc; thus the ſine, tangent, *&c.* of the arc AE is called the co-ſine, co-tangent, *&c.* of the arc AB.

28. The ſine of the ſupplement of an arc is the ſame with the ſine of the arc itſelf; for, drawing them according to the definitions, there reſults the ſelf-ſame line.

29. A right-lined angle is meaſured by an arc of a circle deſcribed upon the angular point as a centre, comprehended between the two legs that form the angle; thus (fig. 14.) the angle ABD is meaſured by the arc AD of the circle CADE that is deſcribed upon the point B as a centre; and the angle is ſaid to be of as many degrees as the arc is; ſo if the arc AD be 45 degrees, then the angle ABD is ſaid to be an angle of 45 degrees.

Hence the angles are greater or leſs, according as the arc deſcribed about the angular point and terminated by the two legs contain a greater or a leſs number of degrees.

30. When one line falls perpendicularly on another, as AB on CD, fig. 15. then the angles are right (by the 10th def.); and deſcribing a circle on the centre B, ſince the angles ABC ABD are equal, their meaſures muſt be ſo too, *i. e.* the arcs AC AD muſt be equal; but the whole CAD is a ſemicircle, ſince CD, a line paſſing through the centre B, is a diameter; therefore each of the parts AC AD is a quadrant, *i. e.* 90 degrees; ſo the meaſure of a right angle is always 90 degrees.

31. If one line AB fall any way upon another, CD, then the ſum of the two angles ABC ABD is always equal to the ſum of two right angles; fig. 16. For on the point B, deſcribing the circle CAD, it is plain, that CAD is a ſemicircle (by the 14th); but CAD is equal to CA and AD the meaſure of the two angles; therefore the ſum of the two angles is equal to a ſemicircle, that is, to two right angles, (by the laſt).

Cor. 1. From whence it is plain, that all the angles which can be made from a point in any line, towards one ſide of the line, are equal to two right angles.

2. And that all the angles which can be made about a point, are equal to four right ones.

32. If one line AC croſs another BD in the point E, then the oppoſite angles are equal, *viz.* BEA to CED, and BEC equal to AED; fig. 17. For upon the point E, as a centre, deſcribing the circle ABCD, it is plain ABC is a ſemicircle, as alſo BCD (by the 14th); therefore the arc ABC is equal to the arc BCE; and from both taking the common arc BC, there will remain AB equal to CD, *i. e.* the Angle BEA equal to the angle CED (by art. 29.). After the ſame manner we may prove, that the angle BEC is equal to the angle AED.

33. Lines which are equally diſtant from one another, are called *parallel lines*; as AB, CD, fig. 18.

34. If a line GH croſs two parallels AB, CD, (fig. 19.) then the external oppoſite angles are equal, *viz.* GEB equal to CFH and AEG equal to HFD. For ſince AB and CD are parallel to one another, they may be conſidered as one broad line, and GH croſſing it; then the vertical or oppoſite angles GEB CFG are equal (by art. 32.), as alſo AEG and HFD by the ſame.

35. If a line GH croſs two parallels AB CD, then the alternate angles, *viz.* AEF and EFD, or CFE and FEB, are equal; that is, the angle AEF is equal to the angle EFD, and the angle CFE is equal to the angle FEB, for GEB is equal to AEF (by art. 32.), and CFH is equal to EFD (by the ſame); but GEB is equal to CFH (by the laſt); therefore AEF, is equal to EFD. The ſame way we may prove FEB equal to EFC.

36. If a line GH croſs two parallel lines AB, CD, then the external angle GEB is equal to the internal oppoſite one EFD, or GEA equal to CFE. For the angle AEF is equal to the angle EFD (by the laſt); but AEF is equal to GEB (by art. 32.), therefore GEB is equal to EFD. The ſame way we may prove AEG equal to CFE.

37. If a line GH croſs two parallel lines AB CD, then the ſum of the two internal angles, *viz.* BEF and DFE, or AEF and CFE, are equal to two right angles; for ſince the angle GEB is equal to the angle EFD (by art. 36.), to both add the angle FEB, then GEB and BEF are equal to BEF and DFE; but GEB and BEF are equal to two right angles (by art. 31.) therefore BEF and DFE are alſo equal to two right angles. The ſame way we may prove that AEF and CFE are equal to two right angles.

39. A figure is any part of ſpace bounded by lines or a line. If the bounding lines be ſtrait, it is called a *rectilineal figure*, as A, fig. 20. if they be curved, it is called a *curvineal figure*, as B or C, fig. 21. and fig. 22. if they be partly curve lines and partly ſtrait, it is called a *mixt figure*, as D, fig. 23.

35. The moſt ſimple rectilinear figure is that which is bounded by three right lines, and is called a *triangle*, as A, fig. 24.

40. Triangles are divided into different kinds, both with reſpect to their ſides and angles: with reſpect to their ſides they are commonly divided into three kinds, *viz.*

41. A

41. A triangle having all its three ſides equal to one another, is called an *equilateral triangle*, as A, fig. 25.

42. A triangle having two of its ſides equal to one another, and the third ſide not equal to either of them, is called an *Iſoſceles triangle*, as B, fig. 26.

43. A triangle having none of its ſides equal to one another, is called a *ſcalene triangle*, as C, fig. 27.

44. Triangles, with reſpect to their angles, are divided into three different kinds, *viz.*

45. A triangle having one of its angles right, is called a *right-angled triangle*, as A, fig. 28.

46. A triangle having one of its angles obtuſe, or greater than a right angle, is called an *obtuſe-angled triangle*, as B, fig. 29.

47 Laſtly, a triangle having all its angles acute, is called an *acute-angled triangle*, as C, fig. 30.

48. In all right-angled triangles, the ſides comprehending the right angle are called the legs, and the ſide oppoſite to the right angle is called the *hypothenuſe*. Thus in the right-angled triangle ABC, fig. 31. (the right angle being at B) the two ſides AB and BC, which comprehend the right angle ABC, are the legs of the triangle; and the ſide AC, which is oppoſite to the right angle ABC, is the hypothenuſe of the right-angled triangle ABC.

49. Both obtuſe and acute angled triangles are in general called *oblique-angled triangles*; in all which any ſide is called the *baſe*, and the other two the *ſides*.

50. The perpendicular height of any triangle is a line drawn from the vertex to the baſe perpendicularly; thus if the triangle ABC (fig. 32.) be propoſed, and BC be made its baſe, then A will be the vertex, *viz.* the angle oppoſite to the baſe; and if from A you draw the line AD perpendicular to BC, then the line AD is the height of the triangle ABC ſtanding on BC as its baſe.

Hence all triangles ſtanding between the ſame parallels have the ſame height, ſince all the perpendiculars are equal by the nature of parallels.

51. A figure bounded by four ſides is called a *quadrilateral* or *quadrangular figure*, as ABDC, fig. 33.

52. Quadrilateral figures whoſe oppoſite ſides are parallel, are called *parallelograms*. Thus in the quadrilateral figure ABDC, if the ſide AC be parallel to the ſide BD which is oppoſite to it, and AB be parallel to CD, then the figure ABDC is called a parallelogram.

53. A parallelogram having all its ſides equal and angles right, is called a *ſquare*, as A, fig. 34.

54. That which hath only the oppoſite ſides equal and its angles right, is called a *rectangle*, as B, fig. 35.

55. That which hath equal ſides but oblique angles, is called a *rhombus*, as C, fig. 36. and is juſt an inclined ſquare.

56. That which hath only the oppoſite ſides equal and the angles oblique, is called a *rhomboides*, as D, fig. 37. and may be conceived as an inclined rectangle.

57. When none of the ſides are parallel to another, then the quadrilateral figure is called a *trapezium*.

58. Every other right lined figure, that has more ſides than four, is in general called a *polygon*. And figures are called by particular names according to the number of their ſides, *viz.* one of five ſides is called a *pentagon*, of ſix a *hexagon*, of ſeven a *heptagon*, and ſo on. When the ſides forming the polygon are equal to one another, the figure is called a regular figure or polygon.

59. *In any triangle* ABC (fig. 38.) *one of its legs, as* BC, *being produced towards* D, *the external angle* ACD *is equal to both the internal oppoſite ones taken together*, viz. *to* ABC *and* BAC. In order to prove this, through C draw CE parallel to AB; then ſince CE is parallel to AB, and the lines AC and BD croſſeth them, the angle ECD is equal to ABC (by art. 36.) and the angle ACE equal to CAB (by art. 35.); therefore the angles ECD and ECA are equal to the angles ABC and CAB; but the angles ECD and ECA are together equal to the angle ACD; therefore the angle ACD is equal to both the angles ABC and CAB taken together.

Cor. Hence it may be proved, that if two lines AB and CD (fig. 39.) be croſſed by a third line EF, and the alternate angles AEF and EFD be equal, the lines AB and CD will be parallel; for if they are not parallel, they muſt meet one another on one ſide of the line EF (ſuppoſe at G) and ſo form the triangle EFG, one of whoſe ſides GE being produced to A, the exterior angle AEF muſt (by this article) be equal to the ſum of the two angles EFG and EGF; but, by ſuppoſition, it is equal to the angle EFG alone; therefore the angle AEF muſt be equal to the ſum of the two angles EFG and EGF, and at the ſame time equal to the angle EFG alone, which is abſurd; ſo the lines AB and CD cannot meet, and therefore muſt be parallel.

60. *In any triangle* ABC, *all the three angles taken together are equal to two right angles.* To prove this, you muſt produce BC, one of its legs, to any diſtance, ſuppoſe to D; then by the laſt propoſition, the external angle, ACD, is equal to the ſum of the two internal oppoſite ones CAB and ABC; to both add the angle ACB, then the ſum of the angles ACD and ACB will be equal to the ſum of the angles CAB and CBA and ACB. But the ſum of the angles ACD and ACB, is equal to two right ones (by art. 32.), therefore the ſum of the three angles CAB and CBA and ACB, is equal to two right angles; that is, the ſum of the three angles of any triangle ACB is equal to two right angles.

Cor. 1. Hence in any triangle given, if one of its angles be known, the ſum of the other two is alſo known: for ſince (by the laſt) the ſum of all the three is equal to two right angles, or a ſemicircle, it is plain, that taking any one of them from a ſemicircle or 180 degrees, the remainder will be the ſum of the other two. Thus (in the former triangle ABC) if the angle ABC be 40 degrees, by taking 40 from 180 we have 140 degrees; which is the ſum of the two angles BAC, ACB: the converſe of this is alſo plain, *viz.* the ſum of any two angles of a triangle being given, the other angle is alſo known by taking that ſum from 180 degrees.

2. In any right-angled triangle, the two acute angles muſt juſt make up a right one between them; conſequently, any one of the oblique angles being given, we may find the other by ſubtracting the given one from 90 degrees, which is the ſum of both.

61. If in any two triangles, ABC (fig. 40.) DEF (fig. 41.) two legs of the one, *viz.* AB and AC, be equal to two

two legs in the other, *viz.* to DE and DF, each to each refpectively, *i. e.* AB to DE, and AC to DF; and if the angles included between the equal legs be equal, *viz.* the angle BAC equal to the angle EDF; then the remaining leg of the one fhall be equal to the remaining leg of the other, *viz.* BC to EF; and the angles oppofite to equal legs fhall be equal, *viz.* ABC equal to DEF (being oppofite to the equal legs AC and DF), alfo ACB equal to DFE (which are oppofite to the equal legs AB and DE). For if the triangle ABC be fuppofed to be lifted up and put upon the triangle DEF, and the point A on the point D; it is plain, fince BA and DE are of equal length, the point E will fall upon the point B; and fince the angles BAC EDF are equal, the line AC will fall upon the line DF; and they being of equal length, the point C will fall upon the point F; and fo the line BC will exactly agree with the line EF, and the triangle ABC will in all refpects be exactly equal to the triangle DEF; and the angle ABC will be equal to the angle DEF, alfo the angle ACB will be equal to the angle DFE.

Cor. 1. After the fame manner it may be proved, that if in any two triangles ABC, DEF, (fee the preceding figure) two angles ABC and ACB of the one, be equal to two angles DEF and EFE of the other, each to each refpectively, *viz.* the angle ABC to the angle DEF, and the angle ACB equal to the angle DFE, and the fides included between thefe angles be alfo equal, *viz.* BC equal to EF, then the remaining angles and the fides oppofite to the equal angles, will alfo be equal each to each refpectively; *viz.* the angle BAC equal to the angle BDF, the fide AB equal to DE, and AC equal to DF: for if the triangle ABC be fuppofed to be lifted up and laid upon the triangle DEF, the point B being put upon the point E, and the line BC upon the line EF, fince BC and EF are of equal lengths, the point C will fall upon the point F, and fince the angle ACB is equal to the angle DFE, the line CA will fall upon the line FD, and by the fame way of reafoning the line BA will fall upon the line ED; and therefore the point of interfection of the two lines BA and CA, *viz.* A, will fall upon the point of interfection of the two lines BD and FD, *viz.* D, and confequently BA will be equal to DE, and AC equal to DF, and the angle BAC equal to the angle EDF.

Cor. 2. It follows likewife from this article, that if any triangle ABC (fig. 42.) has two of its fides AB and AC equal to one another, the angles oppofite to thefe fides will alfo be equal, *viz.* the angles ABC equal to the angle ACB. For fuppofe the line AD, bifecting the angle BAC, or dividing it into two equal angles BAD and CAD, and meeting BC in D, then the line AD will divide the whole triangle BAC into two triangles ABD and DAC; in which BA and AD two fides of the one, are equal to CA and AD two fides of the other, each to each refpectively, and the included angles BAD and DAC are by fuppofition equal; therefore (by this article) the angle ABC muft be equal to the angle ACB.

62. *Any angle, as* BAD (fig. 43.) *at the circumference of a circle* BADE, *is but half the angle* BCD *at the centre ftanding on the fame arch* BED. To demonftrate this, draw through A and the centre C, the right line ACE, then the angle ECD is equal to both the angles DAC and ADG (by art. 59.); but fince AC and CD are equal (being two radii of the fame circle) the angles fubtended by them muft be equal alfo, (by *art.* 62. *cor.* 2.) *i. e.* the angle CAD equal to the angle CDA; therefore the fum of them is double any one of them, *i. e.* DAC and ADC is double of CAD, and therefore ECD is alfo double of DAC: the fame way it may be proved, that ECB is double of CAB; and therefore the angle BCD is double of the angle BAD, or BAD the half of BCD, which was to be proved.

Cor. 1. Hence an angle at the circumference is meafured by half the arc it fubtends; for the angle at the centre (ftanding on the fame arc) is meafured by the whole arc (by art. 29.); but fince the angle at the centre is double that at the circumference, it is plain the angle at the circumference muft be meafured by only half the arc it ftands upon.

Cor. 2. Hence all angles, ACB, ADB, AEB, *&c.* (fig. 44.) at the circumference of a circle, ftanding on the fame chord AB, are equal to one another; for by the laft corollary they are all meafured by the fame arc, *viz.* half the arc AB which each of them fubtends.

Cor. 3. Hence an angle in a fegment greater than a femicircle is lefs than a right angle: thus, if ADB be a fegment greater than a femicircle, (fee the laft figure) than the arc AB, on which it ftands, muft be lefs than a femicircle, and the half of it lefs than a quadrant or a right angle; but the angle ADB in the fegment is meafured by the half of AB, therefore it is lefs than a right angle.

Cor. 4. An angle in a femicircle is a right angle. For fince ABD (fig. 45.) is a femicircle, the arc AED muft alfo be a femicircle: but the angle ABD is meafured by half the arc AED, that is, by half a femicircle or quadrant; therefore the angle ABD is a right one.

Cor. 5. Hence an angle in a fegment lefs than a femicircle, as ABD, (fig. 46.) is greater than a right angle: for fince the arc ABD is lefs than a femicircle, the arc AED muft be greater than a femicircle, and fo it is half greater than a quadrant, *i. e.* than the meafure of a right angle; therefore the angle ABD, which is meafured by half the arc AED, is greater than a right angle.

63. *If from the centre* C *of the circle* ABE, (fig. 47.) *there be let fall the perpendicular* CD *on the chord* AB, *then that perpendicular will bifect the chord* AB *in the point* D. To demonftrate this, draw from the centre to the extremities of the chord the two lines CA, CB; then fince the lines CA and CB are equal, the angles CAB, CBA, which they fubtend muft be equal alfo, (by *art.* 62. *cor.* 2.) but the perpendicular CD divides the triangle ACB into two right-angled triangles ACD and CDB, in which the fum of the angles ACD and CAD in the one, is equal to the fum of the angles DCB and CBD in the other, each being equal to a right angle, (by *cor.* 2. of *art.* 61.) but CAD is equal to CBD, therefore ACD is equal to BCD. So in the two triangles ACD and BCD, the two legs AC and CD in the one, are equal to the two legs BC and CD in the other, each to each refpectively, and the included angles ACD and BCD are equal; therefore the remaining legs AD and BD are equal (by art. 61.) and confequently AB bifected in D.

64. If

64. If from the centre C of a circle ABE, there be drawn a perpendicular CD on the chord AB, and produced till it meet the circle in F, then the line CF bisects the arch AB in the point F; for (see the foregoing figure) joining the points A and F, F and B by the streight lines AF, FB, then in the triangles ADF, BDF, AD is equal to DB (by art. 63.) and DF common to both; therefore AD and DF, two legs of the triangle ADF, are equal to BD and DF, two legs of the triangle BDF, and the included angles ADF BDF are equal, being both right; therefore (by art. 61.) the remaining legs AF and FB are equal; but in the same circle equal lines are chords of equal arches, therefore the arches AF and FB are equal. So the whole arch AFB is bisected in the point F by the line CF.

Cor. 1. From art. 63. it follows, that any line bisecting a chord at right angles is a diameter; for since (by art. 63.) a line draw from the centre perpendicular to a chord, bisects that chord at right angles; therefore, conversly, a line bisecting a chord at right angles, must pass thro' the centre, and consequently be a diameter

Cor. 2. From the two last articles it follows, that the sine of any arc is the half of the chord of twice the arc; for (see the foregoing scheme) AD is the sine of the arc AF, by the definition of a sine, and AF is half the arc AFB, and AD half the chord AB (by art. 63.); therefore the *cor.* is plain.

65. In any triangle, the half of each side is the sine of the opposite angle; for if a circle be supposed to be drawn through the three angular points A, B, and D of the triangle ABD, fig. 48. then the angle DAB is measured by half the arch BKD (by *cor.* 1. of *art.* 62.) but the half of BD, *viz.* BE, is the sine of half the arch BKD, *viz.* the sine of BK (by *cor.* 2. of the last) which is the measure of the angle BAD; therefore the half of BD is the sine of the angle BAD; the same way it may be proved, that the half of AD is the sine of the angle ABD, and the half of AB is the sine of the angle ADB.

66. The sine, tangent, &c. of any arch is called also the sine, tangent, &c. of the angle whose measure the arc is: thus because the arc GD (fig. 49.) is the measure of the angle GCD; and since GH is the sine, DE the tangent, HD the versed sine, CE the secant, also GK the co-sine, BF the co-tangent, and CF the co-secant, &c. of the arch GD; then GH is called the sine, DE the tangent, &c. of the angle GCD, whose measure is the arch GD.

67. *If two equal and parallel lines*, AB *and* CD (fig. 50.) *be joined by two others*, AC *and* BD; *then these shall also be equal and parallel.* To demonstrate this, join the two opposite angles A and D with the line AD; then it is plain this line AD divides the quadrilateral, ACDB, into two triangles, *viz.* ABD, ACD, in which AB a leg of the one, is equal to DC a leg of the other, by supposition, and AD is common to both triangles; and since AB is parallel to CD, the angle BAD will be equal to the angle ADC, (by art. 36.) therefore in the two triangles BA and AD; and the angle BAD is equal to CD and DA; and the angle ADC, that is, two legs and the included angle in the one, is equal to two legs and the included angle in the other; therefore (by art. 61) BD is equal to AC, and since the angle DAC is equal to the angle ADB, therefore the lines BD AC are parallel (by *cor. art.* 59.)

Cor. 1. Hence it is plain, that the quadrilateral ABDC is a parallelogram, since the opposite sides are parallel.

Cor. 2. In any parallelogram the line joining the opposite angles (called the diagonal) as AD, divides the figure into two equal parts, since it has been proved that the triangles ABD ACD are equal to one another.

Cor. 3. It follows also, that a triangle ACD on the same base CD, and between the same parallels with a parallelogram ABDC, is the half of that parallelogram.

Cor. 4. Hence it is plain, that the opposite sides of a parallelogram are equal; for it has been proved, that ABDC being a parallelogram, AB will be equal to CD, and AC equal to BD.

68. All parallelograms on the same or equal bases, and between the same parallels, are equal to one another; that is, if BD and GH (fig. 51.) be equal, and the lines BH and AF be parallel, then the parallelograms ABDC, BDFE, and EFHG, are equal to one another. For AC is equal to EF, each being equal to BD, (by *cor.* 4. of 67.) To both add CE, then AE will be equal CF. So in the two triangles ABE CDF, AB a leg of the one, is equal to CD a leg in the other; and AE is equal to CF, and the angle BAE is equal to the angle DCF (by art. 36.); therefore the two triangles ABE CDF are equal (by art. 61.); and taking the triangle CKE from both, the figure ABKC will be equal to the figure KDFE; to both which add the little triangle KBD, then the parallelogram ABDC will be equal to the parallelogram BDFE. The same way it may be proved, that the parallelogram EFHG is equal to the parallelogram EFDB; so the three parallelograms ABDC, BDFE, and EFHG will be equal to one another.

Cor. Hence it is plain, that triangles on the same base, and between the same parallels, are equal; since they are the half of the parallelograms on the same base and between the same parallels. (by *cor.* 3. of last *art.*)

69. *In any right-angled triangle*, ABC, (fig. 52.) *the square of the hypothenuse* BC, *viz.* BCMH, *is equal to the sum of the squares made on the two sides* AB *and* AC, viz. *to* ABDE *and* ACGF. To demonstrate this, through the point A draw AKL perpendicular to the hypothenuse BC, join AH, AM, DC, and BG; then it is plain that DB is equal to BA (by art. 53.), also BH is equal to BC (by the same); so in the two triangles DBC ABH, the two legs DB and BC in the one are equal to the two legs AB and BH in the other; and the included angles DBC and ABH are also equal; (for DBA is equal to CBH, being both right; to each add ABC, then it is plain that DBC is equal to ABH) therefore the triangles DBC ABH are equal (by art. 61.) but the triangle DBC is half of the square ABDE (by *cor.* 3. of 67th) and the triangle ABH is half the parallelogram BKLH (by the same), therefore half the square ABDE is equal to half the parallelogram BKL. Consequently the square ABDE is equal to the parallelogram BKLH. The same way it may be proved, that the square ACGF is equal to the parallelogram KCML. So the sum of the squares ABDE and ACGF is equal the sum of the parallelograms BKLH and KCML, but the sum of these parallelograms is equal to the square BCMH, therefore the

 sum

fum of the fquares on AB and AC is equal to the fquare on BC.

Cor. 1. Hence in a right-angled triangle, the hypothenufe and one of the legs being given, we may eafily find the other, by taking the fquare of the given leg from the fquare of the hypothenufe, and the fquare root of the remainder will be the leg required.

Cor. 2. Hence, the legs in a right-angled triangle being given, we may find the hypothenufe, by taking the fum of the fquares of the given legs, and extracting the fquare root of that fum.

70. If upon the line AB (fig. 53.) there be drawn a femicircle ADB, whofe centre is C, and on the point C there be raifed a perpendicular to the line AB, *viz.* CD; then it is plain the arc DB is a quadrant, or contains 90 degrees; fuppofe the arc DB to be divided into 9 equal arcs, each of which will contain 10 degrees, then on the point B raifing BE perpendicular to the line AB, it will be a tangent to the circle in the point B, and if to every one of the divifions of the quadrant, *viz.* B 10, B 20, B 30, B 40, *&c.* you draw the fine, tangent, *&c.* (as in the fcheme) we fhall have the fine, tangent, *&c.* to every ten degrees in the quadrant: and the fame way we may have the fine, tangent, *&c.* to every fingle degree in the quadrant, by dividing it into 90 equal parts beginning from B, and drawing the fine, tangent, *&c.* to all the arcs beginning at the fame point B. By this method they draw the lines of fines, tangents, *&c.* of a certain circle on the fcale; for after drawing them on the circle, they take the length of them, and fet them off in the lines drawn for that purpofe. The fame way, by fuppofing the radius of any number of equal parts, (fuppofe 1000, or 10,000, *&c.*) it is plain the fine, tangent, *&c.* of every arc muft confift of fome number of thefe equal parts; and by computing them in parts of the radius, we have tables of fines, tangents, *&c.* to every arc in the quadrant, called natural fines, tangents, *&c.* and the logarithms of thefe give us tables of logarithmic fines, tangents, *&c.* See LOGARITHMS.

71. In any triangle, ABC, (Plate XCIV. fig. 1.) if one of its fides, as AC, be bifected in E, (and confequently AC double of AE) and thtough E be drawn ED, parallel to BC, and meeting AB in D, then BC will be double of ED, and AB double of AD, through D draw DF, parallel to AC, meeting BC in F: for fince, by conftruction, DF is parallel to AC, and DE parallel to BC; therefore, (by art. 36.) the angle BFD will be equal to the angle BCA, (and by the fame article) the angle BCA will be equal to the angle DEA, confequently the angle BFD will be equal to the angle DEA; alfo, (by art. 36.) the angle BDF will be equal to the angle DAE; and fince DF is parallel to EC, and DB parallel to FC, the quadrilateral DFCE will be a parallelogram; and therefore, (by art. 59. cor. 4.) DF will be equal to EC, which, by conftruction, is equal to AE; fo in the two triangles BDF DAE, the two angles BFD and BDF in the one, are equal to the two angles DBA and DAE in the other, each to each refpectively; and the included fide DF, is equal to the included fide AE; therefore, (by art. 61. cor. 1.) AD will be equal to DB, and confequently AB double of AD; alfo (by the fame) DE will be equal to BF; but DE is alfo (by art. 67. cor. 4.) equal to FC; therefore BF and EC together, or BC, will be double of DE.

After the fame manner it may be proved, that if in the triangle AKG, (fig. 2.) AE be taken equal to a third part of AK, and through E be drawn ED, parallel to KG, and meeting AG in D; then ED will be equal to a third part of GK, and AD equal to a third part of AG.

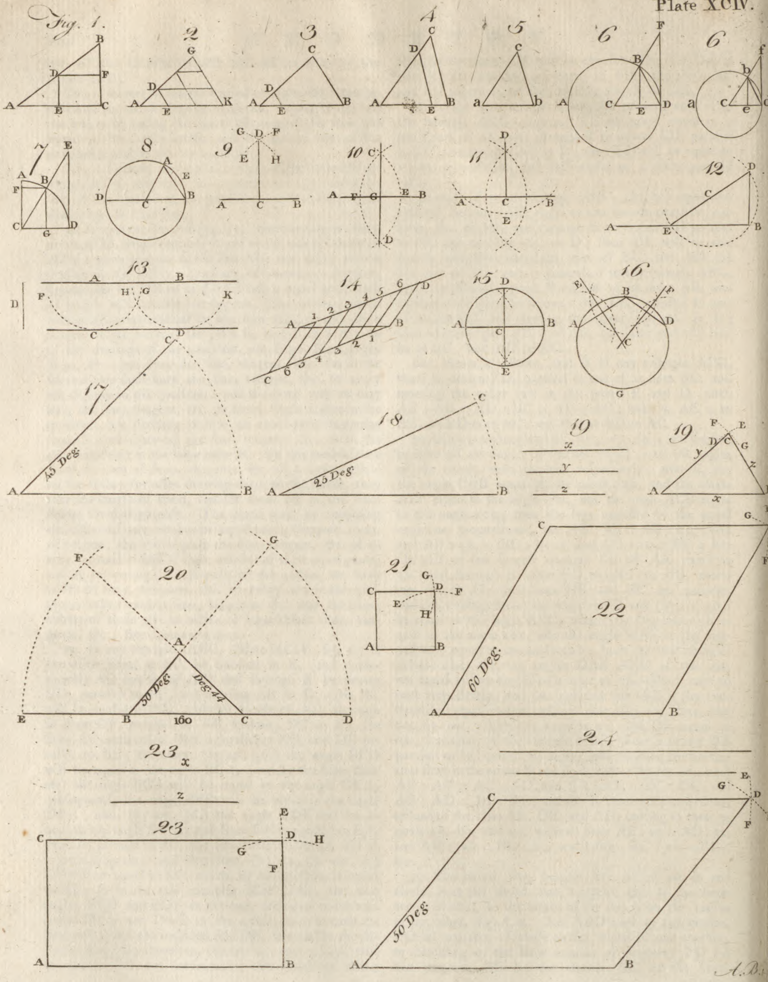
Likewife if in any triangle ABC, (fig. 3.) upon the fide AB, be taken AE, equal to one fourth, one fifth, one fixth, *&c.* of AB, and through E be drawn ED parallel to BC and meeting AC in D; then DE will be one fourth, one fifth, one fixth, *&c.* of BC, and AD the like part of AC; and, in general, if in any triangle ABC, there be affumed a point E on one of its fides AB, and through that point be drawn a line ED, parallel to one of it fides BC, and meeting the other fide AC in D; then whatever part AE is of AB, the fame part will ED be of BC, and AD of AC.

Cor. Hence it follows, that if in any triangle ABC, there be drawn ED, parallel to one of its fides BC, and meeting the other two in the points E and D, then AE : AB :: ED : BC :: AD : AC; that is, AE is to AB, as ED is to BC, and that as AD to AC.

72. If any two triangles ABC, fig 4. abc, fig. 5. are fimilar, or have all the angles of the one equal to all the angles of the other, each to each refpectively; that is, the the angle CAB equal to the angle cab, and the angle ABC equal to the angle abc, and the angle ACB equal to the angle acb; then the legs oppofite to the equal angles are proportioned, *viz.* AB : ab :: AC : ac :: and and AB : ab :: BC : bc :: and AC : ac :: BC : bc. On AB of the largeft triangle fet off AE equal to ab, and through E draw ED parallel to BC, meeting AC in D; then fince DE and BC are parallel, and AB croffing them, the angle AED will (by art. 36.) be equal to the angle ABC, which (by fuppofition) is equal to the angle abc, alfo the angle DAE is (by fuppofition) equal to the angle cab; fo in the two triangles AED, abc, the two angles DAE AED of the one, are equal to two angles cab abc of the other, each to each refpectively, and the included fide AE is (by conftruction) equal to the included fide ab; therefore, (by art. 61. cor. 1.) AD is equal to ac, and DE equal to cb; but fince, in the triangle ABC, there is drawn DE parallel to BC one of its fides, and meeting the two other fides in the points D and E, therefore (by cor. art. 71.) AB : AE :: AC : AD, and AB : AE :: BC : DE, and AC : AD :: BC : DE; and in the three laft proportions, inftead of the lines AE, DE, and AD, putting in their equals ab, bc, and ac, we fhall have AB : ab :: AC : ac, and AB : ab :: BC : bc, and laftly, AC : ac :: BC : bc.

73. The chord, fine, tangent, *&c.* of any arc in one circle, is to the chord, fine, tangent, *&c.* of the fame arc in another, as the radius of the one is to the radius of the other, fig. 6, 6. Let ABD abd be two circles, BD bd two arcs of thefe circles, equal to one another, or confifting of the fame number of degrees; FD fd the tangents, BD bd the chords, BE be the fines, *&c.*

Plate XCIV.



&c. of these two arcs BD bd, and CD cd the radii of the circles; then say, CD : cd :: FD : fd, and CD : cd :: BD : bd, and CD : cd :: BE : be, *&c.* For since the arcs BD bd are equal, the angles BCD bcd will be equal; and FD fd, being tangents to the points D and d, the angles CDF cdf will be equal, being each a right angle (art. 22.) so in the two triangles CDF cdf, the two angles FCD CDF of the one, being equal to the two angles fcd cdf of the other, each to each, the remaining angle CFD, will be equal to the remaining angle cfd, (by art. 60.); therefore the triangles CFD cfd are similar, and consequently (by art. 73) CD : cd :: FD : fd. In the same manner it may be demonstrated, that CD : cd :: BD : bd, and CD : cd :: BE : be, *&c.*

74. Let ABD (fig. 7) be a quadrant of a circle described by the radius CD BD any arc of it, and BA its complement, BG or CF the sine, CG or BF the cosine, DE the tangent, and CE the secant of that arc BD. Then since the triangles CDE CGB are similar or equiangular, it will be (by art. 72.) DE : EC :: GB : BC, *i. e.* the tangent of any arc, is to the secant of the same, as the sine of it is to the radius. Also since DE : EC :: GB : BC; therefore, by inverting that proportion, we have EC : DE :: BC : GB, *i e.* the secant is to the tangent, as the radius is to the sine of any arc.

Again, since the triangles CDE CGB are similar, therefore (by art. 72.) it will be CD : CE :: CG : CB, *i. e.* as the radius is to the secant of any arc, so is the cosine of that arc to the radius. And by inverting the proportion we have this, *viz.* As the secant of any arc is to the radius, so is the radius to the co-sine of that arc.

75. In all circles the chord of 60 is always equal in length to the radius. Thus in the circle AEBD, (fig. 8.) if the arc AEB be an arc of 60 degrees, then drawing the chord AB, I say AB shall be equal to the radius CB or AC; for in the triangle ACB, the angle ACB is 60 degrees, being measured by the arc AEB; therefore the sum of the other two angles is 120 degrees, (by *cor.* 1. of 60.); but since AC and CB are equal to the two angles CAB, CBA will also be equal; consequently each of them half their sum 120, *viz.* 60 degrees; therefore all the three angles are equal to one another, consequently all the legs, therefore AB is equal to CB.

Cor. Hence the radius from which the lines on any scale are formed, is the chord of 60 on the line of chords.

Geometrical Problems.

PROB. 1. From a point C (fig. 9.) in a given line AB to raise a perpendicular to that line.

Rule. From the point C take the equal distances CB, CA on each side of it. Then stretch the compasses to any distance greater than CB or CA, and with one foot of them in B, sweep the arc EF with the other; again, with the same opening, and one foot in A, sweep the arc GH with the other, and these two arcs will intersect one another in the point D; then join the given points C and D with the line CD, and that shall be the perpendicular required.

2. To divide a given right line AB (fig. 10.) into two equal parts; that is, to bisect it.

Rule. Take any distance with your compasses that you are sure is greater than half the given line; then setting one foot of them in B, with the other sweep the arc DFC; and with the same distance, and one foot in A, with the other sweep the arc CED; these two arcs will intersect one another in the points C D, which joined by the right line DC will bisect AB in G.

3. From a given point D, (fig. 11.) to let fall a perpendicular on a given line AB.

Rule. Set one foot of the compasses in the point D, and extend the other to any distance greater than the least distance between the given point and the line, and with that extent sweep the arc AEB, cutting the line in the two points A and B, then (by the last prob.) bisect the line AB in the point C, lastly join C and D, and that line CD is the perpendicular required.

4. (Fig. 12.) Upon the end B of a given right line BA, to raise a perpendicular.

Rule. Take any extent in your compasses, and with one foot in B fix the other in any point C without the given line; then with one point of the compasses in C, describe with the other the circle EBD, and thro' E and C draw the diameter ECD meeting the circle in D; join D and B, and the right line DB is that required; for EBD is a right angle (by *cor.* 4. of 63.).

5. (Fig. 13.) To draw one line parallel to another given line AB, that shall be distant from one another by any given distance D.

Rule. Extend your compasses to the given distance D; then setting one foot of them in any point of the given line (suppose A), with the other sweep the arc FCG; again, at the same extent, and one foot in any other point of the given line B, sweep the arc HDK, and draw the line CD touching them, and that will be parallel to the given line AB, and distant from it by the line D as was required.

6. (Fig. 14.) To divide a given line AB into any number of equal parts, suppose 7.

Rule. From the point A draw any line AD, making an angle with the line AB, then through the point B, draw a line BC parallel to AD; and from A, with any small opening of the compasses, set off a number of equal parts (on the line AD,) less by one than the proposed number (here 6); then from B set off the same number of the same parts (on the line BC); lastly, join 6 and 1, 2 and 5, 3 and 4, 4 and 3, 5 and 2, 6 and 1, and these lines will cut the given line as required.

7. (Fig. 15.) To quarter a given circle, or to divide it into four equal parts.

Rule. Thro' the centre C of the given circle, draw a diameter AB, then upon the point C raise a perpendicular DCE to the line AB; and these two diameters AB and DE shall quarter the circle.

8 (Fig. 16) Thro' three given points A, B, and D, to draw a circle. (*Note*, The three points must not lie in the same straight line.)

Rule. Join A and B, also B and D, with the streight lines AB BD; then (by prob. 2.) bisect AB with the line

line EC, also BD with the line FC, which two lines will cut one another in some point C; that is the centre of the circle required: then fixing one point of your compasses in D, and stretching the other to A, describe the circle ABDG, which will pass thro' the three points given. The reason of this is plain from cor. 1. of art. 64.

9. (Fig. 17.) From the point A of the given line AB, to draw another line (suppose AC) that shall make with AB an angle of any number of degrees, suppose 45.

Rule. Let the given line AB be produced, then take off your scale the length of the chord of 60 degrees, which is equal to the radius of the circle the scale was made for (by art. 75.); and setting one foot in A, with the other sweep of the arc BC; then with your compasses take from your scale the chord of 45 degrees, and set off that distance from B to C. Lastly, join A and C, and the line AC is that required. For the angle CAB, which is measured by the arc BC, is an angle of 45 degrees, as was required.

10. An angle BAC (fig. 18.) being given, to find how many degrees it contains.

Rule. With your compasses take the length of your chord of 60 from your scale. Then, setting one foot of them in A, with the other sweep the arc BC, which is the arc comprehended between the two legs AB, AC produced if needful. Lastly, take with your compasses the distance BC, and applying it to your line of chords on the scale, you will find how many degrees the arc BC contains, and consequently the degrees of the angle BAC which was required.

11. Three lines x, y, and z being given, (fig. 19. 19.) to form a triangle of them; but any two of these lines taken together must always be greater than the third.

Rule. Make any one of them, as x, the base; then with your compasses take another of them, as z, and setting one foot in one end of the line x, as B, with the other sweep the arc DE; and taking with your compasses the length of the other y, set one foot of them in A, the other end of the line x, and with the other sweep the arc FG, which will cut the other in C; lastly, join CA and CB, and the triangle CAB is that required.

12. To make a triangle, having one of its legs of any number of equal parts (suppose 160), and one of the angles at that leg 50 degrees, and the other 44 degrees.

Rule. Draw an indefinite line ED, (fig. 20.) then take off the line of equal parts with your compasses, 160 of them, and set them on the indefinite line, as BC; then (by prob. 9.) draw BA, making the angle ABC of 50 degrees, and (by the same) draw from C the line AC, making the angle ACB of 44 degrees; which two lines will meet one another in A, and the triangle ABC is that required. See TRIGONOMETRY.

13. Upon a given line AB (fig. 21.) to make a square.

Rule. Upon the extremity A of the given line AB, raise a perpendicular AC (by prob. 4.); then take AC equal to AB, and with that extent, setting one foot of the compasses in C, sweep with the other foot the arc GH; then with the same extent, and one foot in B, with the other sweep the arc EF, which will meet the former in some point D; lastly, join C and D, D and B, and the figure ABDC will be the square required.

14. On a given line AB (fig. 22.) to draw a rhomb that shall have one of its angles equal to any number of degrees, suppose 60 degrees.

Rule. From the point A of the given line AB, draw the line AC, making the angle CAB of 60 degrees, (by prob. 9.) then take AC equal to AB, and with that extent, fixing one foot of the compasses in B, with the other describe the arc GH; and at the same extent, fixing one foot of the compasses in C, with the other describe the arc EF cutting the former in D; lastly, join CD and DB, and the figure ACDB is that required.

15. Given two lines x and z, of these two to make a rectangle.

Rule Draw a line, as AB, (fig. 23. 23.) equal in length to one of the given lines x; and on the extremity A of that line, raise a perpendicular AC, on which take AC equal to the other line z; then take with your compasses the length of the line AB, and at that extent, fixing one foot of them in C, with the other sweep the arc EF; and also taking with your compasses the extent of the line AC, fix one foot of them in B, and with the other sweep the arc GH, which will meet the former in D; lastly, join CD and BD, and the figure ABDC will be that required.

16. Two lines x and z being given, of these to form a rhomboides that shall have one of its angles any number of degrees, suppose 50.

Rule. Draw a line AB (fig. 24. 24.) equal in length to one of the lines, as x; then draw the line AC, making with the former the angle BAC equal to the proposed, suppose 50 degrees, and on that line take AC equal to the given line z, then with your compasses take the length of AB, and fixing one foot in C, sweep the arc EF; also, taking the length of AC, and setting one foot in B, with the other sweep the arc GH, which will cut the former in D; then join CD and DB, so the figure ACDB will be that required.

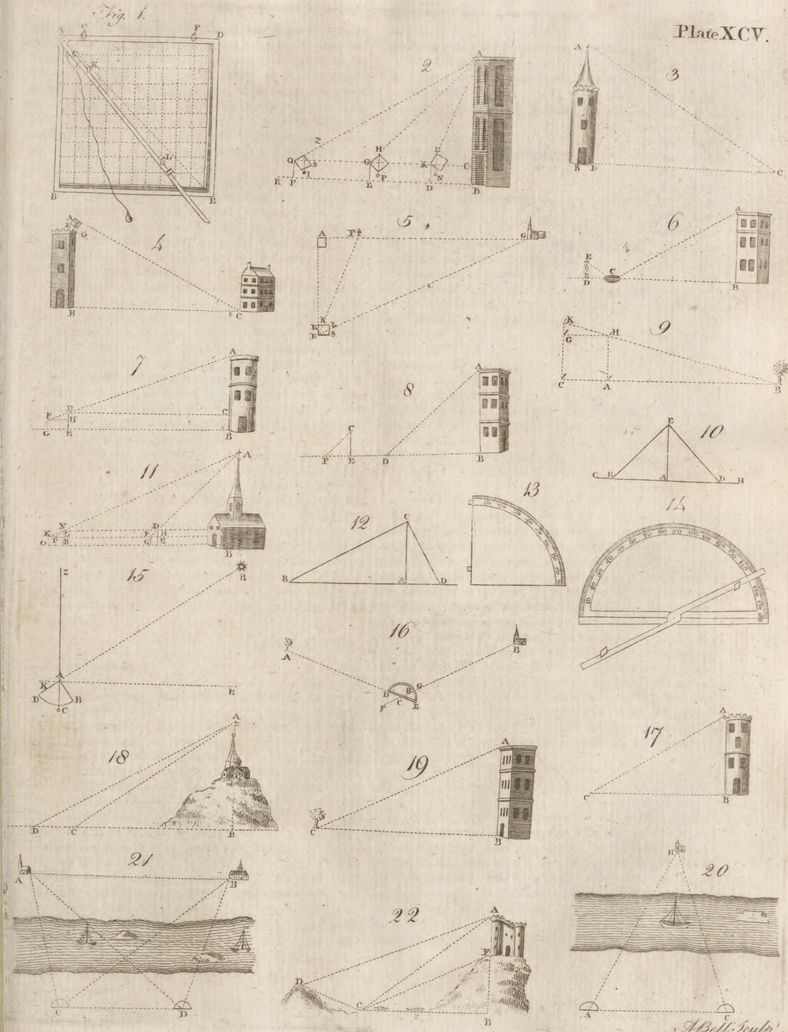
PART II.

THE APPLICATION OF THE FOREGOING PRINCIPLES TO THE MENSURATION OF SURFACES, SOLIDS, &c.

Of the Mensuration of Lines and Angles.

A Line, or length, to be measured, whether it be distance, height, or depth, is measured by a line less than it. With us the least measure of length is an inch: not that we measure no line less than it, but because we do not use the name of any measure below that of an inch; expressing lesser measures by the fractions of an inch: and in this treatise we use decimal fractions as the easiest. Twelve inches make a foot; three feet and an

Plate XCV.



A Bell Sculp.

inch make the Scots ell; six ells make a fall; forty falls make a furlong; eight furlongs make a mile: so that the Scots miles is 1184 paces, accounting every pace to be five feet. These things are according to the statutes of Scotland; notwithstanding which, the glaziers use a foot of only eight inches; and other artists for the most part use an English foot, on account of the several scales marked on the English foot-measure for their use. But the English foot is somewhat less than the Scots; so that 185 of these make 186 of those.

Lines, to the extremities and any intermediate point of which you have easy access are measured by applying to them the common measure a number of times. But lines, to which you cannot have such access, are measured by methods taken from geometry; the chief whereof we shall here endeavour to explain. The first is by the help of the geometrical square.

" As for the English measures, the yard is three feet, " or thirty-six inches. A pole is sixteen feet and a half, " or five yards and a half. The chain, commonly called " *Gunter's chain*, is four poles, or twenty-two yards, " that is, sixty six feet. An English statute-mile is four- " score chains, or 1760 yards, that is, 5280 feet.

" The chain (which is now much in use, because it is " very convenient for surveying) is divided into a hun- " dred links, each of which is $7\frac{92}{100}$ of an inch: whence " it is easy to reduce any number of those links to feet, " or any number of feet to links.

" A chain that may have the same advantages in sur- " veying in Scotland, as Gunter's chain has in England, " ought to be in length seventy-four feet, or twenty-four " Scots ells, if no regard is had to the difference of the " Scots and English foot above mentioned. But, if re- " gard is had to that difference, the Scots chain ought " to consist of $74\frac{2}{5}$ English feet, or 74 feet 4 inches and " $\frac{4}{5}$ of an inch. This chain being divided into an hun- " dred links, each of those links is 8 inches and $\frac{928}{1000}$ of " an inch. In the following table, the most noted mea- " sures are expressed in English inches and decimals of " an inch."

	English inch.	*Dec.*
The English foot, is	12	000
The Paris foot,	12	788
The Rhindland foot, measured by Mr Picart,	12	362
The Scots foot,	12	065
The Amsterdam foot, by Snellius and Picart,	11	172
The Dantzick foot, by Hevelius,	11	297
The Danish foot, by Mr Picart,	12	465
The Swedish foot, by the same,	11	692
The Brussels foot, by the same,	10	828
The Lyons foot, by Mr Auzout,	13	458
The Bononian foot, by Mr Cassini,	14	938
The Milan foot, by Mr Auzout,	15	631
The Roman palm used by merchants, according to the same,	9	791
The Roman palm used by architects,	8	779
The palm of Naples, according to Mr Auzout,	10	314
The English yard,	36	000
The English ell,	45	000
The Scots ell,	37	200
The Paris aune used by mercers, according to Mr Picart,	46	786
The Paris aune used by drapers, according to the same,	46	680
The Lyons aune, by Mr Auzout,	46	570
The Geneva aune,	44	760
The Amsterdam ell,	26	800
The Danish ell, by Mr Picart,	24	930
The Swedish ell,	23	380
The Norway ell,	24	510
The Brabant or Antwerp ell,	27	170
The Brussels ell,	27	260
The Bruges ell,	27	550
The brace of Bononia, according to Auzout,	25	200
The brace used by architects in Rome,	30	730
The brace used in Rome by merchants,	34	270
The Florence brace used by merchants, according to Picart,	22	910
The Florence geographical brace,	21	570
The vara of Seville,	33	127
The vara of Madrid,	39	166
The vara of Portugal,	44	031
The cavedo of Portugal,	27	354
The ancient Roman foot,	11	632
The Persian arish, according to Mr Græves,	38	364
The shorter pike of Constantinople, according to the same,	25	576
Another pike of Constantinople, according to Mess. Mallet and De la Porte,	27	920

PROPOSITION I.

PROB. *To describe the structure of the geometrical square.*—The geometrical square is made of any solid matter, as brass or wood, or of any four plain rulers joined together at right angles, (as in Plate XCV. fig. 1.) where A is the centre, from which hangs a thread with a small weight at the end, so as to be directed always to the centre. Each of the sides BE and DE is divided into an hundred equal parts, or (if the sides be long enough to admit of it) into a thousand parts; C and F are two sights, fixed on the side AD. There is moreover an index GH, which, when there is occasion, is joined to the centre A, in such manner as that it can move round, and remain in any given situation. On this index are two sights perpendicular to the right line going from the centre of the instrument: these are K and L. The side DE of the instrument is called the upright side; E the reclining side.

PROPOSITION II.

FIG. 2. *To measure an accessible height*, AB, *by the help of a geometrical square, its distance being known.*—Let BR be an horizontal plane, on which there stands perpendicularly any line AB: let BD, the given distance of the observator from the height, be 96 feet; let the height of the observator's eye be supposed 6 feet; and let the instrument, held by a steady hand, or rather leaning on a support, be directed towards the summit A, so that one eye (the other being shut) may see it clearly through the sights; the perpendicular or plumb-line meanwhile hanging free, and touching the surface of the in-

ſtrument: let now the perpendicular be ſuppoſed to cut off on the right ſide KN 80 equal parts. It is clear that LKN, ACK, are ſimilar triangles; for the angles LKN, ACK are right angles, and therefore equal; moreover LN and AC are parallel, as being both perpendicular to the horizon; conſequently, (by art. 60. cor. 1. part 1.) the angles KLN, KAC, are equal; wherefore, (by art. 60. cor. 2. of part 1.) the angles LNK, and AKC, are likewiſe equal: ſo that in the triangles NKL, KAC, (by art. 72. of part 1.) as NK : KL :: KC (*i. e.* BD) : CA; that is, as 80 to 100, ſo is 96 feet to CA. Therefore, by the rule of three, CA will be found to be 120 feet; and CB, which is 6 feet, being added, the whole height is 126 feet.

But if the diſtance of the obſervator from the height, as BE, be ſuch, that, when the inſtrument is directed as formerly toward the ſummit A, the perpendicular falls on the angle P, oppoſite to H, the centre of the inſtrument, and BE or CG be given of 120 feet; CA will alſo be 120 feet. For in the triangles HGP, ACG, equiangular, as in the preceding caſe, as PG : GH : : GC : CA. But PG is equal to GH; therefore GC is likewiſe equal to CA: that is, CA will be 120 feet, and the whole height 126 feet as before.

Let the diſtance BF be 300 feet, and the perpendicular or plumb-line cut off 40 equal parts from the reclining ſide: Now, in this caſe, the angles QAC, QZI, are equal, and the angles QZI, ZIS, are equal; therefore the angle ZIS is equal to the angle QAC. But the angles ZSI QCA are equal, being right angles; therefore, in the equiangular triangles ACQ, SZI, it will be, as ZS : SI : : CQ : CA; that is, as 100 to 40, ſo is 300 to CA. Wherefore, by the rule of three, CA will be found to be of 102 feet. And, by adding the height of the obſervator, the whole BA will be 126 feet. Note, that the height is greater than the diſtance, when the perpendicular cuts the right ſide, and leſs if it cut the reclined ſide; and that the height and diſtance are equal, if the perpendicular fall on the oppoſite angle.

SCHOLIUM.

If the height of a tower, to be meaſured as above, end in a point, (as in fig. 3.) the diſtance of the obſervator oppoſite to it, is not CD, but is to be accounted from the perpendicular to the point A; that is, to CD muſt be added the half of the thickneſs of the tower, *viz.* BD: which muſt likewiſe be underſtood in the following propoſitions, when the caſe is ſimilar.

PROPOSITION III.

Fig. 4. *From the height of a tower* AB *given, to find a diſtance on the horizontal plane* BC, *by the geometrical ſquare*.—Let the inſtrument be ſo placed, as that the mark C in the oppoſite plane may be ſeen through the ſights; and let it be obſerved how many parts are cut off by the perpendicular. Now, by what hath been already demonſtrated, the triangles AEF, ABC, are ſimilar; therefore, it will be as EF to AE, ſo AB (compoſed of the height of the tower BG, and of the height of the centre of the inſtrument A, above the tower BG) to the diſtance BC. Wherefore, if, by the rule of three, you ſay, as EF to AE, ſo is AB to BC, it will be the diſtance ſought.

PROPOSITION IV.

Fig. 5. *To meaſure any diſtance at land or ſea, by the geometrical ſquare.*—In this operation, the index is to be applied to the inſtrument, as was ſhown in the deſcription; and, by the help of a ſupport, the inſtrument is to be placed horizontally at the point A; then let it be turned till the remote point F, whoſe diſtance is to be meaſured, be ſeen through the fixed ſights; and bringing the index to be parallel with the other ſide of the inſtrument, obſerve by the ſights upon it any acceſſible mark B, at a ſenſible diſtance: then carrying the inſtrument to the point B, let the immoveable ſights be directed to the firſt ſtation A, and the ſights of the index to the point F. If the index cut the right ſide of the ſquare, as in K, in the two triangles BRK, and BAF, which are æquiangular, it will be as BR to RK, ſo BA (the diſtance of the ſtations to be meaſured with a chain) to AF; and the diſtance AF ſought will be found by the rule of three. But if the index cut the reclined ſide of the ſquare in any point L, where the diſtance of a more remote point is ſought; in the triangles BLS, BAG, the ſide LS ſhall be to SB, as BA to AG, the diſtance ſought; which accordingly will be found by the rule of three.

PROPOSITION V.

Fig. 6. *To meaſure an acceſſible height by means of a plain mirror.*—Let AB be the height to be meaſured; let the mirror be placed at C, in the horizontal plane BD, at a known diſtance BC; let the obſerver go back to D, till he ſee the image of the ſummit in the mirror, at a certain point of it, which he muſt diligently mark; and let DE be the height of the obſervator's eye. The triangles ABC and EDC are equiangular; for the angles at D and B are right angles; and ACB, ECD, are equal, being the angles of incidence and reflexion of the ray AC, as is demonſtrated in optics; wherefore the remaining angles at A and E are alſo equal: therefore it will be, as CD to DE, ſo CB to BA; that is, as the diſtance of the obſervator from the point of the mirror in the right line betwixt the obſervator and the height, is to the height of the obſervator's eye, ſo is the diſtance of the tower from that point of the mirror, to the height of the tower ſought; which therefore will be found by the rule of three.

Note 1. The obſervation will be more exact, if, at the point D, a ſtaff be placed in the ground perpendicularly, over the top of which the obſervator may ſee a point of the glaſs exactly in a line betwixt him and the tower.

Note 2. In place of a mirror may be uſed the ſurface of water contained in a veſſel, which naturally becomes parallel to the horizon.

PROPOSITION VI.

Fig. 7. *To meaſure an acceſſible height* AB *by means of two ſtaffs.*—Let there be placed perpendicularly in the ground a longer ſtaff DE, likewiſe a ſhorter one FG, ſo as the obſervator may ſee A, the top of the height to be meaſured, over the ends D F of the two ſtaffs; let FH and DC, parallel to the horizon, meet DE and AB in H and C; then the triangles FHD, DCA, ſhall be equiangular;

equiangular; for the angles at C and H are right ones; likewise the angle A is equal to the angle FDH; wherefore the remaining angles DFH, and ADC, are also equal: Wherefore, as FH, the distance of the staffs, to HD, the excess of the longer staff above the shorter; so is DC, the distance of the longer staff from the tower, to CA, the excess of the height of the tower above the longer staff. And thence CA will be found by the rule of three.

To which if the length DE be added, you will have the whole height of the tower BA.

SCHOLIUM.

FIG. 8. Many other methods may be occasionally contrived for measuring an accessible height. For example, from the given length of the shadow BD, to find out the height AB, thus: Let there be erected a staff CE perpendicularly, producing the shadow EF: The triangles ABD, CEF, are equiangular; for the angles at B and E are right; and the angles ADB and CFE are equal, each being equal to the angle of the sun's elevation above the horizon: Therefore, as EF, the shadow of the staff, to EC, the staff itself; so BD, the shadow of the tower, to BA, the height of the tower. Though the plane on which the shadow of the tower falls be not parallel to the horizon, if the staff be erected in the same plane, the rule will be the same.

PROPOSITION VII.

To measure an inaccessible height by means of two staffs.—Hitherto we have supposed the height to be accessible, or that we can come at the lower end of it; now if, because of some impediment, we cannot get to a tower, or if the point whose height is to be found out be the summit of a hill, so that the perpendicular be hid within the hill; if, for want of better instruments, such an inaccessible height is to be measured by means of two staffs, let the first observation be made with the staffs DE and FG, (as in prop. 6.); then the observator is to go off in a direct line from the height and first station, till he come to the second station; where (fig. 11.) he is to place the longer staff perpendicularly at RN, and the shorter staff at KO, so that the summit A may be seen along their tops; that is, so that the points KNA may be in the same right line. Through the point N, let there be drawn the right line NP parallel to FA: Wherefore in the triangles KNP, KAF, the angles KNP KAF are equal, also the angle AKF is common to both; consequently the remaining angle KPN is equal to the remaining angle KFA. And therefore, PN : FA :: KP : KF. But the triangles PNL, FAS are similar; therefore, PN : FA :: NL : SA. Therefore, (by the 11. 5. Eucl.) KP : KF :: N L : SA. Thence, alternately, it will be, as KP (the excess of the greater distance of the short staff from the long one above its lesser distance from it) to NL, the excess of the longer staff above the shorter; so KF, the distance of the two stations of the shorter staff to SA the excess of the height sought above the height of the shorter staff. Wherefore SA will be found by the rule of three. To which let the height of the shorter staff be added, and the sum will give the whole inaccessible height BA.

Note 1. In the same manner may an inaccessible height be found by a geometrical square, or by a plain speculum. But we shall leave the rules to be found out by the student, for his own exercise.

Note 2. That by the height of the staff we understand its height above the ground in which it is fixed.

Note 3. Hence depends the method of using other instruments invented by geometricians; for example, of the geometrical cross: And if all things be justly weighed, a like rule will serve for it as here. But we incline to touch only upon what is most material.

PROPOSITION VIII.

FIG. 9. *To measure the distance* AB, *to one of whose extremities we have access, by the help of four staffs.*—Let there be a staff fixed at the point A; then going back at some sensible distance in the same right line, let another be fixed in C, so as that both the points A and B be covered and hid by the staff C: likewise going off in a perpendicular from the right line CB, at the point A, (the method of doing which shall be shown in the following *scholium*), let there be placed another staff at H; and in the right line CKG (perpendicular to the same CB, at the point B), and at the point of it K, such that the points K, H, and B may be in the same right line, let there be fixed a fourth staff. Let there be drawn, or let there be supposed to be drawn, a right line GH parallel to CA. The triangles KGH, HAB, will be equiangular; for the angles HAB KGH are right angles. Also the angles ABH, KHG are equal; wherefore, as KG (the excess of CK above AH) to GH, or to CA, the distance betwixt the first and second staff; so is AH, the distance betwixt the first and third staff, to AB the the distance sought.

SCHOLIUM.

FIG. 10. To draw on a plane a right line AE perpendicular to CH, from a given point A; take the right lines AB, AD, on each side equal; and in the points B and D, let there be fixed stakes, to which let there be tied two equal ropes BE, DE, or one having a mark in the middle, and holding in your hand their extremities joined, (or the mark in the middle, if it be but one), draw out the ropes one the ground; and then, where the two ropes meet, or at the mark, when by it the rope is fully stretched, let there be placed a third stake at E; the right line AE will be perpendicular to CH in the point A (prob. 1. of part. i.). In a manner not unlike to this, may any problems that are resolved by the square and compasses, be done by ropes and a cord turned round as a radius.

PROPOSITION IX.

FIG. 12. *To measure the distance* AB, *one of whose extremities is accessible.*—From the point A, let the right line AC of a known length be made perpendicular to AB, (by the preceding *scholium*): likewise draw the right line CD perpendicular to CB, meeting the right line AB in D: then as DA : AC :: AC : AB. Wherefore, when DA and AC are given, AB will be found by the rule of three.

SCHOLIUM.

All the preceding operations depend on the equality of some angles of triangles, and on the similarity of the triangles arising from that equality. And on the same principles

ciples depend innumerable other operations which a geometrician will find out of himſelf, as is very obvious. However, ſome of theſe operations require ſuch exactneſs in the work, and without it are ſo liable to errors, that, *cæteris paribus*, the following operations, which are performed by a trigonometrical calculation, are to be preferred; yet could we not omit thoſe above, being moſt eaſy in practice, and moſt clear and evident to thoſe who have only the firſt elements of geometry. But if you are provided with inſtruments, the following operations are more to be relied upon. We do not inſiſt on the eaſieſt caſes to thoſe who are ſkilled in plain trigonometry, which is indeed neceſſary to any one who would apply himſelf to practice. See TRIGONOMETRY.

PROPOSITION X.

FIG. 13. *To deſcribe the conſtruction and uſe of the geometrical quadrant.*—The geometrical quadrant is the fourth part of a circle divided into ninety degrees, to which two ſights are adapted, with a perpendicular or plumb line hanging from the centre. The general uſe of it is for inveſtigating angles in a vertical plane, comprehended under right lines going from the centre of the inſtrument, one of which is horizontal, and the other is directed to ſome viſible point. This inſtrument is made of any ſolid matter as wood, copper, &c.

PROPOSITION XI.

FIG. 14. *To deſcribe and make uſe of the graphometer.*—The graphometer is a ſemicircle made of any hard matter, of wood, for example, or braſs, divided into 180 degrees; ſo fixed on a *fulcrum*, by means of a braſs ball and ſocket, that it eaſily turns about, and retains any ſituation; two ſights are fixed on its diameter. At the centre there is commonly a magnetical needle in a box. There is likewiſe a moveable ruler, which turns round the centre, and retains any ſituation given it. The uſe of it is to obſerve any angle, whoſe vertex is at the centre of the inſtrument in any plane, (though it is moſt commonly horizontal, or nearly ſo), and to find how many degrees it contains.

PROPOSITION XII.

FIG. 15. and 16. *To deſcribe the manner in which angles are meaſured by a quadrant or graphometer.*—Let there be an angle in a vertical plane, comprehended between a line parallel to the horizon HK, and the right line RA, coming from any remarkable point of a tower or hill, or from the ſun, moon, or a ſtar. Suppoſe that this angle RAH is to be meaſured by the quadrant: let the inſtrument be placed in the vertical plane, ſo as that the centre A may be in the angular point: and let the ſights be directed towards the object at R, (by the help of the ray coming from it, if it be the ſun or moon, or by the help of the viſual ray, if it is any thing elſe), the degrees and minutes in the arc BC cut off by the perpendicular, will meaſure the angle RAH required. For, from the make of the quadrant, BAD is a right angle; therefore BAR is likewiſe right, being equal to it. But, becauſe HK is horizontal, and AC perpendicular, HAC will be a right angle; and therefore equal alſo to BAR. From thoſe angles ſubtract the part HAB that is common to both; and there will remain the angle BAC equal to the angle RAH. But the arc BC is the meaſure of the angle BAC; conſequently, it is likewiſe the meaſure of the angle RAH.

Note, That the remaining arc on the quadrant DC is the meaſure of the angle RAZ, comprehended between the foreſaid right line RA and AZ which points to the zenith.

Let it now be required to meaſure the angle ACB (fig. 16) in any plane, comprehended between the right-lines AC and BC, drawn from two points A and B, to the place of ſtation C. Let the graphometer be placed at C, ſupported by its *fulcrum* (as was ſhown above); and let the immoveable ſights on the ſide of the inſtrument DE be directed towards the point A; and likewiſe (while the inſtrument remains immoveabe) let the ſights of the ruler FG (which is moveable about the centre C) be directed to the point B. It is evident, that the moveable ruler cuts off an arc DH, which is the meaſure of the angle ACB ſought. Moreover, by the ſame method, the inclination of CE, or of FG, may be obſerved with the meridian line, which is pointed out by the magnetic needle incloſed in the box, and is moveable about the centre of the inſtrument, and the meaſure of this inclination or angle found in degrees.

PROPOSITION XIII.

FIG. 17. *To meaſure an acceſſible height by the geometrical quadrant.*—By the 12th prop. of this part, let the angle C be found by means of the quadrant. Then in the triangle ABC, right-angled at B, (BC being ſuppoſed the horizontal diſtance of the obſervator from the tower), having the angle at C, and the ſide BC, the required height BA will be found by the 3d caſe of plain trigonometry. See TRIGONOMETRY.

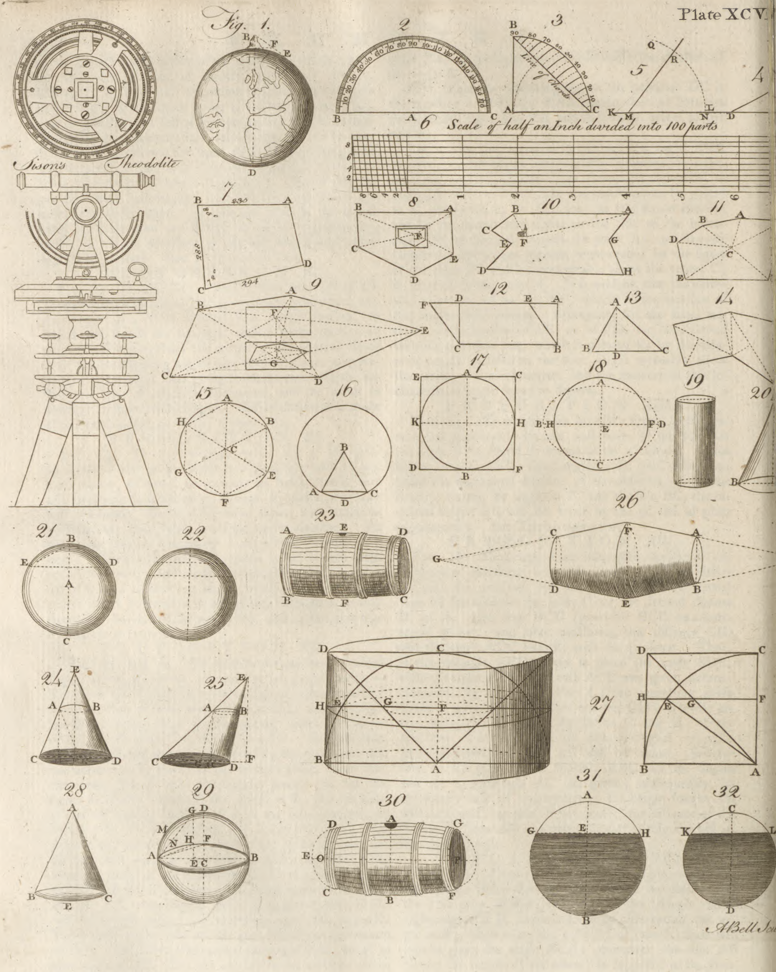
PROPOSITION XIV.

FIG. 18. *To meaſure an inacceſſible height by the geometrical quadrant.*—Let the angle ACB be obſerved with the quadrant (by the 12th prop. of this part;) then let the obſerver go from C to the ſecond ſtation D, in the right line BCD (provided BCD be a horizontal plane); and after meaſuring this diſtance CD, take the angle ADC likewiſe with the quadrant. Then, in the triangle ACD, there is given the angle ADC, with the angle ACD; becauſe ACB was given before: therefore (by art. 59. of Part I.) the remaining angle CAD is given likewiſe. But the ſide CD is likewiſe given, being the diſtance of the ſtation C and D; therefore (by the firſt caſe of oblique-angled triangles in trigonometry) the ſide AC will be found. Wherefore, in the right-angled triangle ABC, all the angles and the hypothenuſe AC are given; conſequently, by the fourth caſe of trigonometry, the height ſought AB will be found; as alſo (if you pleaſe) the diſtance of the ſtation C, from AB the perpendicular within the hill or inacceſſible height.

PROPOSITION XV.

FIG. 19. *From the top of a given height, to meaſure the diſtance* BC.—Let the angle BAC be obſerved by the 12th prop. of this; wherefore in the triangle ABC, right-angled at B, there is given by obſervation the angle at A; whence (by the 59th art. of Part I.) there will alſo be given the angle BCA: moreover the ſide AB (being the height of the tower) is ſuppoſed to be given. Wherefore,

Plate XCV.



A.Bell Sculp

Wherefore, by the 3d caſe of trigonometry, BC, the diſtance ſought, will be found.

PROPOSITION XVI.

FIG. 20. *To meaſure the diſtance of two places* A *and* B, *of which one is acceſſible, by the graphometer.*—Let there be erected at two points A and C, ſufficiently diſtant, two viſible ſigns; then (by the 12th prop. of this part) let the two angles BAC, BCA be taken by the graphometer. Let the diſtance of the ſtations A and C be meaſured with a chain. Then the third angle B being known, and the ſide AC being likewiſe known; therefore, by the firſt caſe of trigonometry, the diſtance required, AB, will be found.

PROPOSITION XVII.

FIG. 21. *To meaſure by the graphometer, the diſtance of two places, neither of which is acceſſible.*—Let two ſtations C and D be choſen, from each of which the places may be ſeen whoſe diſtance is ſought: let the angles ACD, ACB, BCD, and likewiſe the angles BDC, BDA, CDA, be meaſured by the graphometer; let the diſtance of the ſtations C and D be meaſured by a chain, or (if it be neceſſary) by the preceding practice. Now, in the triangle ACD, there are given two angles ACD and ADC; therefore, the third CAD is likewiſe given; moreover the ſide CD is given; therefore, by the firſt caſe of trigonometry, the ſide AD will be found. After the ſame manner, in the triangle BCD, from all the angles and one ſide CD given, the ſide BD is found. Wherefore, in the triangle ADB, from the given ſides DA and DB, and the angle ADB contained by them, the ſide AB (the diſtance ſought) is found by the 4th caſe of trigonometry of oblique-angled triangles.

PROPOSITION XVIII.

FIG. 22. *It is required by the graphometer and quadrant, to meaſure an acceſſible height* AB, *placed ſo on a ſteep, that one can neither go near it in an horizontal plane, nor recede from it, as we ſuppoſed in the ſolution of the* 14*th Prop.*—Let there be choſen any ſituation as C, and another D; where let ſome mark be erected: let the angles ACD and ADC be found by the graphometer; then the third angle DAC will be known. Let the ſide CD, the diſtance of the ſtations, be meaſured with a chain, and thence (by trigon.) the ſide AC will be found. Again, in the triangle ACB, right angled at B, having found by the quadrant the angle ACB, the other angle CAB is known likewiſe: but the ſide AC in the triangle ADC is already known; therefore the height required AB will be found by the 4th caſe of right-angled triangles. If the height of the tower is wanted, the angle BCF will be found by the quadrant; which being taken from the angle ACB already known, the angle ACF will remain: but the angle FAC was known before; therefore the remaining angle AFC will be known. But the ſide AC was alſo known before; therefore, in the triangle AFC, all the angles and one of the ſides AC being known, AF, the height of the tower above the hill, will be found by trigonometry.

SCHOLIUM.

It were eaſy to add many other methods of meaſuring heights and diſtances; but, if what is above be underſtood, it will be eaſy (eſpecially for one that is verſed in the elements) to contrive methods for this purpoſe, according to the occaſion: ſo that there is no need of adding any more of this ſort. We ſhall ſubjoin here a method by which the diameter of the earth may be found out.

PROPOSITION XIX.

PLATE CXVI. FIG. 1. *To find the diameter of the earth from one obſervation.*—Let there be choſen a high hill AB, near the ſea-ſhore, and let the obſervator on the top of it, with an exact quadrant divided into minutes and ſeconds by tranſverſe diviſions, and fitted with a teleſcope in place of the common ſights, meaſure the the angle ABE contained under the right line AB, which goes to the centre, and the right line BE drawn to the ſea, a tangent to the globe at E; let there be drawn from A perpendicular to BD, the line AF meeting BE in F. Now in the right-angled triangle BAF all the angles are given, alſo the ſide AB, the height of the hill; which is to be found by ſome of the foregoing methods, as exactly as poſſible; and (by trigonometry) the ſides BF and AF are found. But, by cor. 36th 3. Eucl. AF is equal to FE; therefore BE will be known. Moreover, by 36th 3. Eucl. the rectangle under BA and BD is equal to the ſquare of BE. And thence, by 17th 6. Eucl. as AB : BE :: BE : BD. Therefore, ſince AB and BE are already given, BD will be found by 11th, 6. Eucl. or by the rule of three; and ſubtracting BA, there will remain AD the diameter of the earth ſought.

SCHOLIUM.

Many other methods might be propoſed for meaſuring the diameter of the earth. The moſt exact is that propoſed by Mr Picart of the academy of ſciences at Paris.

"According to Mr Picart, a degree of the meridian "at the latitude of 49° 21′, was 57,060 French toiſes, "each of which contains ſix feet of the ſame meaſure; "from which it follows, that, if the earth be an exact "ſphere, the circumference of a great circle of it will "be 123,249,600 Paris feet, and the ſemidiameter of "the earth 19.615,800 feet: but the French mathematicians, who of late have examined Mr Picart's operations, aſſure us, That the degree in that latitude "is 57,183 toiſes. They meaſured a degree in Lapland, in the latitude of 66° 20′, and found it of "57,438 toiſes. By comparing theſe degrees, as well "as by the obſervations on pendulums, and the theory "of gravity, it appears that the earth is an oblate ſpheroid; and (ſuppoſing thoſe degrees to be accurately "meaſured) the axis or diameter that paſſes through the "poles will be to the diameter of the equator, as 177 to "178, or the earth will be 22 miles higher at the equator "than at the poles. A degree has likewiſe been meaſured at the equator, and found to be conſiderably leſs "than at the latitude of Paris; which confirms the oblate figure of the earth. But an account of this laſt "menſuration has not been publiſhed as yet. If the "earth was of an uniform denſity from the ſurface to "the centre, then, according to the theory of gravity, "the meridian would be an exact ellipſis, and the axis "would be to the diameter of the equator as 230 to "231; and the difference of the ſemidiameter of the "equator and ſemiaxis about 17 miles."

In what follows, a figure is often to be laid down on paper, like to another figure given; and becaufe this likenefs confifts in the equality of their angles, and in the fides having the fame proportion to each other (by the definitions of the 6th of Eucl.) we are now to fhew what methods practical geometricians ufe for making on paper an angle equal to a given angle, and how they conftitute the fides in the fame proportion. For this purpofe they make ufe of a protractor, (or, when it is wanting, a line of chords), and of a line of equal parts.

PROPOSITION XX.

FIG. 2. 3. 4. 5. and 6. *To defcribe the conftruction and ufe of the protractor, of the line of chords, and of the line of equal parts.*--The protractor is a fmall femicircle of brafs, or fuch folid matter. The femicircumference is divided into 180 degrees. The ufe of it is, to draw angles on any plane, as on paper, or to examine the extent of angles already laid down. For this laft purpofe, let the fmall point in the centre of the protractor be placed above the angular point, and let the fide AB coincide with one of the fides that contain the angle propofed; the number of degrees cut off by the other fide, computing on the protractor from B, will fhow the quantity of the angle that is to be meafured.

But if an angle is to be made of a given quantity on a given line, and at a given point of that line, let AB coincide with the given line, and let the centre A of the inftrument be applied to that point. Then let there be a mark made at the given number of degrees; and a right line drawn from that mark to the given point, will conftitute an angle with the given right line of the quantity required; as is manifeft.

This is the moft natural and eafy method, either for the extent of an angle on paper, or for defcribing on paper an angle of a given quantity.

But when there is fcarcity of inftruments, or becaufe a line of chords is more eafily carried about, (being defcribed on a ruler on which there are many other lines befides), practical geometricians frequently make ufe of it. It is made thus: let the quadrant of a circle be divided into 90 degrees; (as in fig. 4.) The line AB is the chord of 90 degrees; the chord of every arc of the quadrant is transferred to this line AB, which is always marked with the number of degrees in the correfponding arc.

Note, that the chord of 60 degrees is equal to the radius, by corol. 15. 4th Eucl. If now a given angle EDF is to be meafured by the line of chords from the centre D, with the diftance DG, (the chord of 60 degrees,) defcribe the arch GF; and let the points G and F be marked where this arch interfects the fides of the angle. Then if the diftance GF, applied on the line of chords from A to B, gives (for example) 25 degrees, this fhall be the meafure of the angle propofed.

When an obtufe angle is to be meafured with this line, let its complement to a femicircle be meafured, and thence it will be known. It were eafy to transfer to the diameter of a circle the chords of all arches to the extent of a femicircle; but fuch are rarely found marked upon rules.

But now, if an angle of a given quantity, fuppofe of 50 degrees, is to be made at a given point M of the right line KL (fig. 6.) From the centre M, and the diftance MN, equal to the chord of 60 degrees, defcribe the arc QN. Take off an arc NR, whofe chord is equal to that of 50 degrees on the line of chords; join the points M and R; and it is plain that MR fhall contain an angle of 50 degrees with the line KL propofed.

But fometimes we cannot produce the fides, till they be of the length of a chord of 60 degrees on our fcale; in which cafe it is fit to work by a circle of proportions (that is a fector), by which an arc may be made of a given number of degrees to any radius.

The quantities of angles are likewife determined by other lines ufually marked upon rules, as the lines of fines, tangents, and fecants; but, as thefe methods are not fo eafy or fo proper in this place, we omit them.

To delineate figures fimilar or like to others given, befides the equality of the angles, the fame proportion is to be preferved among the fides of the figure that is to be delineated, as is among the fides of the figures given. For which purpofe, on the rules ufed by artifts, there is a line divided into equal parts, more or lefs in number, and greater or leffer in quantity, according to the pleafure of the maker.

A foot is divided into inches; and an inch, by means of tranfverfe lines, into 100 equal parts: fo that with this fcale, any number of inches, below twelve, with any part of an inch, can be taken by the compaffes, providing fuch part be greater than the one hundredth part of an inch. And this exactnefs is very neceffary in delineating the plans of houfes, and in other cafes.

PROPOSITION XXI.

FIG. 7. *To lay down on paper, by the protractor or line of chords, and line of equal parts, a right-lined figure like to one given, providing the angles and fides of the figure given be known by obfervation or menfuration.* —For example, fuppofe that it is known that in a quadrangular figure, one fide is of 235 feet, that the angle contained by it and the fecond fide is of 84°, the fecond fide of 288 feet, the angle contained by it and the third fide of 72°, and that the third fide is 294 feet. Thefe things being given, a figure is to be drawn on paper like to this quadrangular figure. On your paper, at a proper point A, let a right line be drawn, upon which take 235 equal parts, as AB. The part reprefenting a foot is taken greater or leffer, according as you would have your figure greater or lefs. In the adjoining figure, the 100th part of an inch is taken for a foot. And accordingly an inch divided into 100 parts, and annexed to the figure, is called a fcale of 100 feet. Let there be made at the point B (by the preceding prop.) an angle ABC of 85°, and let BC be taken of 288 parts like to the former. Then let the angle BCD be made of 72°, and the fide CD of 294 equal parts. Then let the fide AD be drawn; and it will compleat the figure like to the figure given. The meafures of the angle A and D can be known by the protractor or line of chords, and the fide AD by the line of equal parts; which will exactly anfwer to the correfponding angles and to the fide of the primary figure.

After the very fame manner, from the fides and angles given, which bound any right-lined figure, a figure like to it may be drawn, and the reft of its fides and angles be known.

COROL-

COROLLARY.

Hence any trigonometrical problem in right-lined triangles, may be resolved by delineating the triangle from what is given concerning it, as in this proposition. The unknown sides are examined by a line of equal parts, and the angles by a protractor or line of chords.

PROPOSITION XXII.

The diameter of a circle being given, to find its circumference nearly.—The periphery of any polygon inscribed in the circle is less than the circumference, and the periphery of any polygon described about a circle is greater than the circumference. Whence Archimedes first discovered that the diameter was in proportion to the circumference, as 7 to 22 nearly; which serves for common use. But the moderns have computed the proportion of the diameter to the circumference to greater exactness. Supposing the diameter 100, the periphery will be more than 314, but less than 315. The diameter is more nearly to the circumference, as 113 to 355. But Ludolphus van Cuelen exceeded the labours of all; for by immense study he found, that, supposing the diameter 100,000,000,000,000,000,000,000,000,000,000,

the periphery will be less than

314,159,265,358,979,323,846,264,338,327,951,

but greater than

314,159,265,358,979,323,846,264,338,327,950;

whence it will be easy, any part of the circumference being given in degrees and minutes, to assign it in parts of the diameter.

Of Surveying and Measuring of LAND.

HITHERTO we have treated of the measuring of angles and sides, whence it is abundantly easy to lay down a field, a plane, or an entire country: for to this nothing is requisite but the protraction of triangles, and of other plain figures, after having measured their sides and angles. But as this is esteemed an important part of practical geometry, we shall subjoin here an account of it with all possible brevity; suggesting withal, that a surveyor will improve himself more by one day's practice, than by a great deal of reading.

PROPOSITION XXIII.

To explain what surveying is, and what instruments Surveyors use.—First, it is necessary that the surveyor view the field that is to be measured, and investigate its sides and angles, by means of an iron chain (having a particular mark at each foot of length, or at any number of feet, as may be most convenient for reducing lines or surfaces to the received measures), and the graphometer described above. Secondly, It is necessary to delineate the field *in plano*, or to form a map of it; that is, to lay down on paper a figure similar to the field; which is done by the protractor (or line of chords) and of the line of equal parts. Thirdly, It is necessary to find out the area of the field so surveyed and represented by a map. Of this last we are to treat below.

The sides and angles of small fields are surveyed by the help of a plain table; which is generally of an oblong rectangular figure, and supported by a *fulcrum*, so as to turn every way by means of a ball and socket. It has a moveable frame, which surrounds the board, and serves to keep a clean paper put on the board close and tight to it. The sides of the frame facing the paper are divided into equal parts every way. The board hath besides a box with a magnetic needle, and moreover a large index with two sights. On the edge of the frame of the board are marked degrees and minutes, so as to supply the room of a graphometer.

PROPOSITION XXIV.

FIG. 8. *To delineate a field by the help of a plain-table, from one station whence all its angles may be seen, and their distances measured by a chain.*—Let the field that is to be laid down be ABCDE. At any convenient place F, let the plain-table be erected; cover it with clean paper, in which let some point near the middle represent the station. Then applying at this place the index with the sights, direct it so as that through the sights some mark may be seen at one of the angles, suppose A; and from the point F, representing the station, draw a faint right line along the side of the index: then, by the help of the chain, let FA the distance of the station from the foresaid angle be measured. Then taking what part you think convenient for a foot or pace from the line of equal parts, set off on the faint line the parts corresponding to the line FA that was measured; and let there be a mark made representing the angle of the field A. Keeping the table immoveable, the same is to be done with the rest of the angles; then right lines joining those marks shall include a figure like to the field, as is evident from 5. 6. Eucl.

COROLLARY.

The same thing is done in like manner by the graphometer: for having observed in each of the triangles, AFB, BFC, CFD, *&c.* the angle at the station F, and having measured the lines from the station to the angles of the field, let similar triangles be protracted on paper (by the 21. prop. of this) having their common vertex in the point of station. All the lines, excepting those which represent the sides of the field, are to be drawn faint or obscure.

Note 1. When a surveyor wants to lay down a field, let him place distinctly in a register all the observations of the angles, and the measures of the sides, until, at time and place convenient, he draw out the figure on paper.

Note 2. The observations made by the help of the graphometer are to be examined: for all the angles about the point F ought to be equal to four right ones. (by cor. 2. art. 30. of part I.)

PROPOSITION XXV.

FIG. 9. *To lay down a field by means of two stations, from each of which all the angles can be seen, by measuring only the distance of the stations.*—Let the instrument be placed at the station F: and having chosen a point representing it upon the paper which is laid upon the plain table, let the index be applied at this point, so as to be moveable about it. Then let it be directed successively to the several angles of the field: and when any angle is seen through the sights, draw an obscure line along the side of the index. Let the index, with the sights, be directed after the same manner to the station G: on the obscure line drawn along its side, pointing to A,

A, set off from the scale of equal parts a line corresponding to the measured distance of the stations, and this will determine the point G. Then remove the instrument to the station G, and applying the index to the line representing the distance of the stations, place the instrument so that the first station may be seen through the sights. Then the instrument remaining immoveable, let the index be applied at the point representing the second station G, and be successively directed by means of its sights, to all the angles of the field, drawing (as before) obscure lines: and the intersection of the two obscure lines that were drawn to the same angle from the two stations will always represent that angle on the plan. Care must be taken that those lines be not mistaken for one another. Lines joining those intersections will form a figure on the paper like to the field.

SCHOLIUM.

It will not be difficult to do the same by the graphometer, if you keep a distinct account of your observations of the angles made by the line joining the stations, and the lines drawn from the stations to the respective angles of the field. And this is the most common manner of laying down whole countries. The tops of two mountains are taken for two stations, and their distance is either measured by some of the methods mentioned above, or is taken according to common repute. The sights are successively directed towards cities, churches, villages, forts, lakes, turnings of rivers, woods, &c.

Note, The distance of the stations ought to be great enough, with respect to the field that is to be measured; such ought to be chosen as are not in a line with any angle of the field. And care ought to be taken likewise that the angles, for example, FAG, FDG, &c. be neither very acute, nor very obtuse. Such angles are to be avoided as much as possible; and this admonition is found very useful in practice.

PROPOSITION XXVI.

Fig. 10. *To lay down any field, however irregular its figure may may be, by the help of the graphometer.*—Let ABCEDHG be such a field. Let its angles (in going round it) be observed with a graphometer (by the 12. of this) and noted down; let its sides be measured with a chain; and (by what was said on the 21. of this) let a figure like to the given field be protracted on paper. If any mountain is in the circumference, the horizontal line hid under it is to be taken for a side, which may be found by two or three observations according to some of the methods described above; and its place on the map is to be distinguished by a shade, that it may be known a mountain is there.

If not only the circumference of the field is to be laid down on the plan, but also its contents, as villages, gardens, churches, public roads, we must proceed in this manner.

Let there be (for example) a church F, to be laid down in the plan. Let the angles ABF BAF be observed and protracted on paper in their proper places, the intersection of the two sides BF and AF will give the place of the church on the paper: Or, more exactly, the lines BF AF being measured, let circles be described from the centres B and A, with parts from the scale corresponding to the distances BF and AF, and the place of the church will be at their intersection.

Note 1. While the angles observed by the graphometer are taken down, you must be careful to distinguish the external angles, as E and G, that they may be rightly protracted afterwards on paper.

Note 2. Our observations of the angles may be examined by computing if all the internal angles make twice as many right angles, four excepted, as there are sides of the figure: (for this is demonstrated by 32. 1. Eucl.) But in place of any external angle DEC, its complement to a circle is to be taken.

PROPOSITION XXVII.

Fig. 11. *To lay down a plain field without instruments.*—If a small field is to be measured, and a map of it to be made, and you are not provided with instruments; let it be supposed to be divided into triangles, by right-lines, as in the figure; and after measuring the three sides of any of the triangles, for example of ABC, let its sides be laid down from a convenient scale on paper, (by the 22. of this.) Again, let the other two sides BD CD of the triangle CBD be measured and protracted on the paper by the same scale as before. In the same manner proceed with the rest of the triangles of which the field is composed, and the map of the field will be perfected; for the three sides of a triangle determine the triangle; whence each triangle on the paper is similar to its correspondent triangle in the field, and is similarly situated; consequently the whole figure is like to the whole field.

SCHOLIUM.

If the field be small, and all its angles may be seen from one station, it may be very well laid down by the plain-table, (by the 24. of this). If the field be larger, and have the requisite conditions, and great exactness is not expected, it likewise may be plotted by means of the plain-table, or by the graphometer, (according to the 25. of this; but in fields that are irregular and mountainous, when an exact map is required, we are to make use of the graphometer, (as in the 26. of this,) but rarely of the plain-table.

Having protracted the bounding lines, the particular parts contained within them may be laid down by the proper operations for this purpose, (delivered in the 26th proposition; and the method described in the 27th proposition may be sometimes of service;) for we may trust more to the measuring of sides, than to the observing of angles. We are not to compute four-sided and many sided figures till they are resolved into triangles: for the sides do not determine those figures.

In the laying down of cities, or the like, we may make use of any of the methods described above that may be most convenient.

The map being finished, it is transferred on clean paper, by putting the first sketch above it, and marking the angles by the point of a small needle. These points being joined by right lines, and the whole illuminated by colours proper to each part, and the figure of the mariners compass being added to distinguish the north and south, with a scale on the margin, the map or plan will be finished and neat.

We

We have thus briefly and plainly treated of ſurveying, and ſhown by what inſtruments it is performed; having avoided thoſe methods which depend on the magnetic needle, not only becauſe its direction may vary in different places of a field (the contrary of this at leaſt doth not appear,) but becauſe the quantity of an angle obſerved by it cannot be exactly known; for an error of two or three degrees can ſcarcely be avoided in taking angles by it.

As for the remaining part of ſurveying, whereby the area of a field already laid down on paper is found in acres, roods, or any other ſuperficial meaſures; this we leave to the following ſection, which treats of the menſuration of ſurfaces.

"Beſides the inſtruments deſcribed above, a ſurveyor "ought to be provided with an off-ſet ſtaff equal in "length to ten links of the chain, and divided into ten "equal parts. He ought likewiſe to have ten arrows or "ſmall ſtraight ſticks near two feet long, ſhod with iron "ferrils. When the chain is firſt opened, it ought to be "examined by the off-ſet ſtaff. In meaſuring any line, "the leader of the chain is to have the ten arrows at firſt "ſetting out. When the chain is ſtretched in the line, "and the near end touches the place from which you mea"ſure, the leader ſticks one of the ten arrows in the "ground, at the far end of the chain. Then the leader "leaving the arrow, proceeds with the chain another "length; and the chain being ſtretched in the line, ſo "that the near end touches the firſt arrow, the leader "ſticks down another arrow at his end of the chain. The "line is preſerved ſtraight, if the arrows be always ſet "ſo as to be in a right line with the place you meaſure "from, and that to which you are going. In this man"ner they proceed till the leader have no more arrows. "At the eleventh chain, the arrows are to be carried to "him again, and he is to ſtick one of them into the "ground, at the end of the chain. And the ſame is to "be done at the 21. 31. 41. *&c.* chains, if there are "ſo many in a right line to be meaſured. In this man"ner you can hardly commit an error in numbering the "chains, unleſs of ten chains at once.

"The off-ſet ſtaff ſerves for meaſuring readily the di"ſtances of any things proper to be repreſented in your "plan, from the ſtation-line while you go along. Theſe "diſtances ought to be entered into your field-book, "with the correſponding diſtances from the laſt ſtation, "and proper remarks, that you may be enabled to plot "them juſtly, and be in no danger of miſtaking one for "another when you extend your plan. The field-book "may be conveniently divided into five columns. In "the middle column the angles at the ſeveral ſtations "taken by the theodolite are to be entered, with di"ſtances from the ſtations. The diſtances taken by the "off-ſet ſtaff, on either ſide of the ſtation-line, are to be "entered into columns on either ſide of the middle co"lumn, according to their poſition with reſpect to that "line. The names and characters of the objects, with "proper remarks, may be entered in columns on either "ſide of theſe laſt.

"Becauſe, in the place of the graphometer deſcribed "by our author, ſurveyors now make uſe of the theodo"lite, we ſhall ſubjoin a deſcription of Mr Siſſon's lateſt "improved theodolite from Mr Gardner's practical ſur"veying improved. See a figure of it in Plate XCVI.

"In this inſtrument, the three ſtaffs, by braſs ferrils "at top, ſcrew into bell-metal joints, that are moveable "between braſs pillars, fixed in a ſtrong braſs plate; in "which, round the centre, is fixed a ſocket with a ball move"able in it, and upon which the four ſcrews preſs, that ſet "the limb horizontal: Next above is another ſuch plate, "through which the ſaid ſcrews paſs, and on which, "round the centre, is fixed a fruſtum of a cone of bell"metal, whoſe axis (being connected with the centre of "the bell) is always perpendicular to the limb, by means "of a conical braſs ferril fitted to it, whereon is fixed "the compaſs-box; and on it the limb, which is a ſtrong "bell-metal ring, whereon are moveable three braſs in"dexes; in whoſe plate are fixed four braſs pillars, "that, joining at top, hold the centre pin of the bell"metal double ſextant, whoſe double index is fixed on "the centre of the ſame plate: Within the double ſex"tant is fixed the ſpirit-level, and over it the teleſcope.

"The compaſs box is graved with two diamonds for "north and ſouth, and with 20 degrees on both ſides "of each, that the needle may be ſet to the variation, "and its error alſo known.

"The limb has two *fleurs de luce* againſt the diamonds "in the box, inſtead of 180 each; and is curiouſly di"vided into whole degrees, and numbered to the left "hand at every ten to twice 180, having three indexes "diſtant 120, (with Nonius's diviſions on each for the "decimals of a degree), that are moved by a pinion fix"ed below one of them, without moving the limb; and "in another is a ſcrew and ſpring under, to fix it to any "part of the limb. It has alſo diviſions numbered, for "taking the quarter girt in inches of round timber at the "middle height, when ſtanding ten feet horizontally "diſtant from its centre; which at 20 muſt be doubled, "and at 30 tripled; to which a ſhorter index is uſed, "having Nonius's diviſions for the decimals of an inch; "but an abatement muſt be made for the bark, if not ta"ken off.

"The double ſextant is divided on one ſide from un"der its centre (when the ſpirit-tube and teleſcope are "level) to above 60 degrees each way, and numbered at "10, 20, *&c.* and the double index (through which it "is moveable) ſhews on the ſame ſide the degree and de"cimal of any altitude or depreſſion to that extent "by Nonius's diviſions: On the other ſide are diviſions "numbered, for taking the upright height of timber, *&c.* "in feet, when diſtant 10 feet; which at 20 muſt be "doubled, and at 30 tripled; and alſo the quantities for "reducing hypothenuſal lines to horizontal. It is "moveable by a pinion fixed in the double index.

"The teleſcope is a little ſhorter than the diameter "of the limb, that a fall may not hurt it; yet it will "magnify as much, and ſhew a diſtant object as perfect, "as moſt of triple its length. In its focus are very fine "croſs wires, whoſe interſection is in the plane of the "double ſextant; and this was a whole circle, and turn"ed in a lathe to a true plane, and is fixed at right angles "to the limb; ſo that, whenever the limb is ſet horizon"tal, (which is readily done by making the ſpirit-tube "level

" level over two ſcrews, and the like over the other two), " the double ſextant and teleſcope are moveable in a vertical plane; and then every angle taken on the limb " (though the teleſcope be never ſo much elevated or " depreſſed) will be an angle in the plane of the horizon. " And this is abſolutely neceſſary in plotting a horizontal " plane.

" If the lands to be plotted are hilly, and not in any " one plane, the lines meaſured cannot be truly laid down " on paper, without being reduced to one plance, which " muſt be the horizontal, becauſe angles are taken in that " plane.—

" In viewing your objects, if they have much altitude " or depreſſion, either write down the degree and decimal " ſhewn on the double ſextant, or the links ſhewn on the " back ſide; which laſt ſubtracted from every chain in " the ſtation-line, leaves the length in the horizontal " plane. But if the degree is taken, the following table " will ſhew the quantity.

A table of the links to be ſubtracted out of every chain in hypothenuſal lines of ſeveral degrees altitude, or depreſſion, for reducing them to horizontal.

Degrees.	*Links.*	*Degrees.*	*Links.*	*Degrees.*	*Links.*
4,05	$\frac{1}{4}$	14,07	3	23,074	8
5,73	$\frac{1}{2}$	16,26	4	24,495	9
7,02	$\frac{3}{4}$	18,195	5	25,84	10
8,11	1	19,95	6	27,13	11
11,48	2	21,565	7	28,36	12

" Let the firſt ſtation line really meaſure 1107 links, " and the angle of altitude or depreſſion be 19°, 95; " looking in the table you will find againſt 19°, 95, is 6 " links. Now 6 times 11 is 66; which ſubtracted from " 1107, leaves 1041, the true length to be laid down " in the plan.

" It is uſeful in ſurveying, to take the angles, which " the bounding lines form, with the magnetic needle, " in order to check the angles of the figure, and to plot " them conveniently afterwards."

Of the Surfaces of Bodies.

THE ſmalleſt ſuperficial meaſure with us is a ſquare inch; 144 of which make a ſquare foot. Wrights make uſe of theſe in the meaſuring of deals and planks; but the ſquare foot which the glaziers uſe in meaſuring of glaſs, conſiſts only of 64 ſquare inches. The other meaſures are, firſt, the ell ſquare; ſecondly, the fall, containing 36 ſquare ells; thirdly, the rood, containing 40 falls; fourthly, the acre, containing 4 roods. Slaters, maſons, and paviours, uſe the ell ſquare and the fall; ſurveyors of land uſe the ſquare ell, the fall, the rood, and the acre.

The ſuperficial meaſures of the Engliſh are, firſt, the ſquare foot; ſecondly, the ſquare yard, containing 9 ſquare feet, for their yard contains only 3 feet; thirdly, the pole, containing $30\frac{1}{4}$ ſquare yards; fourthly, the rood, containing 40 poles; fifthly, the acre, containing 4 roods. And hence it is eaſy to reduce our ſurperficial meaſures to the Engliſh, or theirs to ours.

" In order to find the content of a field, it is moſt con- " venient to meaſure the lines by the chains deſcribed a- " bove, p. 693. that of 22 yards for computing the Eng- " liſh acres, and that of 24 Scots ells for the acres of " Scotland. The chain is divided into 100 links, and the " ſquare of the chain is 10,000 ſquare links; ten ſquares " of the chain, or 100,000 ſquare links, give an acre. " Therefore, if the area be expreſſed by ſquare links, " divide by 100,000, or cut off five decimal places, and " the quotient ſhall give the area in acres and decimals " of an acre. Write the entire acres apart; but multi- " ply the decimals of an acre by 4, and the product ſhall " give the remainder of the area in roods and decimals " of a rood. Let the entire roods be noted apart after " the acres; then multiply the decimals of a rood by 40, " and the product ſhall give the remainder of the area in " falls or poles. Let the entire falls or poles be then " writ after the roods, and multiply the decimals of a " fall by 36, if the area is required in the meaſures of " Scotland; but multiply the decimals of a pole by $30\frac{1}{4}$, " if the area is required in the meaſures of England, and " the product ſhall give the remainder of the area in " ſquare ells in the former caſe, but in ſquare yards in " the latter. If, in the former caſe, you would reduce " the decimals of the ſquare ell to ſquare feet, multiply " them by 9.50694; but, in the latter caſe, the decimals " of the Engliſh ſquare yard are reduce to ſquare feet, " by multiplying them by 9.

" Suppoſe, for example, that the area appears to con- " tain 12.65842 ſquare links of the chain of 24 ells; " and that this area is to be expreſſed in acres, roods, " falls, &c. of the meaſures of Scotland. Divide the " ſquare links by 100,000, and the quotient 12.65842 " ſhows the area to contain 12 acres $\frac{65842}{100000}$ of an acre. " Multiply the decimal part by 4, and the product " 2.63368 gives the remainder in roods and decimals of " a rood. Thoſe dec mals of the rood being multipled " by 40, the product gives 25.3472 falls. Multiply the " decimals of the fall by 36, and the product gives " 12.4992 ſquare ells. The decimals of the ſquare ell " multiplied by 9.50994 give 4.7458 ſquare feet. " Therefore the area propoſed amounts to 12 acres, 2 " roods, 25 falls, 12 ſquare ells, and $4\frac{7458}{10000}$ ſquare " feet.

" But if the area contains the ſame number of ſquare " links of Gunter's chain, and is to be expreſſed by " Engliſh meaſures, the acres and roods are computed in " the ſame manner as in the former caſe. The poles are " computed as the falls. But the decimals of the pole, " *viz.* $\frac{3472}{10000}$, are to be multiplied by $30\frac{1}{4}$ (or 30.25), " and the product gives 10.5028 ſquare yards. The de- " cimals of the ſquare yard, multiplied by 9, give 4.5252 " ſquare feet; therefore, in this caſe, the area is in " Engliſh meaſure 12 acres, 2 roods, 25 poles, 10 ſquare " yards, and $4\frac{5252}{10000}$ ſquare feet.

" The Scots acre is to the Engliſh acre, by ſtatute, " as 100,000 to 78,694, if we have regard to the diffe- " rence betwixt the Scots and Engliſh foot above men- " tioned. But it is cuſtomary in ſome parts of England " to

"to have 18, 21 &c. feet to a pole, and 160 ſuch poles "to an acre; whereas, by the ſtatute, $16\frac{1}{2}$ feet make a "pole. In ſuch caſes the acre is greater in the dupli- "cate ratio of the number of feet to a pole.

"They who meaſure land in Scotland by an ell of 37 "Engliſh inches, make the acre leſs than the true Scots "acre by $593\frac{6}{10}$ ſquare Engliſh feet, or by about $\frac{1}{93}$ of "the acre.

"An huſband-land contains 6 acres of ſock and ſythe- "land, that is, of land that may be tilled with a plough, "and mown with a ſythe; 13 acres of arable land make "an oxgang or oxengate; four oxengate make a pound- "land of old extent (by a decree of the Exchequer, "March 11. 1585), and is called *librata terræ*. A "forty-ſhilling land of old extent contains eight oxgang, "or 104 acres.

"The arpent, about Paris, contains 32400 ſquare Pa- "ris feet, and is equal to $2\frac{2}{3}$ Scots roods, or $\frac{37}{100}$ Eng- "liſh roods.

"The *actus quadratus*, according to Varro, Collu- "mella, &c. was a ſquare of 120 Roman feet. The "*jugerum* was the double of this. It is to the Scots a- "cre as 10,000 to 20,456, and to the Engliſh acre as "10,000 to 16,097. It was divided (like the *as*) into "12 *unciæ*, and the *uncia* into 24 *ſcrupula*."—This, with the three preceding paragraphs, are taken from an ingenious manuſcript, written by Sir Robert Stewart profeſſor of natural philoſophy. The greateſt part of the table in p. 693. was taken from it likewiſe.

PROPOSITION XXVIII.

FIG. 12. *To find out the area of a rectangular parallelogram* ABCD.—Let the ſide AB, for example, be 5 feet long, and BC (which conſtitutes with BA a right angle at B) be 17 feet. Let 17 be multiplied by 5, and the product 85 will be the number of ſquare feet in the area of the figure ABCD. But if the parallelogram propoſed is not rectangular as BEFC, its baſe BC multiplied into its perpendicular height AB (not into its ſide BE) will give its area. This is evident from art. 68. of part 1.

PROPOSITION XXIX.

FIG. 13. *To find the area of a given triangle.*—Let the triangle BAC be given, whoſe baſe BC is ſuppoſed 9 feet long: let the perpendicular AD be drawn from the angle A oppoſite to the baſe, and let us ſuppoſe AD to be four feet. Let the half of the perpendicular be multiplied into the baſe, or the half of the baſe into the perpendicular, or take the half of the product of the whole baſe into the perpendicular, the product gives 18 ſquare feet for the area of the given triangle.

But if only the ſides are given, the perpendicular is found either by protracting the triangle, or by 12th and 13th 2. Eucl. or by trigonometry. But how the area of a triangle may may be found from the given ſides only, ſhall be ſhewn in the 31ſt prop.

PROPOSITION XXX.

FIG. 14. *To find the area of any rectilineal figure.*—If the figure be irregular, let it be reſolved into triangles; and drawing perpendiculars to the baſes in each of them, let the area of each triangle be found by the preceding prop. and the ſum of theſe areas will give the area of the figure.

SCHOLIUM 1.

In meaſuring boards, planks, and glaſs, their ſides are to be meaſured by a foot-rule divided into 100 equal parts; and after multiplying the ſides, the decimal fractions are eaſily reduced to leſſer denominations. The menſuration of theſe is eaſy, when they are rectangular parallelograms.

SCHOLIUM 3.

If a field is to be meaſured, let it firſt be plotted on paper, by ſome of the methods above deſcribed, and let the figure ſo laid down be divided into triangles, as was ſhown in the preceding propoſition.

The baſe of any triangle, or the perpendicular upon the baſe, or the diſtance of any two points of the field, is meaſured by applying it to the ſcale according to which the map is drawn.

SCHOLIUM 3.

But if the field given be not in a horizontal plane, but uneven and mountainous, the ſcale gives the horizontal line between any two points, but not their diſtance meaſured on the uneven ſurface of the field. And indeed it would appear, that the horizontal plane is to be accounted the area of an uneven and hilly country. For if ſuch ground is laid out for building on, or for planting with trees, or bearing corn, ſince theſe ſtand perpendicular to the horizon, it is plain, that a mountainous country cannot be conſidered as of greater extent for thoſe uſes than the horizontal plane; nay, perhaps, for nouriſhing of plants, the horizontal plane may be preferable.

If, however, the area of a figure, as it lies regularly on the ſurface of the earth, is to be meaſured, this may be eaſily done by reſolving it into triangles as it lies. The ſum of their areas will be the area ſought; which exceeds the area of the horizontal figure more or leſs, according as the field is more or leſs uneven.

PROPOSITION XXXI.

FIG. 13. *The ſides of a triangle being given, to find the area, without finding the perpendicular.*—Let all the ſides of the triangle be collected into one ſum; from the half of which let the ſides be ſeparately ſubtracted, that three differences may be found betwixt the foreſaid half ſum and each ſide; then let theſe three differences and the half ſum be multiplied into one another, and the ſquare root of the product will give the area of the triangle. For example, let the ſides be 10, 17, 21; the half of their ſum is 24; the three differences betwixt this half ſum and the three ſides, are 14, 7, and 3. The firſt being multiplied by the ſecond, and their product by the third, we have 294 for the product of the differences; which multiplied by the foreſaid half ſum 24, gives 7056; the ſquare root of which 84 is the area of the triangle. The demonſtration of this, for the ſake of brevity, we omit. It is to be found in ſeveral treatiſes, particularly in Clavius's Practical Geometry.

PROPOSITION XXXII.

FIG. 15. *The area of the ordinate figure* ABEFGH *is equal to the product of the half circumference of the polygon, multiplied into the perpendicular drawn from the centre of the circumſcribed circle to the ſide of the polygon.*—For the ordinate figure can be reſolved into as many equal triangles, as there are ſides of the figure;

figure; and since each triangle is equal to the product of half the base into the perpendicular, it is evident that the sum of all the triangles together, that is the polygon, is equal to the product of half the sum of the bases (that is the half of the circumference of the polygon) into the common perpendicular height of the triangles drawn from the centre C to one of the sides; for example, to AB.

PROPOSITION XXXIII.

FIG. 16. *The area of a circle is found by multiplying the half of the periphery into the radius, or the half of the radius into the periphery*—For a circle is not different from an ordinate or regular polygon of an infinite number of sides, and the common height of the triangles into which the polygon or circle may be supposed to be divided is the radius of the circle.

Were it worth while, it were easy to demonstrate accurately this proposition, by means of the inscribed and circumscribed figures, as is done in the 5th prop. of the treatise of Archimedes concerning the dimensions of the circle.

COROLLARY.

Hence also it appears, that the area of the sector ABCD is produced by multiplying the half of the arc into the radius, and likewise that the area of the segment of the circle ADC is found by subtracting from the area of the sector the area of the triangle ABC.

PROPOSITION XXXIV.

FIG. 17. *The circle is to the square of the diameter, as* 11 *to* 14 *nearly.*—For if the diameter AB be supposed to be 7, the circumference AHBK will be almost 22 (by the 22d prop. of this part), and the area of the square DC will be 49; and, by the preceding prop. the area of the circle will be $38\frac{1}{2}$: therefore the square DC will be to the inscribed circle as 49 to $38\frac{1}{2}$, or as 98 to 77, that is, as 14 to 11. *Q. E. D.*

If greater exactness is required, you may proceed to any degree of accuracy: for the square DC is to the inscribed circle, as 1 to $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\frac{1}{11}+\frac{1}{13}$, *&c. in infinitum.*

"This series will be of no service for computing the "area of the circle accurately, without some further artifice, because it converges at too slow a rate. The "area of the circle will be found exactly enough for "most purposes, by multiplying the square of the diameter by 7854, and dividing by 10,000, or cutting "off four decimal places from the product; for the area "of the circle is to the circumscribed square nearly as "7854 to 10,000."

PROPOSITION XXXV.

FIG. 18. *To find the area of a given ellipse*—Let ABCD be an ellipse, whose greater diameter is BD, and the lesser AC, bisecting the greater perpendicularly in E. Let a mean proportional HF be found (by 13th 6. Eucl.) between AC and BD, and (by the 33d of this) find the area of the circle described on the diameter HF. This area is equal to the area of the ellipse ABCD. For because, as BD to AC, so the square of BD to the square of HF, (by 2. cor. 20th 6. Eucl.): but (by the 2d 12. Eucl.) as the square of BD to the square of HF, so is the circle of the diameter BD to the circle of the diameter HF: therefore as BD to AC, so is the circle of the diameter BD to the circle of the diameter HF. And (by the 5th prop. of Archimedes of spheroids) as the greater diameter BD to the lesser AC, so is the circle of the diameter BD to the ellipse ABCD. Consequently (by the 11th 5. Eucl.) the circle of the diameter BD will have the same proportion to the circle of the diameter HF, and to the ellipse ABCD. Therefore, (by 9th 5. Eucl.) the area of the circle of the diameter HF will be equal to the area of the ellipse ABCD. *Q. E. D.*

SCHOLIUM.

From this and the two preceding propositions, a method is derived of finding the area of an ellipse. There are two ways: 1st, Say, as one is to the lesser diameter, so is the greater diameter to a fourth number, (which is found by the rule of three.) Then again say, as 14 to 11, so is the 4th number found to the area sought. But the second way is shorter. Multiply the lesser diameter into the greater, and the product by 11; then divide the whole product by 14, and the quotient will be the area sought of the ellipse. For example, Let the greater diameter be 10, and the lesser 7; by multiplying 10 by 7, the product is 70; and multiplying that by 11, it is 770; and dividing 770 by 14, the quotient will be 55, which is the area of the ellipse sought.

"The area of the ellipse will be found more accurately, by multiplying the product of the two diameters "by .7854."

We shall add no more about other plain surfaces, whether rectilinear or curvilinear, which seldom occur in practice; but shall subjoin some propositions about measuring the surfaces of solids.

PROPOSITION XXXVI.

To measure the surface of any prism.—By the 14th definition of the 11th Eucl. a prism is contained by planes, of which two opposite sides (commonly called the bases) are plain rectilineal figures; which are either regular and ordinate, and measured by prop. 32. of this; or however irregular, and then they are measured by the 38th prop. The other sides are parallelograms, which are measured by prop. 28th; and the whole superficies of the prism consists of the sum of those taken altogether.

PROPOSITION XXXVII.

To measure the superficies of any pyramid.—Since its basis is a rectilinear figure, and the rest of the planes terminating in the top of the pyramid are triangles; these measured separately, and added together, give the surface of the pyramid required.

PROPOSITION XXXVIII.

To measure the superficies of any regular body.—These bodies are called regular, which are bounded by equilateral and equiangular figures. The superficies of the tetraedron consists of four equal and equiangular triangles; the superficies of the hexaedron, or cube, of six equal squares; an octedron, of eight equal equilateral triangles; a dodecaedron, of twelve equal and ordinate pentagons; and the superficies of an icosiædron of twenty equal and equilateral triangles. Therefore it will be easy to measure these surfaces from what has been already shown.

In the same manner we may measure the superficies of a solid contained by any planes.

PRO-

PROPOSITION XXXIX.

FIG. 19. *To measure the superficies of a cylinder.*—Because a cylinder differs very little from a prism, whose opposite planes (or bases) are ordinate figures of an infinite number of sides, it appears that the superficies of a cylinder, without the bases, is equal to an infinite number of parallelograms; the common altitude of all which is the same with the height of the cylinder, and the bases of them all differ very little from the periphery of the circle which is the base of the cylinder. Therefore this periphery multiplied into the common height, gives the superficies of the cylinder, excluding the bases; which are to be measured separately by the help of the 33d prop.

This proposition concerning the measure of the surface of the cylinder (excluding its basis) is evident from this, that when it is conceived to be spread out, it becomes a parallelogram, whose base is the periphery of the circle of the base of the cylinder stretched into a right line, and whose height is the same with the height of the cylinder.

PROPOSITION XL.

FIG. 20. *To measure the surface of a right cone.*—The surface of a right cone is very little different from the surface of a right pyramid, having an ordinate polygon for its base of an infinite number of sides; the surface of which (excluding the base) is equal to the sum of the triangles. The sum of the bases of these triangles is equal to the periphery of the circle of the base, and the common height of the triangles is the side of the cone AB; wherefore the sum of these triangles is equal to the product of the sum of the bases (*i. e.* the periphery of the base of the cone) multiplied into the half of the common height, or it is equal to the product of the periphery of the base.

If the area of the base is likewise wanted, it is to be found separately by the 33d prop. If the surface of a cone is supposed to be spread out on a plane, it will become a sector of a circle, whose radius is the side of the cone; and the arc terminating the sector is made from the periphery of the base. Whence, by corol. 33d prop. of this, its dimension may be found.

COROLLARY.

Hence it will be easy to measure the surface of a *frustum* of a cone cut by a plane parallel to the base.

PROPOSITION XLI.

FIG. 21. *To measure the surface of a given sphere.*—Let there be a sphere, whose centre is A, and let the area of its convex surface be required. Archimedes demonstrates (37. prop. 1. book of the sphere and cylinder) that its surface is equal to the area of four great circles of the sphere; that is, let the area of the great circle be multiplied by 4, and the product will give the area of the sphere; or, (by the 20th 6. and 2d 12 of Eucl.) the area of the sphere given is equal to the area of a circle whose radius is the right line BC, the diameter of the sphere. Therefore having measured (by 33d prop) the circle described with the radius BC, this will give the surface of the sphere.

PROPOSITION XLII.

FIG. 22. *To measure the surface of a segment of a sphere.*—Let there be a segment cut off by the plane ED. Archimedes demonstrates (49, and 50. 1 *De sphæra*) that the surface of this segment, excluding the circular base, is equal to the area of a circle whose radius is the right line BE drawn from the vertex B of the segment to the periphery of the circle DE. Therefore, (by the 33d prop.) it is easily measured.

COROLLARY 1.

Hence that part of the surface of a sphere that lieth between two parallel planes is easily measured, by subtracting the surface of the lesser segment from the surface of the greater segment.

COROLLARY 2.

Hence likewise it follows, that the surface of a cylinder, described about a sphere (excluding the basis) is equal to the surface of the sphere, and the parts of the one to the parts of the other, intercepted between planes parallel to the basis of the cylinder.

Of Solid Figures and their Mensuration, comprehending likewise the Principles of gauging Vessels of all Figures.

As in the former part of this treatise we took an inch for the smallest measure in length, and an inch square for the smallest superficial measure; so now, in treating of the mensuration of solids, we take a cubical inch for the smallest solid measure. Of these 109 make a Scots pint; other liquid measures depend on this, as is generally known.

In dry measures, the firlot, by statute, contains $19\frac{1}{4}$ pints; and on this depend the other dry measures: therefore, if the content of any solid be given in cubical inches, it will be easy to reduce the same to the common liquid or dry measures, and conversely to reduce these to solid inches. The liquid and dry measures, in use among other nations, are known from their writers.

"As to the English liquid measures, by act of parliament 1706, any round vessel, commonly called a cylinder, having an even bottom, being seven inches in diameter throughout, and six inches deep from the top of the inside to the bottom, (which vessel will be found by computation to contain 230 $\frac{907}{1000}$ cubical inches), or any vessel containing 231 cubical inches, and no more, is deemed to be a lawful wine-gallon. An English pint therefore contains $28\frac{7}{8}$ cubical inches; two pints make a quart; four quarts a gallon; 18 gallons a roundlet; three roundlets and an half, or 63 gallons, make a hogshead; the half of a hogshead is a barrel; one hogshead and a third, or 84 gallons, make a puncheon; one puncheon and a half, or two hogsheads, or 126 gallons, make a pipe or butt; the third part of a pipe, or 42 gallons, make a tierce; two pipes, or three puncheons, or four hogsheads, make a ton of wine. Though the English wine gallon is now fixed at 231 cubical inches, the standard kept in Guildhall being measured, before many persons of distinction, May 25th 1688, it was found to contain only 224 such inches.

"In the English beer measure, a gallon contains 282 cubical inches; consequently $35\frac{1}{4}$ cubical inches make a pint, two pints make a quart, four quarts make a gallon,

gallon, nine gallons a firkin, four firkins a barrel. In ale, eight gallons make a firkin, and 32 gallons make a barrel. By an act of the firſt of William and Mary, 34 gallons is the barrel, both for beer and ale, in all places, except within the weekly bills of mortality.

“ In Scotland it is known that four gills make a mutchkin, two mutchkins make a chopin; a pint is two chopins; a quart is two pints; and a gallon is four quarts, or eight pints. The accounts of the cubical inches contained in the Scots pint vary conſiderably from each other. According to our author, it contains 109 cubical inches. But the ſtandard-jugs kept by the dean of guild of Edinburgh (one of which has the year 1555, with the arms of Scotland, and the town of Edinburgh, marked upon it) having been carefully meaſured ſeveral times, and by different perſons, the Scots pint, according to thoſe ſtandards, was found to contain about $103\frac{4}{10}$ cubic inches. The pewterers jugs (by which the veſſels in common uſe are made) are ſaid to contain ſometimes betwixt 105 and 106 cubic inches. A caſk that was meaſured by the brewers of Edinburgh, before the commiſſioners of Exciſe in 1707, was found to contain $46\frac{7}{8}$ Scots pints; the ſame veſſel contained $18\frac{1}{10}$ Engliſh ale-gallons. Suppoſing this menſurating to be juſt, the Scots pint will be to the Engliſh ale-gallon as 289 to 750; and if the Engliſh ale-gallon be ſuppoſed to contain 282 cubical inches, the Scots pint will contain 108.664 cubical inches. But it is ſuſpected, on ſeveral grounds, that the experiment was not made with ſufficient care and exactneſs.

“ The commiſſioners appointed by authority of parliament to ſettle the meaſures and weights, in their act of February 19. 1618, relate, That having cauſed fill the Linlithgow firlot with water, they found that it contained $21\frac{1}{4}$ pints of the juſt Stirling jug and meaſure. They likewiſe ordain that this ſhall be the juſt and only firlot; and add, *That the wideneſs and breadneſs of the which firlot, under and above even over within the buirds, ſhall contain nineteen inches and the ſixth part of an inch, and the deepneſs ſeven inches and a third part of an inch.* According to this act (ſuppoſing their experiment and computation to have been accurate) the pint contained only 99.56 cubical inches; for the content of ſuch a veſſel as is deſcribed in the act, is 2115.85, and this divided by $21\frac{1}{4}$ gives 99.56. But, by the weight of water ſaid to fill this firlot in the ſame act, the meaſure of the pint agrees nearly with the Edinburgh ſtandard above mentioned.

“ As for the Engliſh meaſures of corn, the Wincheſter gallon contains $272\frac{1}{4}$ cubical inches; two gallons make a peck; four pecks, or eight gallons (that is 2178, cubical inches) make a buſhel; and a quarter is eight buſhels.

“ Our author ſays, that $19\frac{1}{2}$ Scots pints make a firlot. But this does not appear to be agreeable to the ſtatute above mentioned, nor to the ſtandard-jugs. It may be conjectured that the proportion aſſigned by him has been deduced from ſome experiment of how many pints, according to common uſe, were contained in the firlot. For if we ſuppoſe thoſe pints to have been each of 108.664 cubical inches, according to the experiment made in the 1707 before the commiſſioners of exciſe, deſcribed above; then $19\frac{1}{2}$ ſuch pints will amount to 2118.94, cubical inches; which agrees nearly with 2115.85, the meaſure of the firlot by ſtatute above mentioned. But it is probable, that in this he followed the act 1587, where it is ordained, That the wheat-firlot ſhall contain 19 pints and two joucattes. A wheat-firlot marked with the Linlithow ſtamps being meaſured, was found to contain about 2211 cubical inches. By the ſtatute of 1618 the barley-firlot was to contain 31 pints of the juſt Stirling-jug.

“ A Paris pint is 48 cubical Paris inches, and is nearly equal to an Engliſh wine-quart. The *Boiſſean* contains 644 68099 Paris cubical inches, or 780.36 Engliſh cubical inches.

“ The Roman *amphora* was a cubical Roman foot, the *congius* was the eighth part of the *amphora*, the *ſextarius* was one ſixth of the *congius*. They divided the *ſextarius* like the *as* or *libra*. Of dry meaſures, the *medimnus* was equal to two amphoras, that is, about $1\frac{1}{2}\frac{1}{5}$ Engliſh legal buſhels; and the *modius* was the third part of the *amphora*.”

PROPOSITION XLIII.

To find the ſolid content of a given priſm.—By the 29th prop. let the area of the baſe of the priſm be meaſured, and be multiplied by the height of the priſm, the product will give the ſolid content of the priſm.

PROPOSITION XLIV.

To find the ſolid content of a given pyramid.—The area of the baſe being found, (by the 30th prop.) let it be multiplied by the third part of the height of the pyramid, or the third part of the baſe by the height, the product will give the ſolid content, by 7th 12. Eucl.

COROLLARY.

If the ſolid content of a *fruſtum* of a pyramid is required, firſt let the ſolid content of the entire pyramid be found; from which ſubtract the ſolid content of the part that is wanting, and the ſolid content of the broken pyramid will remain.

PROPOSITION XLV.

To find the content of a given cylinder.—The area of the baſe being found by prop. 33. if it be a circle, and by prop. 35. if it be an ellipſe, (for in both caſes it is a cylinder,) multiply it by the height of the cylinder, and the ſolid content of the cylinder will be produced.

COROLLARY.

FIG. 23. And in this manner may be meaſured the ſolid content of veſſels and caſks not much different from a cylinder, as ABCD. If towards the middle EF it be ſomewhat groſſer, the area of the circle of the baſe being found (by 33d prop.) and added to the area of the middle circle EF, and the half of their ſum (that is, an arithmetical mean between the area of the baſe and the area of the middle circle) taken for the baſe of the veſſel, and multiplied into its height, the ſolid content of the given veſſel will be produced.

Note, That the length of the veſſel, as well as the diameters of the baſe, and of the circle EF, ought to be taken within the ſtaves; for it is the ſolid content within the ſtaves that is ſought.

PROPOSITION XLVI.

To find the ſolid content of a given cone.—Let the area

area of the base (found by prop. 33.) be multiplied into $\frac{1}{3}$ of the height, the product will give the solid content of the cone; for by the 10th 12. Eucl. a cone is the third part of a cylinder that has the same base and height.

PROPOSITION XLVII.

FIG. 24. 25. *To find the solid content of a* frustum *of a cone cut by a plane parallel to the plane of the base.*—First, let the height of the entire cone be found, and thence (by the preceding prop.) its solid content; from which subtract the solid content of the cone cut off at the top, there will remain the solid content of the *frustum* of the cone.

How the content of the entire cone may be found, appears thus: Let ABCD be the *frustum* of the cone (either right or scalenous, as in the figures 2. and 3.) let the cone ECD be supposed to be compleated; let AG be drawn parallel to DE, and let AH and EF be perpendicular on CD; it will be (by 2d 6. Eucl.) as CG:CA:: CD:CE; but (by art. 72. of part. 1.) as CA:AH::CE: EF; consequently (by 22d 5. Eucl.) as CG:AH::CD: FF; that is, as the excess of the diameter of the lesser base is to the height of the *frustum*, so is the diameter of the greater base to the height of the entire cone.

COROLLARY.

FIG. 26. Some casks whose staves are remarkably bended about the middle, and strait towards the ends, may be taken for two portions of cones, without any considerable error. Thus ABEF is a *frustum* of a right cone, to whose base EF, on the other side, there is another similar *frustum* of a cone joined, EDCF. The vertices of these cones, if they be supposed to be completed, will be found at G and H. Whence, (by the preceding prop.) the solid content of such vessels may be found.

PROPOSITION XLVIII.

FIG. 27. A cylinder circumscribed about a sphere, that is, having its base equal to a great circle of the sphere, and its height equal to the diameter of the sphere, is to the sphere as 3 to 2.

Let ABEC be the quadrant of a circle, and ABDC the circumscribed square; and likewise the triangle ADC; by the revolution of the figure about the right line AC, as axis, a hemisphere will be generated by the quadrant, a cylinder of the same base and height by the square, and a cone by the triangle. Let these three be cut any how by the plane HF, parallel to the base AB; the section in the cylinder will be a circle whose radius is FH, in the hemisphere a circle of the radius EF, and in the cone a circle of the radius GF.

By (art. 69. of part 1.) EAq, or HFq=EFq and FAq taken together, (but AFq=FGq, because AC=CD); therefore the circle of the radius HF is equal to a circle of the radius EF together with a circle of the radius GF; and since this is true every where, all the circles together described by the respective *radii* HF (that is, the cylinder) are equal to all the circles described by the respective *radii* EF and FG (that is, to the hemisphere and the cone taken together); but, (by the 10th 12. Eucl.) the cone generated by the triangle DAC is one third part of the cylinder generated by the square BC. Whence it follows, that the hemisphere generated by the rotation of the quadrant ABEC is equal to the remaining two third parts of the cylinder, and that the whole sphere is $\frac{2}{3}$ of the double cylinder circumscribed about it.

This is that celebrated 39th prop. 1. book of Archimedes of the sphere and cylinder; in which he determines the proportion of the cylinder to the sphere inscribed to be that of 3 to 2.

COROLLARY.

Hence it follows, that the sphere is equal to a cone whose height is equal to the semidiameter of the sphere, having for its base a circle equal to the superficies of the sphere, or to four great circles of the sphere, or to a circle whose radius is equal to the diameter of the sphere, (by prop. 41. of this.) And indeed a sphere differs very little from the sum of an infinite number of cones that have their bases in the surface of the sphere, and their common vertex in the centre of the sphere; so that the superficies of the sphere, (of whose dimension see prop. 41. of this) multiplied into the third part of the semidiameter, gives the solid content of the sphere.

PROPOSITION XLIX.

FIG. 28. *To find the solid content of a sector of the sphere.*—A spherical sector ABC (as appears by the cor. of the preceding prop.) is very little different from an infinite number of cones, having their bases in the superficies of the sphere BEC, and their common vertex in the centre. Wherefore the spherical superficies BEC being found (by prop. 42. of this), and multiplied into the third part of AB the radius of the sphere, the product will give the solid content of the sector ABC.

COROLLARY.

It is evident how to find the solidity of a spherical segment less than a hemisphere, by subtracting the cone ABC from the sector already found But if the spherical segment be greater than a hemisphere, the cone corresponding must be added to the sector, to make the segment.

PROPOSITION L.

FIG. 29. *To find the solidity of the spheroid, and of its segments cut by planes perpendicular to the axis.*—In prop. 44. of this, it is shewn, that every where EH : EG :: CF : CD; but circles are as the squares described upon their rays, that is, the circle of the radius EH is to the circle of the radius EG, as CFq to CDq. And since it is so every where, all the circles described with the respective rays EH, (that is, the spheroid made by the rotation of the semi-ellipses AFB around the axis AB) will be to all the circles described by the respective *radii* EG, (that is, the sphere described by the rotation of the semicircle ADB on the axis AB) as FCq to CDq; that is, as the spheroid to the sphere on the same axis, so is the square of the other axis of the generating ellipse to the square of the axis of the sphere.

And this holds, whether the spheroid be found by a revolution around the greater or lesser axis.

COROLLARY 1.

Hence it appears, that the half of the spheroid, formed by the rotation of the space AHFC around the axis AC, is double of the cone generated by the triangle AFC about the same axis; which is the 32d prop. of Archimedes of conoids and spheroids.

COROLLARY 2.

Hence, likewise, is evident the measure of segments of the

the ſpheroid cut by planes perpendicular to the axis. For the ſegment of the ſpheroid made by the rotation of the ſpace ANHE, round the axis AE, is to the ſegment of the ſphere having the ſame axis AC, and made by the rotation of the ſegment of the circle AMGE, as CF*q* to CD*q*.

But if the meaſure of this ſolid be wanted with leſs labour, by the 34th prop. of Archimedes of conoids and ſpheroids, it will be as BE to AC+EB; ſo is the cone generated by the rotation of the triangle AHE round the axis AE, to the ſegment of the ſphere made by the rotation of the ſpace ANHE round the ſame axis AE; which could eaſily be demonſtrated by the method of indiviſibles.

COROLLARY 3.

Hence it is eaſy to find the ſolid content of the ſegment of a ſphere or ſpheroid intercepted between two parallel planes, perpendicular to the axis. This agrees as well to the oblate as to the oblong ſpheroid; as is obvious.

COROLLARY 4.

FIG. 30. If a caſk is to be valued as the middle piece of an oblong ſpheroid, cut by the two planes DC and FG, at right angles to the axis: firſt, let the ſolid content of the half ſpheroid ABCED be meaſured by the preceding prop. from which let the ſolidity of the ſegment DEC be be ſubtracted, and there will remain the ſegment ABCD; and this doubled will give the capacity of the caſk required.

The following method is generally made uſe of for finding the ſolid content of ſuch veſſels. The double area of the greateſt circle, that is, of that which is deſcribed by the diameter AB at the middle of the caſk, is added to the area of the circle at the end, that is, of the circle DC or FG (for they are uſually equal), and the third part of this ſum is taken for a mean baſe of the caſk; which therefore multiplied into the length of the caſk OP, gives the content of the veſſel required.

Sometimes veſſels have other figures, different from thoſe we have mentioned; the eaſy methods of meaſuring which may be learned from thoſe who practiſe this art. What hath already been delivered, is ſufficient for our purpoſe.

PROPOSITION LI.

FIG. 31. and 32. *To find how much is contained in a veſſel that is in part empty, whoſe axis is parallel to the horizon.*—Let AGBH be the great circle in the middle of the caſk, whoſe ſegment GBH is filled with liquor, the ſegment GAH being empty; the ſegment GBH is known, if the depth EB be known, and EH a mean proportional between the ſegments of the diameter AB and EB; which are found by a rod or ruler put into the veſſel at the orifice. Let the baſis of the caſk, at a medium, be found, which ſuppoſe to be the circle CKDL; and let the ſegment KCL be ſimilar to the ſegment GAH (which is either found by the rule of three, becauſe as the circle AGBH is to the circle CKDL, ſo is the ſegment GAH to the ſegment KCL; or is found from the tables of ſegments made by authors); and the product of this ſegment multiplied by the length of the caſk will give the liquid content remaining in the caſk.

PROPOSITION LII.

To find the ſolid content of a regular and ordinate body.—A tetraedron being a pyramid, the ſolid content is found by the 44th prop. The hexaedron, or cube, being a kind of priſm, it is meaſured by the 43d prop. An octaedron conſiſts of two pyramids of the ſame ſquare baſe and of equal heights; conſequently its meaſure is found by the 44th prop. A dodecaedron conſiſts of twelve pyramids having equal equilateral and equiangular pentagonal baſes; and ſo one of theſe being meaſured (by the 44th prop. of this) and multiplied by 12, the product will be equal to the ſolid content of the dodecaedron. The icoſiaedron conſiſts of 20 equal pyramids having triangular baſes; the ſolid content of one of which being found (by the 44th prop.) and multiplied by 20, gives the whole ſolid. The baſes and heights of theſe pyramids, if you want to proceed more exactly, may be found by trigonometry. See TRIGONOMETRY.

PROPOSITION LIII.

To find the ſolid content of a body however irregular.—Let the given body be immerſed into a veſſel of water, having the figure of a parallelopipedon or priſm, and let it be noted how much the water is raiſed upon the immerſion of the body. For it is plain, that the ſpace which the water fills, after the immerſion of the body, exceeds the ſpace filled before its immerſion, by a ſpace equal to the ſolid content of the body, however irregular. But when this exceſs is of the figure of a parallelopipedon or priſm, it is eaſily meaſured by the 43d prop. of this, *viz.* by multiplying the area of the baſe, or mouth of the veſſel, into the difference of the elevations of the water before and after immerſion. Whence is found the ſolid content of the body given.

In the ſame way the ſolid content of a part of a body may be found, by immerſing that part only in water.

There is no neceſſity to inſiſt here on diminiſhing or enlarging ſolid bodies in a given proportion. It will be eaſy to deduce theſe things from the 11th and 12th books of Euclid.

"The following rules are ſubjoined for the ready computation of the contents of veſſels, and of any ſolids in the meaſures in uſe in Great Britain.

"I. To find the content of a cylindric veſſel in Engliſh wine gallons, the diameter of the baſe and altitude of the veſſel being given in inches and decimals of an inch.

"Square the number of inches in the diameter of the veſſel; multiply this ſquare by the number of inches in the height: then multiply the product by the decimal fraction .0034; and this laſt product ſhall give the content in wine-gallons and decimals of ſuch a gallon. To expreſs the rule arithmetically; let D repreſent the number of inches and decimals of an inch in the diameter of the veſſel, and H the inches and decimals of an inch in the height of the veſſel; then the content in wine-gallons ſhall be $DDH \times \frac{34}{10000}$, or $DDH \times .0034$. *Ex.* Let the diameter $D = 51.2$ inches, the height $H = 62.3$ inches, then the content ſhall be $51.2 \times 51.2 \times 62.3 \times .0034 = 555.27.342$ wine-gallons. This rule follows from prop. 33 and 45. for, by the former, the area of the baſe of the veſſel is in ſquare inches $DD \times .7854$; and by the latter, the content of the veſſel in ſolid

"inches

inches is DDH$\times$.7854; which divided by 231 (the number of cubical inches in a wine-gallon) gives DDH $\times$ 0034, the content in wine-gallons. But though the charges in the excise are made (by statute) on the supposition that the wine-gallon contains 231 cubical inches; yet it is said, that in sale, 224 cubical inches, the content of the standard measured at Guildhall (as was mentioned above) are allowed to be a wine-gallon.

"II. Supposing the English ale-gallon to contain 282 cubical inches, the content of a cylindric vessel is computed in such gallons, by multiplying the square of the diameter of a vessel by its height as formerly, and their product by the decimal fraction .0,027,851: that is, the solid content in ale-gallons is DDH$\times$.0,027,851.

"III. Supposing the Scots pint to contain about 103.4 cubical inches, (which is the measure given by the standards at Edinburgh, according to experiments mentioned above), the content of a cylindric vessel is computed in Scots pints, by multiplying the square of the diameter of the vessel by its height, and the product of these by the decimal fraction 0076. Or the content of such a vessel in Scots pints is DDH$\times$.0076.

"Supposing the Winchester bushel to contain 2187 cubical inches, the content of a cylindric vessel is computed in those bushels by multiplying the square of the diameter of the vessel by the height, and the product by the decimal fraction .0,003,606. But the standard bushel having been measured by Mr Everard and others in 1696, it was found to contain only 2145.6 solid inches; and therefore it was enacted in the act for laying a duty upon malt, *That every round bushel, with a plain and even bottom, being* 18$\frac{1}{2}$ *inches diameter throughout, and* 8 *inches deep, should be esteemed a legal* Winchester *bushel.* According to this act (ratified in the first year of Queen Anne) the legal Winchester bushel contains only 2150.42 solid inches. And the content of a cylindric vessel is computed in such bushels, by multiplying the square of the diameter by the height, and their product by the decimal fraction .0,003,625. Or the content of the vessel in those bushels is DDH $\times$ .0,003,625.

"V. Supposing the Scots wheat firlot to contain 21$\frac{1}{4}$ Scots pints, (as is appointed by the statute 1618), and the pint to be conform to the Edinburgh standards above mentioned, the content of a cylindric vessel in such firlots is computed by multiplying the square of the diameter by the height, and their product by the decimal fraction .00,358. This firlot, in 1426, is appointed to contain 17 pints; in 1457, it was appointed to contain 18 pints; in 1587, it is 19$\frac{1}{4}$ pints; in 1628, it is 21$\frac{1}{4}$ pints: and though this last statute appears to have been founded on wrong computations in several respects; yet this part of the act that relates to the number of pints in the firlot seems to be the least exceptionable; and therefore we suppose the firlot to contain 21$\frac{1}{4}$ pints of the Edinburgh standard, or about 2197 cubical inches; which a little exceeds the Winchester bushel, from which it may have been originally copied.

"VI. Supposing the bear-firlot to contain 31 Scots pints, (according to the statute 1618), and the pint conform to the Edinburgh standards, the content of a cylindric vessel in such firlots is found by multiplying the square of the diameter by the height, and this product by .000,245.

"When the section of the vessel is not a circle, but an ellipsis, the product of the greatest diameter by the least, is to be substituted in those rules for the square of the diameter.

"VII. To compute the content of a vessel that may be considered as a *frustum* of a cone in any of those measures.

"Let A represent the number of inches in the diameter of the greater base, B the number of inches in the diameter of the lesser base. Compute the square of A, the product of A multiplied by B, and the square of B, and collect these into a sum. Then find the third part of this sum, and substitute it in the preceding rules in the place of the square of the diameter; and proceed in all other respects as before. Thus, for example, the content in wine-gallons is $\overline{AA \times AB \times BB} \times \frac{1}{3} \times H \times .0034$.

"Or, to the square of half the sum of the diameters A and B, add one third part of the square of half their difference, and substitute this sum in the preceding rules for the square of the diameter of the vessel; for the square of $\frac{1}{2}A \times \frac{1}{2}B$ added to $\frac{1}{3}$ of the square of $\frac{1}{2}A - \frac{1}{2}B$, gives $\frac{1}{3}AA \times \frac{1}{3}AB \times \frac{1}{3}BB$.

"VIII. When a vessel is a *frustum* of a parabolic conoid, measure the diameter of the section at the middle of the height of the *frustum*; and the content will be precisely the same as of a cylinder of this diameter, of the same height with the vessel.

"IX. When a vessel is a *frustum* of a sphere, if you measure the diameter of the section at the middle of the height of the *frustum*, then compute the content of a cylinder of this diameter of the same height with the vessel, and from this subtract $\frac{1}{3}$ of the content of a cylinder of the same height, on a base whose diameter is equal to its height; the remainder will give the content of the vessel. That is, if D represent the diameter of the middle section, and H the height of the *frustum*, you are to substitute DD$-\frac{1}{3}$HH for the square of the diameter of the cylindric vessel in the first six rules.

"X. When the vessel is a *frustum* of a spheroid, if the bases are equal, the content is readily found by the rule in p. 708. In other cases, let the axis of the solid be to the conjugate axis as n to 1; let D be the diameter of the middle section of the *frustum*, H the height or length of the *frustum*; and substitute in the first six rules $DD - \frac{HH}{3nn}$ for the square of the square of the diameter of the vessel.

"XI. When the vessel is an hyperbolic conoid, let the axis of the solid be to the conjugate axis as n to 1, D the diameter of the section at the middle of the *frustum*, H the height or length: compute $DD \times \frac{1}{3nn} \times HH$, and substitute this sum for the square of the diameter of the cylindric vessel in the first six rules.

"XII. In general, it is usual to measure any round vessel, by distinguishing it into several *frustums*, and

"taking the diameter of the section at the middle of each *frustum*; thence to compute the content of each, as if it was a cylinder of that mean diameter; and to give their sum as the content of the vessel. From the total content, computed in this manner, they subtract successively the numbers which express the circular areas that correspond to those mean diameters, each as often as there are inches in the altitude of the *frustum* to which it belongs, beginning with the uppermost; and in this manner calculate a table for the vessel, by which it readily appears how much liquor is at any time contained in it, by taking either the dry or wet inches; having regard to the inclination or drip of the vessel, when it has any.

"This method of computing the content of a *frustum* from the diameter of the section at the middle of its height, is exact in that case only when it is a portion of a parabolic conoid; but in such vessels as are in common use, the error is not considerable. When the vessel is a portion of a cone or hyperbolic conoid, the content by this method is found less than the truth; but when it is a portion of a sphere or spheroid, the content computed in this manner exceeds the truth. The difference or error is always the same, in the different parts of the same or of similar vessels, when the altitude of the *frustum* is given. And when the altitudes are different, the error is in the triplicate *ratio* of the altitude. If exactness be required, the error in measuring the *frustum* of a conical vessel, in this manner, is $\frac{1}{4}$ of the content of a cone similar to the vessel, of an altitude equal to the height of the *frustum*. In a sphere, it is $\frac{1}{3}$ of a cylinder of a diameter and height equal to the *frustum*. In the spheroid and hyperbolic conoid, it is the same as in a cone generated by the right-angled triangle, contained by the two semiaxes of the figure, revolving about that side which is the semiaxis of the *frustum*.

"In the usual method of computing a table for a vessel, by subducting from the whole content the number that expresses the uppermost area, as often as there are inches in the uppermost *frustum*, and afterwards the numbers for the other areas successively; it is obvious that the contents assigned by the table, when a few of the uppermost inches are dry, are stated a little too high, if the vessel stands on its lesser base, but too low when it stands on its greater base; because, when one inch is dry, for example, it is not the area at the middle of the uppermost *frustum*, but rather the area at the middle of the uppermost inch, that ought to be subducted from the total content, in order to find the content in this case.

"XIII. To measure round timber: Let the mean circumference be found in feet and decimals of a foot; square it; multiply this square by the decimal .079,577, and the product by the length. Ex. Let the mean circumference of a tree be 10·3 feet, and the length 24 feet. Then 10 3 × 10 3 × 079,577 × 24=202.615, is the number of cubical feet in the tree. The foundation of this rule is, that when the circumference of a circle is 1, the area is .0,795,774,715, and that the areas of circles are as the squares of their circumferences.

"But the common way used by artificers for measuring round timber, differs much from this rule. They call one fourth part of the circumference the *girt*, which is by them reckoned the side of a square, whose area is equal to the area of the section of the tree; therefore they square the *girt*, and then multiply by the length of the tree. According to their method, the tree of the last example would be computed at 159. 13 cubical feet only.

"How square timber is measured, will be easily understood from the preceding propositions. Fifty solid feet of hewn timber, and forty of rough timber, make a load.

"XIV. To find the burden of a ship, or the number of tons it will carry, the following rule is commonly given. Multiply the length of the keel taken within board, by the breadth of the ship within board, taken from the midship beam from plank to plank, and the product by the depth of the hold, taken from the plank below the keelson to the under part of the upper-deck plank, and divide the product by 94, the quotient is the content of the tonnage required. This rule however cannot be accurate; nor can one rule be supposed to serve for the measuring exactly the burden of ships of all sorts. Of this the reader will find more in the Memoirs of the Royal Academy of Sciences at Paris, for the year 1721.

"Our author having said nothing of weights, it may be of use to add briefly, that the English Troy-pound contains 12 ounces, the ounce 20 penny-weight, and the penny-weight 24 grains; that the Averdupois pound contains 16 ounces, the ounce 16 drams, and that 112 pounds is usually called the hundred weight. It is commonly supposed, that 14 pounds Averdupois are equal to 17 pounds Troy. According to Mr Everard's experiments, 1 pound Averdupois is equal to 14 ounces 12 penny-weight and 16 grains Troy, that is, to 7000 grains; and an Averdupois ounce is $437\frac{1}{2}$ grains. The Scots Troy-pound (which, by the statute 1718, was to be the same with the French) is commonly supposed equal to $15\frac{3}{4}$ ounces English Troy, or 7560 grains. By a mean of standards kept by the Dean of Guild at Edinburgh, it is $7599\frac{3}{32}$ or 7600 grains. They who have measured the weights which were sent from London, after the union of the kingdoms, to be the standards by which the weights in Scotland should be made, have found the English Averdupois pound (from a medium of the several weights) to weigh 7000 grains, the same as Mr Everard; according to which, the Scots, Paris, or Amsterdam-pound, will be to the pound Averdupois as 38 to 35. The Scots Troy-stone contains 16 pounds, the pound 2 marks or 16 ounces, an ounce 16 drops, a drop 36 grains. Twenty Scots ounces make a Tron pound; but because it is usual to allow one to the score, the Tron pound is commonly 21 ounces. Sir John Skene, however, makes the Tron stone to contain only $19\frac{1}{2}$ pounds."

GEORGE,

GEORGE, or *Knights of St* GEORGE, has been the denomination of ſeveral military orders, whereof that of the garter is one of the moſt illuſtrious. See GARTER.

St GEORGE *del Mina*, the capital of the Dutch ſettlements, on the gold-coaſts of Guinea, ſituated ſeven or eight miles weſt of Cape-coaſt caſtle, the capital of the Britiſh ſettlements there: W. long. 5′, and N. lat. 5°.

Fort St GEORE, a town and fort on the coaſt of Cormandel, in the Hither India: E. long. 80°, and N. lat. 13°.

The town is divided into the White and Black town. The fort, and White-town, which adjoins to it, are inhabited only by Britiſh; the whole circumference, which is not above half a mile, being ſurrounded by a ſtone wall. The outward, or Black town, called Madraſs, has been lately encompaſſed by a ſtone-wall and baſtions, and is about a mile and a half in circumference; the whole being almoſt environed by a river and the ſea.

St GEORGE'*s*, the largeſt of the Bermuda, or Summer-iſlands.

Croſs of St GEORGE, a red one in a field argent, which makes part of the Britiſh ſtandard.

GEORGIA, in Aſia, a province bounded by Circaſſia and Dageſtan on the north, by the Caſpian ſea on the eaſt, by Armenia or Turcomania on the ſouth, and by Mingrelia on the weſt.

GEORGIA, in America, one of the Britiſh plantations, taken out of South-Carolina, from which it is ſeparated by the river Savannah on the north, and bounded by the Atlantic ocean on the eaſt, by the river of St John, which divides it from Spaniſh Florida, on the ſouth and weſt.

GEORGIC, a poetical compoſition upon the ſubject of huſbandry, containing rules therein, put into a pleaſing dreſs, and ſet off with all the beauties and embelliſhments of poetry.

Heſiod and Virgil are the two greateſt maſters in this kind of poetry.

The moderns have produced nothing in this kind, except Rapin's book of Gardening, and the celebrated poem entitled Cyder by Mr Philips, who, if he had enjoyed the advantage of Virgil's language, would have been ſecond to Virgil in a much nearer degree.

GERANITES, in natural hiſtory, an appellation given to ſuch of the ſemipellucid gems as are marked with a ſpot reſembling a crane's eye.

GERANIUM, CRANE'S BILL, in botany, a genus of the monodelphia decandria claſs. It has but one ſtylus; the ſtigmata are five; and the capſule is ſhaped like the bill of a crane. There are fifty-ſeven ſpecies, ſixteen of which are natives of Britain, *viz.* the cicutarium, or hemlock-leaved crane's bill; the maſchatum, or muſhed crane's bill; the maritimum, or ſea crane's bill; the nodoſum, or knotty crane's bill; the phœum, or ſpotted crane's bill; the ſylvaticum, or mountain crane's bill; the pratenſe, or crowfoot crane's bill; the robertianum, or herb Robert; the lucidum, or ſhining dove's-foot crane's bill; the rotundifolium, or round-leaved crane's bill; the perenne, or perennial dove's-foot crane's bill; the molle, or common dove's-foot crane's bill; the puſillum, or ſmall flowered dove's-foot crane's bill; the columbinum, or long ſtalked dove's foot crane's bill; the diſſectum, or jagged-leaved dove's-foot crane's bill; and the ſanguineum, or bloody crane's bill. The leaves of the robertianum and pratenſe were formerly uſed as aſtringents, but are now left out both of the London and Edinburgh diſpenſatories.

GERARDIA, in botany, a genus of the didynamia angioſpermia claſs. The calyx conſiſts of five ſegments; the corolla is bilabiated, the inferior lip being divided into three parts; the lobes are emarginated, the middle one being divided into two ſegments; and the capſule is bilocular, and opens at the baſe. There are five ſpecies, none of them natives of Britain.

GERFALCON, or GYRFALCON. See FALCO.

GERGENTUM, a town of Sicily, the Agrigentum of the ancients, about fifty five miles ſouth-eaſt of Palermo: E. long. 13° 30′, N. lat. 37° 20′.

GERMAINS, or *St* GERMAINS, a town and royal palace of France, fourteen miles north-weſt of Paris.

St GERMAINS is alſo a borough of Cornwal, eight miles weſt of Plymouth. It ſends two members to parliament.

GERM, among gardeners. See BUD.

GERMAN, in genealogy, denotes entire or whole: thus, a brother-german is one both by the father's and mother's ſide; and couſins german are the children of brothers or ſiſters.

GERMAN, or GERMANIC, alſo denotes any thing belonging to Germany; as the German empire, German flute, *&c.*

GERMANDER, in botany. See TEUCRIUM.

GERMANY, an extenſive empire of Europe, ſituated between 5° and 19° E. long. and between 45° and and 55° N. lat.; bounded by Denmark and the Baltic ſea on the north, by Poland and Hungary on the eaſt, by Switzerland and the Alps on the ſouth, and by France, Holland, *&c.* on the weſt.

It is divided into ten circles, three of which lie on the north, *viz.* Upper and Lower Saxony, and Weſtphalia; three on the ſouth, *viz.* Auſtria, Bavaria, and Swabia; three about the middle, *viz* Franconia, and the Upper and Lower Rhine; the tenth, which conſiſted of the duchy of Burgundy and the ſeventeen provinces of the Netherlands, have long been detached from the empire.

There are in Germany upwards of three hundred ſovereign princes and ſtates, moſt of them arbitrary in their reſpective territories.

GERMEN, or GERM. See BUD.

GERMERSHEIM, a town of Germany, ſubject to France, about ten miles eaſt of Landau: E. long. 8° 15′, and N. lat. 49° 12′.

GERMINATION, the firſt ſprouting of the ſeeds of plants. See AGRICULTURE, Part I.

GERONTES, in Grecian antiquity, a ſort of magiſtrates of ancient Sparta, anſwering to the areopagites at Athens.

GERTRUDENBURG, a fortified town of the united Netherlands, in the province of Holland, nine miles north of Breda; subject to the prince of Orange.

GERUND, in grammar, a verbal noun of the neuter gender, partaking of the nature of a participle, declinable only in the singular number, through all the cases except the vocative; as, nom. *amandum*, gen. *amandi*, dat. *amando*, accus. *amandum*, abl. *amando*.

GESNERIA, in botany, a genus of plants, of the didynamia class. The calix rests upon the germen, and consists of five segments; the corolla is bent inwards and backwards; the capsule is below the flower, and bilocular. There are three species, none of them natives of Britain.

GESTATION, among physicians. See PREGNANCY.

GESTRICIA, a province of Sweden, bounded by Helsingia on the north, by the Bothnic gulph on the east, by Upland on the south, and by Dalecarlia on the west.

GESTURE, in rhetoric, consists chiefly in the proper action of the hands and face.

CETHYLLIS, in botany, a genus of the decandria-monogynia class. The calix is a spatha; the corolla consists of six segments; and the capsule has three cells. There is but one species, a native of Africa.

GEVAUDAN, a territory of Languedoc, adjoining to the Cevennes.

GEUM, in botany, a genus of the icosandria-pentagynia class. The calix has eight segments; the petals are eight; and the seeds are hairy and caudated. There are five species, two of which are natives of Britain, *viz.* the urbanum, or common avens; and the the rivale, or water avens. The root of the avens is sometimes used as a stomachic.

GHENT, or GAUNT, a city and capital of Flanders, thirty miles north west of Brussels: E. long. 3° 36′, N. lat. 51°.

It is a large fortified town, twelve miles in circumference, and defended by a citadel; and yet is a place of no great strength, by reason of the vast extent of ground it takes in.

GIAGH, in chronology, a cycle of twelve years; in use among the Turks and Cathayans.

Each year of the giagh bears a name of some animal: the first, that of a mouse; the second, that of a bullock; the third, of a lynx or leopard; the fourth, of a horse; the fifth, of a crocodile; the sixth, of a serpent; the seventh, of a horse; the eighth, of a sheep; the ninth, of a monkey; the tenth, of a hen; the eleventh, of a dog; and the twelfth, of a hog.

They also divide the day into twelve parts, which they call giaghs, and distinguish them by the name of some animals. Each giagh contains two of our hours, and is divided into eight kehs, as many as there are quarters in our hours.

GIALLOLINO, in natural history, a heavy, friable, fine, yellow ochre, called Naples yellow, and much used among painters, who esteem it a very fine colour.

GIANT'S CAUSEWAY, a vast collection of a black kind of marble, called basaltes, in the county of Antrim, in Ireland. See BASALTES.

GIBBOUS, a term in medicine, denoting any protuberance or convexity of the body, as a person haunched, or hump backed.

GIBBOUS, in astronomy, a term used in reference to the enlightened parts of the moon, whilst she is moving from the first quarter to the full, and from the full to the last quarter: for all that time the dark part appears horned, or falcated; and the light one hunched out, convex, or gibbous.

GIBELINS, GIBELLINS, a famous faction in Italy, opposite to another called the Guelphs.

These two factions ravaged and laid waste Italy for a long series of years, so that the history of that country, for the space of two centuries, is no more than a detail of their mutual violences and slaughters. The Gibelins stood for the emperor against the pope: but concerning their origin and the reason of their names, we have but a very obscure account. According to the generality of authors, they rose about the year 1240, upon the emperor Frederick II.'s being excommunicated by the pope Gregory IX. Other writers maintain, that the two factions arose ten years before, though still under the same pope and emperor. But the most probable opinion is that of Maimbourg, who says, that the two factions of Guelphs and Gibellins arose from a quarrel between two ancient and illustrious houses on the confines of Germany, that of the Henries of Gibeling, and that of the Guelphs of Adorf.

GIBRALTAR, a port-town of Andalusia, in Spain, subject to Great Britain: W. long. 6°, and N. lat. 36°.

It stands at the foot of mount Calpe, one of Hercules's pillars, about sixteen miles north of Ceuta, in Africa, from which it is divided by the Streights, to which it gives name. It is built on a rock, in a peninsula, and can only be approached on the land-side by a very narrow passage between the mountain and the sea: cross this passage the Spaniards have drawn a line, and fortified it, to prevent the garrison's having any communication with the country.

The Straits of Gibraltar are about twenty-four miles long, and fifteen broad.

GIFT, in Scots law. See DONATION.

GIGG, or JIGG, in music, denotes a brisk and lively air; or an airy kind of dance to a sprightly measure.

GILAN, a province of Persia, bounded by the Caspian Sea on the north. Its capital is a city of the same name: E long. 48°, and N. lat. 37°.

GILBERTINES, a religious order founded in England by St Gilbert, in the reign of Henry I. The nuns followed the rule of St Benedict, and the monks that of Augustin. There were many monastries of this order in different parts of England.

GILDING, the art of spreading or covering a thing with gold, either in leaf or liquid.

We have this advantage over the ancients, in the manner of using and applying the gold, that the secret of painting in oil, lately discovered, furnishes us with means of gilding works, capable of enduring all the violence of time and weather, which theirs could not.

There

There are ſeveral methods of gilding in uſe among us, as gilding in water, gilding in oil, gilding by fire, &c.

The method of water- GILDING. Water-gilding requires more preparation than oil gilding, and is chiefly on wooden works, and thoſe made of ſtucco; and theſe too muſt be ſheltered from the weather. A ſize is uſed for this way of gilding made of ſhreds, &c. of parchment or gloves boiled in water to the conſiſtence of a jelly. If the thing to be gilt be of wood, it is firſt waſhed with this ſize, boiling hot, and then ſet to dry; and afterwards with white paint mixed up with the ſame ſize. Some uſe Spaniſh white for this purpoſe, and others plaſter of Paris, well beaten and ſifted. This ſized paint muſt be laid on with a ſtiff bruſh; which is to be repeated ſeldomer or oftener according to the nature of the work, as ten or twelve times in flat or ſmooth works; but ſeven or eight times will be ſufficient in pieces of ſculpture. In the former caſe they are applied by drawing the bruſh over the work, in the latter by daubing it. When the whole is dry, they moiſten it with fair water, and rub it over with ſeveral pieces of coarſe linen, if it be on the flat; if not, they beat or ſwitch it with ſeveral ſlips of the ſame linen, tied to a little ſtick, to make it follow and enter all the cavities and depreſſures thereof.

Having thus finiſhed the white, the next thing to be done, is to colour it with yellow ochre: but if it be a piece of ſculpture in relievo, they firſt touch it up, and prepare the ſeveral parts, which may have happened to have been disfigured, by the ſmall iron inſtruments, as gouges, chiſſels, &c. The ochre uſed for this purpoſe muſt be well ground and ſifted, and mixed up with the ſize before-mentioned. This colour is to be laid on hot; and in works of ſculpture, ſupplies the place of gold, which ſometimes cannot be carried into all the depreſſures and cavities of the foliages and ornaments. A lay is alſo applied over this yellow, which ſerves for the ground on which the gold is to be laid: this lay is uſually compoſed of Armenian bole, bloodſtone, black-lead, and a little fat; to which ſome add ſoap, and oil of olives; others, burnt bread, biſtre, antimony, glaſs of tin, butter, and ſugar-candy. Theſe ingredients being all ground down together with hot ſize, three lays of this compoſition is applied upon the yellow, the one after the other has been dried; being cautious not to put any into the cavity of the work to hide the yellow.

The bruſh uſed for this purpoſe, muſt be a ſoft one; and when the matter is become very dry, they go over it again with a ſtronger bruſh, to rub it down, and take off the ſmall grains that ſtick out, in order to facilitate the burniſhing of the gold.

To be prepared for gilding, you muſt have three ſorts of pencils; one to wet, another to touch up and amend, and a third to flatten; alſo a gilding cuſhion, for ſpreading the leaves of gold on when taken out of the book; a knife to cut them, and a ſquirrel's tail fitted with a handle; or elſe a piece of fine ſoft ſtuff on a ſtick, to take them up directly and apply them. You are firſt to begin with wetting your pencils; by which the laſt lay laid on with water is moiſtened, that it may the better receive and retain the gold. Then you are to lay the leaves of gold on the cuſhion; and if whole, you muſt take up with the ſquirrel's tail, but, if in pieces, with the other inſtrument, or the knife wherewith they are cut, and lay and ſpread them gently on the parts of the work you had moiſtened before. If the leaves, as they frequently do, happen to crack or break in laying on, theſe breaches muſt be made up with ſmall bits of leaf, taken up upon the repairing pencil, and the whole work is to be ſmoothed either with the ſame pencil, or another ſomething larger; the gold being preſſed into the dents, into which it could not be ſo eaſily carried by the ſquirrel's tail.

The work having been thus far gilded, muſt be ſet to dry, in order to be burniſhed and flatted. See BURNISHING.

The laſt operation is the applying the vermeil in all the little lines and cavities; and to ſtop and amend any little faults with ſhell-gold. The compoſition called of vermeil is made of gum guttæ, vermilion, and a little of ſome ruddy-brown, ground together with venetian varniſh and oil of turpentine. Some gilders, inſtead of this, make ſhift with fine lacca, or dragon's blood, with gum-water.

Sometimes, inſtead of burniſhing the gold, they burniſh the ground or compoſition laid on the laſt before it, and only afterwards waſh the part over with the ſize. This method is chiefly practiſed for the hands, face, and other nudities in relievo: which, by this means, do not appear ſo very brilliant as the parts burniſhed, though much more ſo than the parts perfectly flat.

To gild a piece of work, and yet preſerve white grounds, they apply a lay of Spaniſh white, mixed with a weak fiſh-glue, on all the parts of the ground, whereon the yellow or the laſt lay might run.

The method of GILDING *in oil.* This operation requires much leſs apparatus than that before-mentioned. The baſis or matter whereon the gold is laid, in this method, is the remains of colours found ſettled to the bottom of the pots in which painters waſh their pencils. This matter, which is very viſcid or ſticky, is firſt ground, and then paſſed through a linen-cloth, and thus laid on the matter to be gilt, after it is waſhed once or twice over with ſize; and if it be wood, with ſome white paint.

When this is almoſt dry, but yet is ſtill unctuous enough to catch and retain the gold, the leaf-gold is laid on, either whole, if the work be large, or cut to pieces, if ſmaller: the leaves of gold are taken up and laid on with a piece of fine, ſoft, well carded cotton; or ſometimes by a pallet for the purpoſe, or ſometimes with the knife with which the leaves were cut, according to the parts of the work that are to be gilded, or the breadth of the gold that is to be laid on. As the gold is laid on, they paſs over it a coarſe ſtiff pencil bruſh, to make it ſtick and as it were incorporate with the ground; and after this they mend any cracks that may

may have happened in it, either with the fame pencil or one that is fmaller, as has been fhewn before in water-gilding.

This kind of gilding is chiefly ufed for domes and roofs of churches, courts, banquetting-houfes, *&c.* and for figures of plafter of Paris, lead, *&c.*

The method of GILDING *with liquid gold.* This is performed by gold reduced to a calx and amalgamated with mercury, in the proportion of about an ounce of mercury to a dram of gold. To perform this, they heat a crucible red hot, and then put the gold and mercury into it, ftirring them gently about till the gold be found melted, and incorporated into a mafs with the mercury. When this is done, they caft them into water, to wafh and purify them; and out of that into other waters, where the amalgama, which is almoft as liquid as if there were nothing but quickfilver in it, may be preferved a long time for ufe.

Before they proceed to lay this amalgamated gold on the metal, they firft render the metal rough, by wafhing it over with aqua fortis, or aqua fecunda; and afterwards rinfe the metal in fair water, and fcour it a little with fine fand, and then it is ready for the gold.

They next cover over the metal with the mixture of gold and mercury, taking it up with a flip of copper, or a brufh made of brafs-wire, fpreading it as even as poffible, to do which they wet the brufh from time to time in fair water. Then they fet the metal to the fire, upon a grate, or in a fort of cage, under which ftands a pan of coals; and in proportion as the mercury, evaporating and flying off, difcovers the places where gold is wanting, they take care to fupply them by adding new parcels of amalgama.

Then the work is rubbed over with the wire-brufh, dipt in beer or vinegar, which leaves it in a condition to be brought to a colour which is the laft part of the procefs, and which the gilders keep to themfelves as a mighty fecret.

The method of GILDING *by fire on metal.* To prepare the metal, they fcratch it well, or rake it; then polifh it with a polifher; and afterwards fet it to the fire to blue, *i. e.* to heat, till it appear of a blue colour. When this has been done, they clap on the firft lay of leaf-gold, rubbing it lightly down with a polifher; and expofe it thus to a gentle fire. They ufually give it but three fuch lays, or four at the moft, each lay confifting of a fingle leaf for common works, and of two for extraordinary ones: after each lay, it is fet a-frefh to the fire; and after the laft lay, the gold is in condition to be burnifhed.

To gild paper. Grind bole-armoniac (with rain-water, and give one laying of it; when it is dry, take glair of eggs, and add to it a little fugar-candy and gum-water, which lay over the former; and upon this, when it is dry enough, lay leaf-filver, or leaf gold.

To gild the leaves of books. Take bole-armoniac, eight penny-weight; fugar-candy, two penny-weight: mix and grind them with glair of eggs: then on a bound book (while it is in the prefs, after it hath been fmeared with glair of eggs, and is dried) fmear the faid compofition; let it dry, then rub it well and polifh it; then with fair water wet the edges of the book, and fuddenly lay on the gold, prefs it down gently with cotton, let it dry, and then polifh it with a tooth.

GILL, a meafure of capacity, containing a quarter of an Englifh pint.

GILLS, in ichthyology. See BRANCHIÆ.

GILOLO, a large ifland of the pacific ocean, lying between 1° S. lat. and 2° N. lat. and between 125° and 128° E. long.

GILOLO is alfo the name of the capital of the above ifland, fituated in 40′ N. lat.

GIN, in mechanics, a machine for driving piles, fitted with a windlafs and winches at each end, where eight or nine men heave, and round which a rope is reeved that goes over the wheel at the top: one end of this rope is feized to an iron-monkey, that hooks to a beetle of different weights, acccording to the piles they are to drive, being from eight to thirteen hundred weight; and when hove up to a crofs-piece, near the wheel, it unhooks the monkey, and lets the beetle fall on the upper end of the pile, and forces the fame into ground: then the monkey's own weight over-hauls the windlafs, in order for its being hooked again to the beetle.

GINGEN, an imperial city of Germany, twenty miles E. of Ulm: E. long. 10°, and north lat. 48° 36′.

GINGER, the root of a fpecies of amomum, too well known to need any defcription: It is a very ufeful fpice in cold flatulent colics, and in laxity and debility of the inteftines.

GINGLYMUS, in anatomy. See ANATOMY, p. 149.

GINSENG, a fmall root brought from North America, and fometimes from China. It has a fweet tafte, accompanied with a flight bitterifhnefs and warmth. The Chinefe look upon it as an univerfal reftorative in all decays.

GIRONNE, a large city and bifhop's fee of Spain, in the province of Catalonia, forty-five miles north-eaft of Barcelona: E. long. 2° 35′, and N. lat. 32°.

GIRONNE′, or GIRONNY, in heraldry, a coat of arms divided into girons, or triangular figures, meeting in the centre of the fhield, and alternately colour and metal. See Plate XCVII. fig 5.

GISBORN, a market-town of Yorkfhire, fifty miles weft of York.

GISBOROUGH, another market-town of Yorkfhire, thirty-feven miles north of York.

GISORS, a city of Normandy in France, twenty-eight miles fouth-eaft of Rouen: E. long. 1° 25′, N. lat. 50° 10′.

GLACIS, in building, an eafy infenfible flope or declivity.

The defcent of the glacis is lefs fteep than that of the talus. In gardening, a defcent fometimes begins in talus, and ends in glacis.

The glacis of the corniche, is an eafy imperceptible flope in the cymatium, to promote the defcent and draining off the rain-water.

GLACIS, in fortification, that mafs of earth which ferves

as

as a parapet to the covered way, ſloping eaſily towards the champain or field.

GLADDON. See Iris.

Glade, in gardening and agriculture, an opening and light paſſage made through a wood, by lopping off the branches of trees along that way.

GLADIATORS, in antiquity, perſons who fought generally in the arena at Rome, for the entertainment of the people.

The gladiators were uſually ſlaves, and fought out of neceſſity; though ſometimes freemen made profeſſion thereof, like our prize fighters, for a livelihood. The Romans borrowed this cruel diverſion from the Aſiatics; and we find that the very high-prieſts had their ludi pontificales, and ludi ſacerdotales. As from the earlieſt ages of antiquity we read that it was cuſtomary to ſacrifice priſoners of war to the manes of the great men that fell in the engagement; in proceſs of time they came to ſacrifice ſlaves at the funerals of all perſons of condition; but as it would have appeared barbarous to cut their throats like beaſts, they were appointed to fight with each other, and do their beſt to ſave their own lives by killing their adverſary.

Hence aroſe the maſters of arms called laniſtæ, and and men learned to fight. Theſe laniſtæ bought ſlaves to train up to this cruel trade, whom they afterwards ſold to ſuch as had occaſion to exhibit ſhews. Junius Brutus, who expelled the kings, was the firſt that honoured the funeral of his father with theſe inhuman diverſions at the ſepulchre of the deceaſed; but afterwards they were removed to the circus and amphitheatres; and other perſons, beſides ſlaves, would hire themſelves to this infamous office.

They were all firſt ſworn that they would fight till death; and if they failed, they were put to death, either by fire, ſwords, clubs, whips, *&c.* It was uſual with the people, or emperor, to grant them life when they ſhewed no ſigns of fear. Auguſtus decreed that it ſhould always be granted them.

From ſlaves and freed men, the wanton ſport ſpread to perſons of rank, as we find in Nero's time. And Domitian exhibited combats of women in the night-time: we alſo read, that dwarfs encountered with one another. Conſtantine the Great firſt prohibited theſe combats in the Eaſt; but the practice was not entirely aboliſhed in the Weſt before Theodoric king of the Oſtrogoths, in the year 500.

When any perſon deſigned to entertain the people with a ſhow of gladiators, he ſet up bills in the public places, giving an account of the time, the number and names of the combatants, and the circumſtances whereby they were to be diſtinguiſhed; each having his ſeveral badge, which generally was a peacock's feather: they alſo gave notice what time the ſhow would laſt; and ſometimes gave repreſentations of theſe things in painting, as is practiſed among us, by thoſe who have any thing to ſhow at fairs, *&c.*

Upon the day appointed for the ſhow, in the firſt place the gladiators were brought out all together, and obliged to take a circuit round the arena in a very ſolemn and pompous manner. After this they proceeded, *paria componere*, to match them by pairs, in which great care was taken to make the matches equal. The firſt ſort of weapons they made uſe of were ſtaves, or wooden files, called rudes; and the ſecond were effective weapons, as ſwords, poinards, *&c.*

The firſt were called *arma luſoria*, or *exercitoria;* the ſecond, *decretoria*, as being given by decree or ſentence of the prætor, or of him at whoſe expence the ſpectacle was exhibited.

They began to fence or ſkirmiſh with the firſt, which was to be the prelude to the battle; and from theſe, when well warmed, they advanced to the ſecond, with which they fought naked. The firſt part of the engagement was called *ventilare*, *præludere;* and the ſecond *dimicare ad certum*, or *verſis armis pugnare.*

When any received a remarkable wound, either his adverſary or the people uſed to cry out, *Habet*, or, *Hoc habet.* If the vanquiſhed ſurrendered his arms, it was not in the victor's power to grant him life: it was the people during the time of the republic, and the prince or people during the time of the empire, that were alone empowered to grant this boon. The two ſigns of favour and diſlike given by the people were, *premere pollicem*, and *vertere pollicem*; the former of which M. Dacier takes to be a clenching of the fingers of both hands between one another, and ſo holding the two thumbs upright cloſe together, was a ſign of the peoples admiration of the courage ſhewn by both combatants; and at the ſame time for the conqueror to ſpare his antagoniſt's life: but the contrary motion, or bending back of the thumbs, ſignified the diſſatiſfaction of the ſpectators, and authoriſed the victor to kill the other combatant downright for a coward. The emperor ſaved whom he liked, if he was preſent at the ſolemnity, in the ſame manner.

After the engagement, ſeveral marks of favour were conferred on the victor, particularly a branch of palm-tree; and oftentimes a ſum of money, perhaps gathered up among the ſpectators: but the moſt common rewards were the pileus and the rudis; the former being given only to ſuch gladiators as were ſlaves, for a token of obtaining their freedom; but the rudis ſeems to have been beſtowed both on ſlaves and freemen, with this difference, that it procured the former no more than a diſcharge from any further performance in public, upon which they commonly turned laniſta: but the rudis, when given to ſuch perſons as, being free, had hired themſelves out for theſe ſhows, reſtored them to a full enjoyment of their liberty. See Pileus, Rudis and Lanista.

GLADIOLUS, in botany, a genus of the triandria monogynia claſs. The corolla is ringent, and divided into ſix parts. There are ten ſpecies, none of them natives of Britain.

GLAMA. See Camelus.

GLAMORGANSHIRE, a county of South Wales, bounded by Brecknockſhire on the north, and by the Briſtol channel on the ſouth. Its capital is Landaff.

GLAND, in anatomy. See Anatomy, p. 307.

GLANDERS,

GLANDERS. See FARRIERY, p. 557.

GLANS, in anatomy. See ANATOMY, p. 270.

GLARIS, the capital of one of the cantons of Switzerland, of the ſame name, the inhabitants of which are both proteſtant and popiſh: it is ſituated thirty-five miles ſouth-eaſt of Zurich, in E. long. 9°, and N. lat. 47°.

GLASGOW, a large city of Scotland, in the ſhire of Lanerkſhire, or Clydeſdale, ſituated on the river Clyde, twenty miles north-weſt of Lanerk, and forty miles weſt of Edinburgh, in 4° 8′, W. long. and 55° 5′, N. lat.

This is one of the moſt elegant towns in Scotland. It has an univerſity, and a good foreign trade.

GLASS, a tranſparent, brittle, factitious body, produced by the action of fire upon a fixt ſalt and ſand, or ſtone, that readily melts.

The chemiſts hold, that there is no body but may be vitrified, or converted into glaſs; being the laſt effect of fire, as all its force is not able to carry the change of any natural body beyond its vitrification.

When or by whom the art of making glaſs was firſt found out is uncertain: ſome will have it invented before the flood; but without any proof. Neri traces the antiquity of this art as far back as the time of Job: but Dr Merret will have it as ancient as either pottery, or the making of bricks: becauſe that a kiln of bricks can ſcarce be burnt, or a batch of pottery be made, but ſome of the bricks and the ware will be at leaſt ſuperficially turned to glaſs; ſo that it muſt have been known at the building of Babel, and as long before as the making of bricks was uſed. It muſt have been known, conſequently, among the Egyptians, when the Iſraelites were employed by them in making bricks. Of this kind, no doubt, was that foſſil glaſs mentioned by Ferrant. Imperat. to be found under-ground in places where great fires had been. The Egyptians indeed boaſt, that this art was taught them by the great Hermes. Ariſtophanes, Ariſtotle, Alexander Aphrodiſæus, Lucretius, and John the divine, put us out of all doubt that glaſs was in uſe in their days.

Pliny relates, that it was firſt diſcovered accidentally in Syria, at the mouth of the river Belus, by certain merchants driven thither by a ſtorm at ſea, who, being obliged to continue there, and dreſs their victuals, by making a fire on the ground, where there was great plenty of the herb kali; that plant burning to aſhes, its ſalts mixed and incorporated with ſand, or ſtones fit to vitrify, and produced glaſs: that this accident being known, the people of Sidon, in that neighbourhood, aſſayed the work, improved the hint, and brought it into uſe; and that this art has been improving ever ſince.

Venice, for many years, excelled all Europe in the fineneſs of its glaſſes; but of late the French and Engliſh have excelled in the Venetians, ſo that we are no longer ſupplied with this commodity from abroad.

Nature and characters of GLASS. Naturaliſts are divided in what claſs of bodies to rank glaſs: ſome making it a concrete juice; others a ſtone; others again rank it among ſemi-metals; but Dr Merret obſerves, that theſe are all natural productions, whereas glaſs is a factitious compound, produced by fire, and never found in the earth, but only the ſand and ſtone that form it: that metals are formed by nature into certain ſpecies; and that fire only produces them, by its faculty of ſeparating heterogeneous, and uniting homogeneous bodies: whereas it produces glaſs, by uniting heterogeneous matter, *viz.* ſalt and ſand, of both which it evidently conſiſts; 100 ℔ weight of ſand yielding above 150 ℔ of glaſs.

The ſame learned doctor gives us a preciſe and accurate enumeration of the ſeveral characters, or properties of glaſs, whereby it is diſtinguiſhed from all other bodies, *viz* 1. That it is an artificial concrete of ſalt and ſand, or ſtones. 2. Fuſible by ſtrong fire. 3. When fuſed, tenacious and coherent. 4. It does not waſte nor conſume in the fire. 5. When melted, it cleaves to iron. 6. When it is red hot, it is ductile, and may be faſhioned into any form; but not malleable; and capable of being blown into a hollowneſs, which no mineral is. 7. Frangible when thin, without annealing. 8. Friable, when cold. 9. Diaphanous, whether hot or cold. 10. Flexible and elaſtic. 11. Diſſoluble by cold and moiſture. 12. Only capable of being graven or cut with a diamond, or other hard ſtone and emery. 13. Receives any dye or colour both externally and internally. 14. Not diſſoluble by aqua fortis, aqua regia, or mercury. 15. Neither acid juices nor any other matter extract either colour, taſte, or any other quality from it. 16. Admits of poliſhing. 17. Neither loſes weight nor ſubſtance by the longeſt and moſt frequent uſe. 18. Gives fuſion to other metals, and ſoftens them. 19. The moſt pliable thing in the world, and that which beſt retains the faſhion given it. 20. Not capable of being calcined. 21. An open glaſs being filled with water in the ſummer time, will gather drops of water on the outſide, juſt ſo far as the water on the inſide reaches; and a perſon's breath blown on it will manifeſtly moiſten it. 22. Little glaſs balls filled with water, mercury, and other liquor, and thrown into the fire, as alſo drops of green glaſs being broken, will fly aſunder with a great noiſe. 23. Neither wine, beer, nor any other liquor, will make it muſty, or change its colour, or ruſt it. 24. It may be cemented, as ſtones and metals. 25. A drinking glaſs, partly filled with water, and rubbed on the brim with a wet finger, yields muſical notes, higher or lower as the glaſs is more or leſs full, and will make the liquor friſk and leap.

Materials for making of GLASS. The materials whereof glaſs is made, we have already mentioned to be ſalt and ſand, or ſtones. The ſalt here uſed, is procured from a ſort of aſhes, brought from the Levant, called polverine, or rochetta; which aſhes are thoſe of a ſort of water-plant, called kali, cut down in ſummer, dried in the ſun, and burnt in heaps, either on the ground, or on iron grates; the aſhes falling into a pit, grow into a hard maſs, or ſtone, fit for uſe.

To extract the ſalt, theſe aſhes, or polverine, are powdered and ſifted, then put into boiling water, and there kept till one third of the water be conſumed; the whole

Fig. 1. GLASS MAKERS at Work

Fig. 2. Casting and Running of PLATE GLASS

Fig. 3.
Grinding and Polishing of PLATE GLASS.

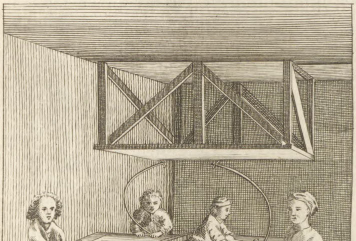


Fig. 4.
GIRONNE.

Fig. 5.
GORE.

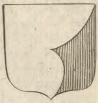


Fig. 6.
GARDANT

Fig. 7.
GULES

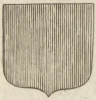
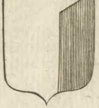


Fig. 8.
GUSSET



A Bell Sc.

whole being ftirred up, from time to time, that the afhes may incorporate with the fluid, and all its falts be extracted: then the veffel is filled up with new water, and boiled over again, till one half be confumed; what remains is a fort of lee, ftrongly impregnated with falt. This lee, boiled over again in frefh coppers, thickens in about twenty-four hours, and fhoots its falt; which is to be ladled out, as its fhoots, into earthern pans, and thence into wooden fats to drain and dry. This done, it is grofly pounded, and thus put in a fort of oven, called calcar, to dry. It may be added, that there are other plants, befides kali, which yield a falt fit for glafs: fuch are the alga, or fea weed, the common way-thiftle, bramble, hops, wormwood, woad, tobacco, fern, and the whole leguminous tribe, as peafe, beans, *&c.*

The fand or ftone, called by the artifts Tarfo, is the fecond ingredient in glafs, and that which gives it the body and firmnefs. Thefe ftones, Agricola obferves, muft be fuch as will fufe; and of thefe fuch as are white and tranfparent are beft; fo that cryftal challenges the precedency of all others.

At Venice they chiefly ufe a fort of pebble, found in the river Tefino, refembling white marble, and called cuogolo. Indeed Ant. Neri affures us, that all ftones which will ftrike fire with fteel, are fit to vitrify: but Dr Merret fhews, that there are fome exceptions from this rule. Flints are admirable; and when calcined, powdered, and fearched, make a pure white cryftalline metal: but the expence of preparing them makes the mafters of our glafs-houfes fparing of their ufe. Where proper ftones cannot be fo conveniently had, fand is ufed; which fhould be white, and fmall, and well wafhed, before it be applied: fuch is ufually found in the mouths and fides of rivers. Our glafs-houfes are furnifhed with a fine fand for cryftal, from Maidftone; the fame with that ufed for fand boxes, and in fcouring; and with a coarfer for green glafs from Woolwich. For cryftal glafs, to 200 ℔ of tarfo, pounded fine, they put 130 ℔ of falt of polverine; mix them together, and put them into the calcar, a fort of reverberatory furnace, being firft well heated. Here they remain baking, frying, and calcining, for five hours, during which the workman keeps mixing them with a rake, to make them incorporate: when taken out, the mixture is called frit, or bollito.

It may be further obferved, that glafs might be made by immediately melting the materials without thus calcining, and making them frit: but the operation would be much more tedious.

A glafs much harder than any prepared in the common way may be made by means of borax, in the following manner. Take four ounces of borax, and an ounce of fine white fand, reduced to powder, and melt them together in a large clofe crucible fet in a wind furnace, keeping a ftrong fire for half an hour: then take out the crucible, and, when cold, break it; and there will be found at the bottom a hard, pure glafs, capable of cutting common glafs almoft like a diamond. This experiment duly varied, fays Dr Shaw, may lead to fome confiderable improvements in the art of glafs, enamels, and artificial gems. It fhews us an expeditious method of making glafs without the ufe of fixed falts, which has generally been thought an effential ingredient in glafs, and which is the ingredient that gives common glafs its foftnefs; and it is not yet known, whether calcined cryftal, or other fubftances being added to this falt, inftead of fand, it might not make a glafs approaching to the nature of a diamond.

Kinds of GLASS. Of thefe materials we have many forts of glafs made, which may principally be diftinguifhed according to their beauty: as the cryftal flint glafs, the cryftal white glafs, the green glafs, and the bottle glafs. Again thefe feveral forts are diftinguifhed by their feveral ufes: as plate or coach glaffes, looking-glaffes, optic glaffes, *&c.* which are made of the firft fort. The fecond fort includes crown-glafs, toys, phials, drinking-glaffes, *&c.* The third fort is well known by its colour, and the fecond by its form.

Balas coloured GLASS is made thus: Put into a pot cryftal frit, thrice wafhed in water; tinge this with manganefe prepared into a clear purple; to this add alumen cativum fifted fine in fmall quantities, and at feveral times; this will make the glafs grow yellowifh, and a little reddifh, but not blackifh, and always diffipates the manganefe. The laft time you add manganefe, give no more of the alumen cativum, unlefs the colour be too full. Thus will the glafs be exactly of the colour of the balas-ruby.

Red GLASS. A blood-red glafs may be made in the following manner: Put fix pounds of glafs of lead, and ten pounds of common glafs, into a pot glazed with white glafs: when the whole is boiled and refined, add, by fmall quantities, and at fmall diftances of time, copper calcined to a rednefs, as much as, on repeated proofs, is found fufficient: then add tartar in powder by fmall quantities at a time, till the glafs is become as red as blood; and continue adding one or other of the ingredients till the colour is quite perfect.

Yellow GLASS. It is a neceffary remark in glafs-making, that the cryftal glafs made with falt that has an admixture of tartar will never receive the true gold yellow, though it will all other colours: for yellow glafs, therefore, a falt muft be prepared from polverine, or pot afhes alone, to make the glafs.

Furnaces for the making GLASS. In this manufacture, there are three forts of furnaces; one, called calcar, is for the frit; the fecond is for working the glafs; the third ferves to anneal the glafs, and is called the leer. See FURNACE.

The calcar A (Plate XCVII. fig. 1.) refembles an oven ten feet long, feven broad, and two deep: the fuel, which in England is fea coal, is put into a trench on one fide of the furnace; and the flame reverberating from the roof upon the frit, calcines it. The glafs-furnace, or working furnace B, is round, of three yards diameter, and two high; or thus proportioned. It is divided into three parts, each of which is vaulted. The lower part C is properly called the crown, and

and is made in that form. Its ufe is to keep a brifk fire of coal and wood, which is never put out. The mouth of it is called the bocca. There are feveral holes in the arch of this crown, through which the flame paffes into the fecond vault, or partition, and reverberates into the pots filled with the ingredients above mentioned. Round the infides are eight or more pots placed, and piling pots on them. The number of pots is always double that of the boccas D, or mouths, or of the number of workmen, that each may have one pot refined to work out of, and another for metal to refine in while he works out of the other. Through the working holes the metal is taken out of the pots, and the pots are put into the furnace; and thefe holes are ftopped with moveable covers made of lute and brick, to fcreen the workmens eyes from the fcorching flames. On each fide of the bocca, or mouth, is a bocarella, or little hole, out of which coloured glafs, or finer metal, is taken from the piling pot. Above this oven, there is the third oven or leer, about five or fix yards long, where the veffels, or glafs, is annealed, or cooled: this part confifts of a tower, befides the leer F, into which the flame afcends from the furnace. The tower has two mouths, through which the glaffes are put in with a fork, and fet on the floor or bottom: but they are drawn out on iron pans, called fraches, through the leer, to cool by degrees; fo that they are quite cold by the time they reach the mouth of the leer, which enters the farofel, or room where the glaffes are to be ftowed.

But the green glafs furnace is fquare; and at each angle it has an arch for annealling, or cooling glaffes. The metal is wrought on two oppofite fides, and on the other two they have their colours, into which are made linnet holes, for the fire to come from the furnace to bake the frit, and to difcharge the fmoke. Fires are made in the arches to anneal the work, fo that the whole procefs is done in one furnace.

Thefe furnaces muft not be of brick, but of hard fandy ftones. In France, they build the outfide of brick, and the inner part to bear the fire is made of a fort of fuller's earth, or tobacco-pipe clay, of which earth they alfo make their melting-pots.

Mr Blancourt obferves, that the worft and roughef work in this art, is the changing the pots, when they are worn out, or cracked. In this cafe the great working hole muft be uncovered; the faulty pot muft be taken out with iron hooks and forks, and a new one muft be fpeedily put in its place, through the flames, by the hands only. For this work, the man guards himfelf with a garment made of fkins, in the fhape of a pantaloon, that covers him all but his eyes, and is made as wet as poffible: the eyes are defended with a proper fort of glafs.

Inftruments for making of Glass. The inftruments made ufe of in this work, may be reduced to thefe that follow. A blowing pipe, made of iron, about two feet and a half long, with a wooden handle. An iron rod to take up the glafs, after it is blown, and to cut off the former. Sciffars to cut the glafs when it comes off from the firft hollow iron. Shears to cut and fhape great glaffes, *&c.* an iron ladle, with the end of the handle cafed with wood, to take the metal out of the refining pot, to put it into the workmens pots. A fmall iron ladle, cafed in the fame manner, to fkim the alkalic falt that fwims at top. Shovels, one like a peel, to take up the great glaffes; another, like a fire-fhovel, to feed the furnace with coals. A hooked iron fork, to ftir the matter in the pots. An iron rake for the fame purpofe, and to ftir the frit. An iron fork, to change or pull the pots out of the furnace, *&c.*

Working or blowing round Glass. The tools thus provided, the workman dips his blowing pipe into the melting-pot; and by turning it about, the metal fticks to the iron more firmly than turpentine. This he repeats four times, at each time rolling the end of his inftrument, with the hot metal thereon, on a piece of iron G, over which is a veffel of water which helps to cool, and fo to confolidate, and to difpofe that matter to bind more firmly with what is to be taken next out of the melting pot. But after he has dipt a fourth time, and the workman perceives there is metal enough on the pipe, he claps his mouth immediately to the other end of it H, and blows gently through the iron tube, till the metal lengthens like a bladder about a foot. Then he rolls it on a marble ftone I, a little while, to polifh it, and blows a fecond time, by which he brings it to the fhape of a globe of about eighteen or twenty inches diameter. Every time he blows into the pipe, he removes it quickly to his cheek, otherwife he would be in danger, by often blowing, of drawing the flame into his mouth; and this globe may be flattened by returning it to the fire, and brought into any form by ftamp-irons, which are always ready. When the glafs is thus blown, it is cut off at the collet, or neck, which is the narrow part that ftuck to the iron. The method of performing this is as follows: the pipe is refted on an iron bar, clofe by the collet; then a drop of cold water being laid on the collet, it will crack about a quarter of an inch, which, with a flight blow, or cut of the fhears K, will immediately feparate the collet.

After this is done, the operator dips the iron rod into the melting-pot, by which he extracts as much metal as ferves to attract the glafs he has made, to which he now fixes this rod at the bottom of his work, oppofite to the opening made by the breaking of the collet. In this pofition the glafs is carried to the great bocca, or mouth of the oven, to be heated and fcalded, by which means it is again put into fuch a foft ftate, that, by the help of an iron inftrument, it can be pierced, opened, and widened without breaking. But the veffel is not finifhed till it is returned to the great bocca: where it being again heated thoroughly, and turned quickly about with a circular motion, it will open to any fize, by the means of the heat and motion. And by this means we come to learn the caufe why the edge of all bowls and glaffes, *&c.* are thicker than the other parts of the fame glaffes; becaufe in the turning it about in the heat, the edge thickens; and the glafs being as it were doubled in that part, the circumference appears like a felvage.

If

If there remains any superfluities, they are cut off with the shears L; for till the glass is cool, it remains in a soft, flexible state. It is therefore taken from the bocca, and carried to an earthen bench, covered with brands, which are coals extinguished, keeping it turning; because that motion prevents any settling, and preserves an evenness in the face of the glass, where, as it cools, it comes to its consistency; being first cleared from the iron rod by a slight stroke by the hand of the workman.

If the vessel conceived in the workman's mind, and whose body is already made, requires a foot, or a handle, or any other member or decoration, he makes them separate; and now assays to join them with the help of hot metal, which he takes out of the pots with his iron rod: but the glass is not brought to its true hardness, till it has passed the leer, or annealing oven, described before.

Working, or blowing, of window or table GLASS. The method of working round glass, or vessels of any sort, is in every particular applicable to the working of window or table-glass, till the blowing iron has been dipt the fourth time. But then, instead of rounding it, the workman blows, and so manages the metal upon the iron plate, that it extends two or three feet in the form of a cylinder. This cylinder is put again to the fire, and blown a second time, and is thus repeated till it is extended to the dimensions required, the side to which the pipe is fixed diminishing gradually till it ends in a pyramidical form; so that, to bring both ends nearly to the same diameter, while the glass is thus flexible, he adds a little hot metal to the end opposite the pipe, and draws it out with a pair of iron pinchers, and immediately cuts off the same end with the help of a little cold water, as before.

The cylinder being now open at one end, is carried back to the bocca, and there, by the help of cold water, it is cut about eight or ten inches from the iron pipe or rod; and the whole length at another place, by which also it is cut off from the iron rod. Then it is heated gradually on an earthen table, by which it opens in length, while the workman, with an iron tool, alternately lowers and raises the two halves of the cylinder, which at last will open like a sheet of paper, and fall into the same flat form in which it serves for use; in which it is preserved by heating it over again, cooling it on a table of copper, and hardening it twenty-four hours in the annealing furnace, to which it is carried upon forks. In this furnace an hundred tables of glass may lie at a time, without injury to each other, by separating them into tens, with an iron shiver between, which diminishes the weight by dividing it, and keeps the tables flat and even.

This was the method formerly made use of for blowing plate-glass, looking-glasses, *&c.*; but the workmen, by this method, could never exceed fifty inches in length, and a proportional breadth, because what were larger were always found to warp, which prevented them from reflecting the objects regularly, and wanted substance to bear the necessary grinding. These imperfections have been remedied by an invention of the Sieur Abraham Thevart, in France, about the year 1688, of casting or running large plates of glass in the following manner.

Casting, or running of large looking-GLASS *plates.* The furnace G, fig. 2. is of a very large dimension, environed with several ovens, or annealing furnaces, called carquasses, besides others for making of frit, and calcining old pieces of glass. This furnace, before it is fit to run glass, costs 3500l. It seldom lasts above three years, and even in that time it must be refitted every six months. It takes six months to rebuild it; and three months to refit it. The melting-pots are as big as large hogsheads, and contain about 2000 weight of metal. If one of them bursts in the furnace, the loss of the matter and time amounts to 250l. The heat of this furnace is so intense, that a bar of iron laid at the mouth thereof becomes red hot in less than half a minute. The materials in these pots are the same as described before; and A is the man breaking the frit for that purpose. When the furnace is red-hot, these materials are put in at three different times, because that helps the fusion; and in twenty-four hours they are vitrified, refined, settled, and fit for casting. H is the bocca, or mouth of the furnace; K is the cistern that conveys the liquid glass it receives out of the melting-pots in the furnace to the casting table. These cisterns are filled in the furnace, and remain therein six hours after they are filled; and then are hooked out by the means of a large iron chain, guided by a pulley marked I, and placed upon a carriage with four wheels marked L, by two men P P. This carriage has no middle piece; so that when it has brought the cistern to the casting-table M, they slip off the bottom of the cistern, and out rushes a torrent of flaming matter O, upon the table: this matter is confined to certain dimensions by the iron rulers N, N, N, which are moveable, retain the fluid matter, and determine the width of the glass; while a man R, with the roller Q resting on the edge of the iron rulers, reduceth it as it cools to an equal thickness, which is done in the space of a minute. This table is supported on a wooden frame, with trustles for the convenience of moving to the annealing furnace; into which, strewed with sand, the new plate is shoved, where it will harden in about ten days. After this, the glass needs only be ground, polished, and foliated for use.

Grinding and polishing of plate-GLASS. Glass is made transparent by fire, but it receives its lustre by the skill and labour of the grinder and polisher, the former of whom takes it rough out of the hands of the maker.

In order to grind plate glass, they lay it horizontally upon a flat stone-table, (fig. 3.) made of a very fine-grained free-stone; and for its greater security they plaster it down with lime, or stucco: for otherwise the force of the workmen, or the motion of the wheel with which they grind it, would move it about.

This stone-table is supported by a strong frame A, made of wood, with a ledge quite round its edges, rising about two inches higher than the glass. Upon this glass to be ground, is laid another rough glass not above half so big, and so loose as to slide upon it; but

cemented

cemented to a wooden plank, to guard it from the injury it muſt otherwiſe receive from the ſcraping of the wheel, to which this plank is faſtened; and from the weights laid upon it, to promote the grinding, or friture, of the glaſſes. The whole is covered with a wheel, B, made of hard light wood, about ſix inches in diameter; by pulling of which backwards and forwards alternately, and ſometimes turning it round, the workmen who always ſtand oppoſite to each other, produce a conſtant attrition between the two glaſſes, and bring them to what degree of ſmoothneſs they pleaſe, by firſt pouring in water and coarſe ſand; after that, a finer ſort of ſand, as the word advanceth, till at laſt they muſt pour in the powder of ſmalt. As the upper or incumbent glaſs poliſhes, and grows ſmoother, it muſt be taken away, and another from time to time put in its place.

This engine is called a mill by the artiſts, and is uſed only in the largeſt ſize glaſſes; for in the grinding of the leſſer glaſſes, they are content to work without a wheel, and to have only four wooden handles faſtened to the four corners of the ſtone which loads the upper plank, by which they work it about.

When the grinder has done his part, who finds it very difficult to bring the glaſs to an exact plainneſs, it is turned over to the care of the poliſher, who with the fine powder of tripoli-ſtone, or emery, brings it to a perfect evenneſs and luſtre. The inſtrument made uſe of in this branch, is a board, *c*, *c*, furniſhed with a felt, and a ſmall roller, which the workman moves by means of a double handle at both ends. The artiſt in working this roller, is aſſiſted with a wooden hoop or ſpring, to the end of which it is fixed: for the ſpring, by conſtantly bringing the roller back to the ſame points, facilitates the action of the workman's arm.

Painting in Glass. The ancient manner of painting in glaſs was very ſimple; it conſiſted in the mere arrangement of pieces of glaſs of different colours in ſome ſort of ſymmetry, and conſtituted what is now called Mowork. See Mosaic.

In proceſs of time they came to attempt more regular deſigns, and alſo to repreſent figures heightened with all their ſhades: yet they proceeded no farther than the contours of the figures in black with water-colours, and hatching the draperies after the ſame manner on glaſſes of the colour of the object they deſigned to paint. For the carnation, they uſed glaſs of a bright red colour; and upon this they drew the principal lineaments of the face, *&c.* with black.

But in time, the taſte for this ſort of painting improving conſiderably, and the art being found applicable to the adorning of churches, baſilics, *&c.* they found out means of incorporating the colours in the glaſs itſelf, by heating them in the fire to a proper degree; having firſt laid on the colours. The colours uſed in painting or ſtaining of glaſs are very different from thoſe uſed in painting either in water or oil colours.

For black, Take ſcales of iron, one ounce; ſcales of copper, one ounce; jet, half an ounce; reduce them to powder, and mix them. For blue, Take powder of blue, one pound; ſal nitre, half a pound; mix them and grind them well together. For carnation, Take red chalk, eight ounces; iron ſcales and litharge of ſilver, of each two ounces; gum arabic, half an ounce; diſſolve in water; grind altogether for half an hour as ſtiff as you can; then put it in a glaſs and ſtir it well, and let it ſtand to ſettle fourteen days. For green, Take red lead, one pound; ſcales of copper, one pound; and flint, five pounds; divide them into three parts; and add to them as much ſal nitre; put them into a crucible, and melt them with a ſtrong fire; and when it is cold, powder it, and grind it on a porphyry. For gold colour, Take ſilver an ounce; antimony, half an ounce; melt them in a crucible; then pound the maſs to powder; and grind it on a copper plate; add to it yellow oker, or brick-duſt calcined again, fifteen ounces; and grind them well together with water. For purple, Take minium, one pound; brown ſtone, one pound; white flint, five pounds; divide them into three parts, and add to them as much ſal nitre as one of the parts; calcine, melt, and grind it as you did the green. For red, Take jet, four ounces; litharge of ſilver, two ounces; red chalk, one ounce; powder them fine, and mix them. For white, Take jet, two parts; white flint, ground on a glaſs very fine, one part; mix them. For yellow, take Spaniſh brown, ten parts; leaf ſilver, one part; antimony, half a part; put all into a crucible, and calcine them well.

In the windows of ancient churches, *&c.* there are to be ſeen the moſt beautiful and vivid colours imaginable, which far exceed any of thoſe uſed by the moderns, not ſo much becauſe the ſecret of making thoſe colours is entirely loſt, as that the moderns will not go to the charge of them, nor be at the neceſſary pains, by reaſon that this ſort of painting is not now ſo much in eſteem as formerly. Thoſe beautiful works which were made in the glaſs-houſes were of two kinds.

In ſome, the colour was diffuſed through the whole ſubſtance of the glaſs. In others, which were the more common, the colour was only on one ſide, ſcarce penetrating within the ſubſtance above one third of a line; though this was more or leſs according to the nature of the colour; the yellow being always found to enter the deepeſt. Theſe laſt, though not ſo ſtrong and beautiful as the former, were of more advantage to the workmen, by reaſon that on the ſame glaſs, though already coloured, they could ſhew other kind of colours where there was occaſion to embroider draperies, enrich them with foliages, or repreſent other ornaments of gold, ſilver, *&c.*

In order to this, they made uſe of emery, grinding or wearing down the ſurface of the glaſs, till ſuch time as they were got through the colour to the clear glaſs. This done, they applied the proper colours on the other ſide of the glaſs. By theſe means, the new colours were hindered from running and mixing with the former, when they expoſed the glaſſes to the fire, as will appear hereafter.

When indeed the ornaments were to appear white, the glaſs was only bared of its colour with emery, without tinging the place with any colour at all; and this

this was the manner by which they wrought their lights, and heightnings, on all kinds of colour.

The firft thing to be done, in order to paint or ftain glafs, in the modern way, is to defign, and even colour the whole fubject on paper. Then they chufe fuch pieces of glafs as are clear, even, and fmooth, and proper to receive the feveral parts, and proceed to diftribute the defign itfelf, or papers it is drawn on, into pieces fuitable to thofe of the glafs; always taking care that the glaffes may join in the contours of the figures, and the folds of the draperies; that the carnations, and other finer parts, may not be impaired by the lead with which the pieces are to be joined together. The diftribution being made, they mark all the glaffes as well as papers, that they may be known again: which done, applying every part of the defign upon the glafs intended for it, they copy, or transfer, the defign upon this glafs with the black colour diluted in gum water, by tracing and following all the lines and ftrokes as they appear through the glafs with the point of a pencil.

When thefe ftrokes are well dried, which will happen in about two days, the work being only in black and white, they give a flight wafh over with urine, gum arabic, and a little black; and repeat it feveral times, according as the fhades are defired to be heightened, with this precaution, never to apply a new wafh till the former is fufficiently dried.

This done, the lights and rifings are given by rubbing off the colour in the refpective places with a wooden point, or the handle of the pencil.

As to the other colours above-mentioned, they are ufed with gum water, much as in painting in miniature; taking care to apply them lightly, for fear of effacing, the out-lines of the defign; or even, for the greater fecurity, to apply them on the other fide; efpecially yellow, which is very pernicious to the other colours, by blending therewith. And here too, as in pieces of black and white, particular regard muft always be had not to lay colour on colour, or lay on a new lay, till fuch time as the former are well dried.

It may be added, that the yellow is the only colour that penetrates through the glafs, and incorporates therewith by the fire; the reft, and particularly the blue, which is very difficult to ufe, remaining on the furface, or at leaft entering very little. When the painting of all the pieces is finifhed, they are carried to the furnace, or oven, to anneal, or bake the colours.

The furnace here ufed is fmall, built of brick, from eighteen to thirty inches fquare. At fix inches from the bottom is an aperture to put in the fuel, and maintain the fire. Over this aperture is a grate, made of three fquare bars of iron, which traverfe the furnace, and divide it into two parts. Two inches above this partition, is another little aperture, through which they take out pieces to examine how the coction goes forward. On the grate is placed a fquare earthen pan, fix or feven inches deep; and five or fix inches lefs every way than the perimeter of the furnace. On the one fide hereof is a little aperture, through which to make trials, placed directly oppofite that of the furnaces deftined for the fame end. In this pan are the pieces of glafs to be placed, in the following manner. Firft, the bottom of the pan is covered with three ftrata, or layers, of quick lime pulverifed; thofe ftrata being feparated by two others of old broken glafs, the defign whereof is to fecure the painted glafs from the too intenfe heat of the fire. This done, the glaffes are laid horizontally on the laft or uppermoft layer of lime.

The firft row of glafs they cover over with a layer of the fame powder, an inch deep; and over this they lay another range of glaffes, and thus alternately till the pan is quite full; taking care that the whole heap always end with a layer of the lime-powder.

The pan being thus prepared, they cover up the furnace with tiles, on a fquare table of earthen ware, clofely luted all round; only leaving five little apertures, one at each corner, and another in the middle, to ferve as chimneys. Things thus difpofed, there remains nothing but to give the fire to the work. The fire for the firft two hours muft be very moderate, and muft be increafed in proportion as the coction advances, for the fpace of ten or twelve hours; in which time it is ufually compleated. At laft the fire, which at firft was charcoal, is to be of dry wood, fo that the flame covers the whole pan, and even iffues out at the chimneys.

During the laft hours, they make effays, from time to time, by taking out pieces laid for the purpofe through the little aperture of the furnace, and pan, to fee whether the yellow be perfect, and the other colours in good order. When the annealing is thought fufficient, they proceed with great hafte to extinguifh the fire, which otherwife would foon burn the colours, and break the glaffes.

Glass *of lead*. See Chemistry, p. 136.

Glass *porcelain*, the name given by many to a modern invention of imitating the china-ware with glafs.

The method of making it, as given by Mr Reamur, who was the firft that carried the attempt to any degree of perfection, is as follows.

The glafs veffels to be converted into porcelain, are to be put into large veffels, fuch as the common fine earthen difhes are baked in; or into fufficiently large crucibles: the veffels are to be filled with a mixture of fine white fand, and of fine gypfum; or plafter ftone, burnt into what is called plafter of Paris; and all the interftices are to be filled up with the fame powder, fo that the glafs veffels may no where touch either one another, or the fides of the veffels they are baked in.

The veffel is to be then covered down, and luted, and the fire does the reft of the work: for this is only to be put into a common potter's furnace, and when it has ftood there the ufual time of baking the other veffels, it is to be taken out, and the whole contents will be found no longer glafs, but converted into a white opake fubftance, which is a very elegant porcelain, and has almoft the properties of that of china.

GLASS *of antimony*. See CHEMISTRY, p 87.

GLASTONBURY, a market town of Somerfetfhire, five miles fouth of Wells.

GLATZ, the capital of a county of the fame name in Bohemia, 100 miles eaft of Prague: E. long. 16° 8′, N. lat. 50° 25′.

GLAUBER's SALT. See CHEMISTRY, p. 127.

GLAUCION, in ornithology. See ANAS.

GLAUCIUM, in botany. See CHELIDONIUM.

GLAUCOMA, in medicine, the change of the cryftalline humour of the eye into an azure-colour. See MEDICINE.

GLAUCUS, in ichthyology. See SQUALUS.

GLAUX, in botany, a genus of the pentandria-monogynia clafs. The calix confifts of one leaf; it has no corolla; the capfule has one cell, 5 valves, and 5 feeds. There is but one fpecies, *viz*. the maritima, fea-milkwort, or glafs-wort, a native of Britain.

GLAZIER, an artificer who works in glafs. See GLASS.

The principal part of a glazier's bufinefs confifts in fitting panes and plates of glafs to the fafhes and window-frames of houfes, pictures, *&c*. and in cleaning the fame.

GLAZING, the polifhing or crufting over earthen ware, by running melted lead or litharge over it.

The common ware is glazed with a compofition of 50 lb. clean fand, 70 lb. lead-afhes, 30 lb. wood-afhes, and 12 lb. falt, all melted into a cake. With this mixture they glaze it over, and then fet it in an earthen glazing pan; taking care that the veffels do not touch one another. As feveral colours are ufed for this purpofe, we fhall give the following receipts, from Smith's laboratory. 1. For a black, take lead-afhes, 18 parts; iron-filings, 3; copper-afhes, 3; and zaffer, 2: this, when melted, will make a brown black; and if you would have it blacker, put fome more zaffer to it. 2. For blue, take lead-afhes, 1 lb. clear fand or pebble, 2 lb. falt, 2 lb. white calcined tartar, 1 lb. Venice or other glafs, 16 lb. and zaffer, half a pound: mix them well together; and after melting, quench them in water, and then melt them again; which operation is to be repeated feveral times; and if you would have it fine and good, it will be proper to put the mixture into a glafs furnace for a day or two. 3. A brown glazing may be given with a mixture of lead-glafs, 12 parts, and common glafs and manganefe, of each one part. 4. A citron-yellow may be made of 6 parts of red-lead, 7 parts of fine red brick-duft, and 2 parts of antimony, all melted together. 5. A flefh-colour, with 12 parts of lead-afhes, and one of white glafs. 6 For a green-colour, take 8 parts of litharge, 8 parts of Venice-glafs, 4 parts of brafs-duft, and melt them together for ufe; or melt together two parts yellow glafs, with as much copper-duft. 7. For a gold-yellow, take of antimony, red lead, and fand, an equal quantity, and melt them into a cake. 8. For a fine purple brown, take lead-afhes, 15 parts; clear fand, 18; manganefe, 1; white glafs, 15 meafures; and 1 of zaffer. 9. For a fine red, take antimony, 2 lb. litharge, 3 lb. ruft of iron calcined, 1 lb. and grind them to a fine powder. 10. For a fine white glazing, take 2 lb. of lead, 1 lb. of tin, and calcine them to afhes; of which take 2 parts; of calcined flint or pebble, 1 part; of falt, 1 part; and mixing them well together, melt them into a cake. At Rotterdam, they make a fine fhining white glazing, by melting together 2 lb. clean tin-afhes, 10 lb. lead afhes, 2 lb. fine Venice-glafs, and $\frac{1}{2}$ lb. tartar. 11 A yellow glazing is made of 4 ounces of red lead, and 2 ounces of antimony, melted together. 12. For a fine yellow, take red lead, 3 pints; antimony and tin, of each 2 lb. then melting them into a cake, grind it fine; and repeating this feveral times, you will have a good yellow.

GLEBE, among miners, fignifies a piece of earth, wherein is contained fome mineral ore.

GLEBE, in law, the land belonging to a parifh-church, befides the tithes.

GLECHOMA, in botany, a genus belonging to the didynamia gymnofpermia clafs. The calix confifts of five fegments; and each pair of antheræ are difpofed in the form of a crofs. There are three fpecies, two of which are natives of Britain, *viz*. the hederacea, or ground-ivy; and the arvenfis, or upright ground-ivy. The leaves of the hederacea are corroborant, aperient, and detergent.

GLEDITSIA, in botany, a genus of the polygamia dioecia clafs. The calix of the hermaphrodite has four fegments; the corolla four petals; there are fix ftamina, and one piftillum. The calix of the male confifts of three leaves, and the corolla of three petals; and it has fix ftamina. The calix of the female confifts of five leaves, and the corolla of five petals; it has but one piftillum; and the capfule is a legumen. There are two fpecies, none of them natives of Britain.

GLEET, in medicine, the flux of a thin limpid humour from the urethra. See MEDICINE.

GLIRES, the name of Linnæus's fourth order of mammalia See NATURAL HISTORY.

GLENOIDES, the name of two cavities, or fmall depreffions, in the inferior part of the firft vertebra of the neck.

GLIS, in zoology. See SCIURUS.

GLISCHROMICTHES, in natural hiftory, the name by which Dr Hill calls the tougher and more vifcid loams.

GLISTER, in furgery. CLYSTER.

GLOBE, in practical mathematics, an artificial fpherical body, on the convex furface of which are reprefented the countries, feas, *&c*. of our earth; or the face of the heavens, the circles of the fphere, *&c*. See GEOGRAPHY.

GLOBULARIA, in botany, a genus of the tetrandria monogynia clafs. The common calix is imbricated; and the proper calix is tubular and below the fruit; the upper labium of the corollulæ is divided into two parts, and the under one into three; and the receptacle is paleaceous. There are feven fpecies, none of them natives of Britain.

GLOBULE, a diminutive of globe, frequently ufed by phyficians in fpeaking of the red fpherical particles of the blood.

GLOCESTER,

GLOCESTER, the capital of Glocefter-fhire, ninety miles weft of London: W. long. 2° 16′, and N. lat. 51° 50′.

It is a bifhop's fee, and fends two members to parliament.

GLOGAW, a city of Silefia, fituated on the river Oder, forty five miles north weft of Breflaw: E long 16° 8′, and N. lat 51° 40′.

Leffer GLOGAW, a town of Silefia, fifty miles fouth of Breflaw.

GLORIOSA, SUPERB LILY, in botany, a genus of the hexandria monogynia clafs. The corolla confifts of fix undulated and reflected petals; and the ftylus is oblique. There is but one fpecies, a native of Malabar.

GLOSSARY, a fort of dictionary, explaining the obfcure and antiquated terms in fome old author.

GLOSSOPETRA, in natural hiftory, a genus of extraneous foffils, fo called from their having been fuppofed the tongues of ferpents turned into ftone, though they are really the teeth of fharks, and are daily found in the mouths of thofe fifhes, where ever taken.

GLOTTIS, in anatomy. See ANATOMY, p. 300.

GLOW WORM See CICINDELA.

GLUCKSTAT. a fortified town of Germany, fituated on the eaft fide of the river Elbe, thirty miles northweft of Hamburgh: E. long. 9°, and N. lat. 54° 20′.

GLUE, among artificers, a tenacious vifcid matter, which ferves as a cement to bind or connect things together.

Glues are of different kinds, according to the various ufes they are defigned for, as the common glue, glove-glue, and parchment-glue; whereof the two laft are more properly called fize.

The common or ftrong glue is chiefly ufed by carpenters, joiners, cabinet makers, *&c.* and the beft kind is that made in England, in fquare pieces of a ruddy brown colour; and, next to this, the Flanders glue. It is made of the fkins of animals, as oxen, cows, calves, fheep, *&c.* and the older the creature is, the better is the glue made of its hide. Indeed, whole fkins are but rarely ufed for this purpofe, but only the fhavings, parings, or fcraps of them; or the feet-finews, *&c.* That made of whole fkins, however, is undoubtedly the beft; as that made of finews is the very worft.

The method of making GLUE. In making glue of parings. they firft fteep them two or three days in water; then wafhing them well out, they boil them to the confiftence of a thick jelly; which they pafs, while hot, through ozier-bafkets, to feparate the impurities from it, and then let it ftand fome time, to purify it further: when all the filth and ordures are fettled to the bottom of the veffel, they melt and boil it a fecond time. They next pour it into flat frames or moulds, whence it is taken out pretty hard and folid, and cut into fquares pieces or cakes. They afterwards dry it in the wind, in a fort of coarfe net; and at laft ftring it, to finifh its drying.

The glue made of finews, feet, *&c.* is managed after the fame manner; only with this difference, that they bone and fcour the feet, and do not lay them to fteep.

The beft glue is that which is oldeft; and the fureft way to try its goodnefs, is to lay a piece to fteep three or four days, and if it fwell confiderably without melting, and when taken out refumes its former drinefs, it is excellent.

A glue that will hold againft fire or water, may be made thus: mix a handful of quicklime with four ounces of linfeed oil; boil them to a good thicknefs, then fpread it on tin-plates in the fhade, and it will become exceeding hard, but may be eafily diffolved over a fire, as glue, and will effect the bufinefs to admiration.

Method of preparing and ufing GLUE. Set a quart of water on the fire, then put in about half a pound of good glue, and boil them gently together till the glue be entirely diffolved and of a due confiftence. When glue is to be ufed, it muft be made thoroughly hot; after which, with a brufh dipped in it, befmear the faces of the joints as quick as poffible; then clapping them together, flide or rub them lengthwife one upon another, two or three times, to fettle them clofe; and fo let them ftand till they are dry and firm.

GLUME, among botanifts. See BOTANY, p. 637.

GLUTÆUS, in anatomy. See ANATOMY, p 204.

GLYCINE, in botany, a genus of the diadelphia decandria clafs. The calix is bilabiated: and the pod confifts of two cells. There are nine fpecies, none of them natives of Britain.

GLYCYRRHIZA, LIQUORICE, in botany, a genus of the diadelphia decandria clafs. The calix is bilabiated; and the pod is oval and compreffed. There are three fpecies, none of them natives of Britain.

The common liquorice is cultivated in moft countries of Europe for the fake of its root. That which is cultivated in Britain is preferable to fuch as comes from abroad; this laft being generally mouldy, which this root is very apt to become, unlefs kept in a dry place. The powder of liquorice ufually fold is often mingled with flour, and probably too often with fubftances not quite fo wholefome: the beft fort is of a brownifh yellow colour (the fine pale yellow being generally fophifticated) and of a very rich fweet tafte, much more agreeable than that of the frefh root. Liquorice is almoft the only fweet that quenches thirft; whence it was called by the Greeks *adipfon.* Galen takes notice, that it was employed in this intention in hydropic cafes, to prevent the neceffity of drinking. Mr Fuller, in his *Medicina gymnaftica*, recommends this root as a very ufeful pectoral, and fays it excellently foftens acrimonious humours, at the fame time that it proves gently detergent: and this account is warranted by experience.

GLYPH, in fculpture and architecture, denotes any canal or cavity ufed as an ornament.

GMELINA, in botany, a genus of the didynamia angiofpermia clafs. The calix has four teeth; the corolla is bell-fhaped, and divided into four fegments; the antheræ are divided into two parts; and the fruit is a bilocular drupa. There is but one fpecies, a native of the Indies.

GNAPHALIUM, CUDWEED, in botany, a genus of the fyngenefia

ſyngeneſia polygamia ſuperflua claſs. The receptacle is naked; the pappus is plumoſe; and the calix is imbricated. There are 41 ſpecies, five of them natives of Britain, *viz.* the dioicum, mountain cudweed, or cat's foot; the margaritaceum, or American cudweed; the luteo-album, or Jerſey cudweed; the ſylvaticum, or upright cudweed; and the uliginoſum, or black-headed cudweed.

GNAT, in zoology. See MUSCA.

GNESNA, the capital city of great Poland, ſituated one hundred and ten miles weſt of Warſaw: E. long. 18°, and N. lat. 53°.

It is the ſee of an archbiſhop, who is always primate of Poland. See POLAND.

GNIDIA, in botany, a genus of the octandria monogynia claſs. The calix is funnel ſhaped, and conſiſts of four ſegments; the petals are four, and inſerted into the calix; and the berry contains but one ſeed. There are three ſpecies, none of them natives of Britain.

GNOMON, in dialling, the ſtyle, pin, or cock of a dial; which, by its ſhadow, ſhews the hour of the day. See DIALLING.

GNOMON, in aſtronomy, a ſtyle erected perpendicular to the horizon, in order to find the altitude of the ſun.

GNOMON *of a globe*, the index of the hour-circle. See GEOGRAPHY.

GNOMONICS, the art of dialling. See DIALLING.

GNOSTICS, in church-hiſtory, Chriſtian heretics ſo called, it being a name which almoſt all the ancient heretics affected to take, to expreſs that new knowledge and extraordinary light to which they made pretenſions; the word gnoſtic ſignifying a learned or enlightened perſon.

GOA, a city and ſea-port of the hither India, ſituated in an iſland of the river Mandoua, and ſubject to the Portugueſe: E. lon 73° 20′, and N. lat. 15° 20′.

GOAT, in zoology. See CAPRA.

GOAT'S BEARD, in botany. See TRAGOPOGON.

GOAT'S RUE, in botany. See GALEGA.

GOAT SUCKER, in ornithology. See CAPRIMULGUS.

GOBIUS, in ichthyology, a genus of fiſhes belonging to the order of thoracici. They have two holes between the eyes, four rays in the membrane of the gills; and the belly-fins are united in an oval form. There are eight ſpecies, principally diſtinguiſhed by the number of rays in their fins.

GOD, one of the many names of the Supreme Being. See RELIGION.

GODDESS, a heathen deity of the female ſex.

The ancients had almoſt as many goddeſſes as gods; ſuch were Juno, the goddeſs of air; Diana, the goddeſs of woods, *&c.* And under this character were repreſented the virtues, graces, and principal advantages of life; Truth, Juſtice, Piety, Liberty, Fortune, Victory, *&c.*

It was the peculiar privilege of the goddeſſes to be repreſented naked on medals; for it was ſuppoſed that the imagination muſt be awed and reſtrained by the conſideration of the divine character.

GOLCONDA, the capital of a province of the ſame name in the hither India: E. long. 77°, and N. lat. 16°.

GOLD. See CHEMISTRY, p. 78, and 129.

GOLD-WIRE, a cylindrical ingot of ſilver, ſuperficially gilt, or covered with gold at the fire, and afterwards drawn ſucceſſively through a great number of little, round holes, of a wire-drawing iron, each leſs than the other, till it be ſometimes no bigger than a hair of the head.

It may be obſerved, that before the wire be reduced to this exceſſive fineneſs, it is drawn through above an hundred and forty different holes; and that each time they draw it, it is rubbed afreſh over with new wax, both to facilitate its paſſage, and to prevent the ſilver's appearing through it.

GOLD-WIRE *flatted*, is the former wire flatted between two rollers of poliſhed ſteel, to fit it to be ſpun on a ſtick, or to be uſed flat, as it is, without ſpinning, in certain ſtuffs, laces, embroideries, *&c.* See STUFF, *&c.*

GOLD-THREAD, or SPUN-GOLD, is a flatted gold, wrapped or laid over a thread of ſilk, by twiſting it with a wheel and iron bobbins.

Manner of forming GOLD-WIRE, *and* GOLD-THREAD, *both round and flat*. Firſt, an ingot of ſilver, of twenty-four pounds, is forged into a cylinder, of about an inch in diameter: then it is drawn through eight or ten holes, of a large, coarſe, wire-drawing iron, both to finiſh the roundneſs, and to reduce it to about three fourths of its former diameter. This done, they file it very carefully all over, to take off any filth remaining on the forge; then they cut it in the middle; and thus make two equal ingots thereof, each about twenty ſix inches long, which they draw through ſeveral new holes, to take off any inequalities the file may have left, and to render it as ſmooth and equable as poſſible.

The ingot thus far prepared, they heat it in a charcoal fire; then taking ſome gold leaves, each about four inches ſquare, and weighing twelve grains, they join four, eight, twelve, or ſixteen of theſe, as the wire is intended to be more or leſs gilt; and when they are ſo joined, as only to form a ſingle leaf, they rub the ingots reeking hot with a burniſher. Theſe leaves being thus prepared, they apply over the whole ſurface of the ingot, to the number of ſix, over each other, burniſhing or rubbing them well down with the blood-ſtone, to cloſe and ſmoothe them. When gilt, the ingots are laid anew in a coal fire; and when raiſed to a certain degree of heat, they go over them a ſecond time with the blood-ſtone, both to ſolder the gold more perfectly, and to finiſh the poliſhing. The gilding finiſhed, it remains to draw the ingot into wire.

In order to this, they paſs it through twenty holes of a moderate drawing iron, by which it is brought to the thickneſs of the tag of a lace: from this time the ingot loſes its name, and commences gold-wire. Twenty holes more of a leſſer iron leaves it ſmall enough for the leaſt iron; the fineſt holes, of which laſt ſcarce exceeding the hair of the head, finiſh the work.

To diſpoſe the wire to be ſpun on ſilk, they paſs it between

between two rollers of a little mill: these rollers are of nicely polished steel, and about three inches in diameter. They are set very close to each other, and turned by means of a handle fastened to one of them, which gives motion to the other. The gold wire in passing between the two, is rendered quite flat, but without losing any thing of its gilding, and is rendered so exceedingly thin and flexible, that it is easily spun on silk thread, by means of a hand wheel, and so wound on a spool or bobin.

GOLD-LEAF, or BEATEN GOLD, is gold beaten with a hammer into exceeding thin leaves, so that it is computed, that an ounce may be beaten into sixteen hundred leaves, each three inches square, in which state it takes up more than 159052 times its former surface.

This gold they beat on a block of black marble, about a foot square, and usually raised three feet high: they make use of three sorts of hammers, formed like mallets, of polished iron: the first, which weighs three or four pounds, serves to chase, or drive; the second, of eleven or twelve pounds, to close; and the third, which weighs fourteen or fifteen pounds, to stretch and finish. They also make use of four moulds of different sizes, *viz.* two of vellum, the smallest whereof consists of forty or fifty leaves, and the larger of two hundred; the other two, consisting each of five hundred leaves, are made of bullocks guts well scoured, and prepared. See MOULD.

Method of preparing and beating GOLD. They first melt a quantity of pure gold, and form it into an ingot: this they reduce, by forging, into a plate about the thickness of a sheet of paper; which done, they cut the plate into little pieces about an inch square, and lay them in the first or smallest mould to begin to stretch them: after they have been hammered here a while with the smallest hammer, they cut each of them into four, and put them into the second mould, to be extended further.

Upon taking them hence, they cut them again into four, and put them into the third mould; out of which they are taken, divided into four, as before, and laid in the last, or finishing mould, where they are beaten to the degree of thinness required.

The leaves thus finished, they take them out of the mould, and dispose them into little paper-books, prepared with a little red bole, for the gold to stick to; each book ordinarily contains twenty-five gold leaves. There are two sizes of these books; twenty-five leaves of the smallest only weigh five or six grains, and the same number of the largest nine or ten grains.

It must be observed, that gold is beaten more or less, according to the kind or quality of the work it is intended for; that for the gold-wire drawers to gild their ingots withal, is left much thicker than that for gilding the frames of pictures, &c. withal. See GILDING.

GOLD-FINCH, in ornithology. See FRINGILLA.

GOLDSMITH, or, as some chuse to express it, *silversmith*, an artist who makes vessels, utensils, and ornaments, in gold and silver.

The goldsmith's work is either performed in the mould, or beat out with the hammer or other engine. All works that have raised figures, are cast in a mould, and afterwards polished and finished: plates, or dishes, of silver or gold, are beat out from thin flat plates; and tankards, and other vessels of that kind, are formed of plates soldered together, and their mouldings are beat, not cast. The business of the goldsmiths formerly required much more labour than it does at present; for they were obliged to hammer the metal from the ingot to the thinness they wanted: but there are now invented flatting-mills, which reduce metals to the thinness that is required, at a very small expence. The goldsmith is to make his own moulds, and for that reason ought to be a good designer, and have a taste in sculpture: he also ought to know enough of metallurgy, to be able to assay mixed metals, and to mix the alloy.

GOLDEN, something that has a relation to gold, or consists of gold.

GOLDEN *number*. See ASTRONOMY, p. 492.

GOLDEN *rule*. See ARITHMETICK, p. 381.

GOLDINGEN, a city of Poland, in the duchy of Courland, sixty miles west of Mittau: E. long. 22°, N. lat 57°.

GOMBRON, the greatest sea-port town in Persia, situated on the strait at the entrance of the gulph of Persia, opposite to the island of Ormus: E. long. 55° 30′, N. lat. 27° 30′.

GOMERA, one of the Canary islands, subject to Spain, and situated west of Teneriff: W. long. 18°, N. lat. 28°.

GOMORRO *islands*, situated between 10° and 13° S. lat. on the eastern coast of Africa.

GOMPHOSIS, in anatomy. See ANATOMY, p. 148.

GOMPHRENA, the *purple everlasting flower*, in botany, a genus of the pentandria digynia class. The calix consists of three coloured leaves; the nectarium is cylindrical, with ten teeth; and the capsule contains one seed. There are seven species, none of them natives of Britain.

GONDOLA, in naval architecture, a flat kind of boat, very long and narrow, chiefly used on the canals at Venice.

GONORRHOEA, in medicine, an involuntary efflux of the seminal juices, and some other recrementitious matter. See MEDICINE.

GOOD, in general, whatever is apt to cause or increase pleasure, or diminish pain in us; or, which amounts to the same, whatever is able to procure or preserve to us the possession of agreeable sensations, and remove those of an opposite nature.

Moral GOOD, denotes the right conduct of the several senses and passions, or their just proportion and accommodation to their respective objects and relations. See MORALS.

GOOD-HOPE, or *Cape of* GOOD-HOPE, the most southern promontory of Africa, where the Dutch have built a good town and fort: E. long. 16° and N. lat. 34° 15′.

GOOSE, in ornithology. See ANAS.

GOOSEBERRY, in botany. See RIBES.

Goose-neck, in a ſhip, a piece of iron fixed on the one end of the tiller, to which the laniard of the whip-ſtaff or the wheel-rope comes, for ſteering the ſhip.

Goose-wing, in the ſea-language. When a ſhip ſails before, or with a quarter wind on a freſh gale, to make the more haſte, they launch out a boom, and ſail on the lee ſide; and a ſail ſo fitted, is called a gooſe-wing.

GOR, the capital of a province of the ſame name, in the Eaſt Indies, ſubject to the Mogul: E. long. 85°, N. lat. 31° 15′.

GORCUM, a city of the United Provinces, ſituated in that of Holland, on the river Waal, twenty two miles eaſt of Rotterdam: E. long. 4° 50′, N lat. 51° 50′.

GORDIAN knot, in antiquity, a knot made in the leathers or harneſs of the chariot of Gordius, king of Phrygia, ſo very intricate, that there was no finding where it began or ended.

The inhabitants had a tradition, that the oracle had declared, that he who untied this knot, ſhould be maſter of Aſia. Alexander having undertaken it, was unable to accompliſh it; when fearing leſt his not untying it ſhould be deemed an ill augury, and prove a check in the way of his conqueſts, he cut it aſunder with his ſword, and thus either accompliſhed or eluded the oracle.

GORE, in heraldry, one of the abatements, which, according to Guillim, denotes a coward. It is a figure conſiſting of two arch lines drawn one from the ſiniſter chief, and the other from the ſiniſter baſe, both meeting in an acute angle in the middle of the feſs point. See Plate XCVII. fig. 4.

GORGE, in architecture, the narroweſt part of the Tuſcan and Doric capitals, lying between the aſtragal, above the ſhaft of the pillar, and the annulets.

Gorge, in fortification, the entrance of the platform of any work. See Fortification.

GORGED, in heraldry, the bearing of a crown, coronet, or the like, about the neck of a lion, a ſwan, *&c.* and in that caſe it is ſaid, the lion or cygnet is gorged with a ducal coronet, *&c.*

Gorged is alſo uſed when the gorge or neck of a peacock, ſwan, or the like bird, is of a different colour or metal from the reſt.

GORGONA, the name of two iſlands; one in the Pacific Ocean on the coaſt of Peru, W. long. 79°, N. lat. 3°; the other in the Mediterranean, twenty five miles weſt of Leghorn.

GORGONS, in antiquity, a warlike female nation of Lybia, in Africa, who had frequent quarrels with another nation of the ſame ſex, called Amazons.

GORLITZ, a city of Upper Saxony, in Germany, fifty miles eaſt of Dreſden: E. long. 15° 6′, N. lat. 51° 12′.

GOSHAWK. See Falco.

GOSLAR, an imperial city of Lower Saxony, in Germany, thirty miles ſouth of Brunſwick: E. long. 10° 30′, N. lat. 52°.

GOSPEL, the hiſtory of the life, actions, death, reſurrection, aſcenſion and doctrine of Jeſus Chriſt.

The word is ſaxon, and of the ſame import with the Latin term *evangelium*, which ſignifies glad tidings, or good news.

This hiſtory is contained in the writings of St Mathew, St Mark, St Luke, and St John; who from thence are called evangeliſts. The Chriſtian church never acknowledged any more than theſe four goſpels as canonical; notwithſtanding which, ſeveral apocryphal goſpels are handed down to us, and others are entirely loſt.

GOSSYPIUM, in botany, a genus of the monodelphia polyandria claſs. The calix is double, the exterior one conſiſting of three leaves; the capſule has four cells; and the ſeeds are covered with down. There are four ſpecies, none of them natives of Britain.

GOTHA the capital of the duchy of Saxe Gotha, in Upper Saxony; E. long. 10° 36′, N. lat. 51°.

It is ſubject to the duke of Saxe Gotha, brother of her royal highneſs the princeſs dowager of Wales.

GOTHIC, in general, whatever has any relation to the Goths: thus, we ſay, Gothic cuſtoms, Gothic architecture, *&c.*

GOTHLAND, the moſt ſouthern province of Sweden, being a peninſula ſurrounded on three ſides by the Baltic Sea. It is ſubdivided into Eaſt and Weſt Gothland, Smaland, Halland, Bleken, and Schonen.

Gothland, is alſo an iſland of the Baltic, ſituated without the province of Gothland and Livonia.

GOTTENBURG, a port-town of Sweden, ſituated between the Sound, on the coaſt of the Schaggerack Sea, near the entrance of the Baltic.

GOTTINGEN, a city of Germany, in the circle of Lower Saxony and dukedom of Brunſwick: E. long. 9° 45′, N. Lat. 51° 32′.

GOTTORP, a city of the dukedom of Sleſwic, in Denmark, and capital of the territories of the duke of Holſtein Gottorp: E. long. 10°, N. lat. 54° 40′.

GOUDE, a city of the United Netherlands, in the province of Holland, ten miles north-eaſt of Rotterdam.

GOVERNMENT, in general, is the polity of a ſtate, or an orderly power conſtituted for the public good.

Civil government was inſtituted for the preſervation and advancement of mens civil intereſts, and for the better ſecurity of their lives, liberties, and properties. The uſe and neceſſity of government is ſuch, that there never was an age or country without ſome ſort of civil authority: but as men are ſeldom unanimous in the means of attaining their ends, ſo their difference in opinion in relation to government, has produced a variety of forms of it. To enumerate them, would be to recapitulate the hiſtory of the whole earth. But they may, in general, be reduced to one of theſe heads: either the civil authority is delegated to one or more, or elſe it is ſtill reſerved to the whole body of the people; whence ariſes the known diſtinction of government into monarchy, ariſtocracy, and democracy.

Mr Hooker thinks, that the firſt government was arbitrary, and adminiſtered by a ſingle perſon; till it was found by experience, that to live by one man's will, was the cauſe of all mens miſery: and this, he concludes, was the original of inventing laws. The Roman and moſt of the Grecian ſtates were built up-

on

on the republican plan; but when the Goths, and other northern nations, destroyed the Roman empire, and extended their conquests into far distant countries, they established, where ever they came, a mixed form of government. The preservation of this constitution depending upon the balance between the king, nobility, and people, the legislative power was lodged in these three states, called by different names in different countries; in the north, diets; in Spain, cortes; in France, estates; and in Britain, parliaments. The excellency of this mixed government, consists in that due poise or balance between rule and subjection, so justly observed in it, that by the necessary concurrence of the nobility and commons, in making and repealing all laws, it has the main advantage of an aristocracy, and a democracy, and yet is free from the disadvantages and evils of either of them. This mixed form of government is, however, now driven almost out of Europe, in some parts of which we can hardly find the shadow of liberty left, and in many there is no more than the name of it remaining. France, Spain, Portugal, Denmark, and part of Germany, were all, an age or two ago, limited monarchies, governed by princes, well advised by parliaments or courts, and not by the absolute will of one man. But now all their valuable rights and liberties are swallowed up by the arbitrary power of their princes: whilst we in great Britain have still happily preserved this noble and ancient Gothic constitution, which all our neighbours once enjoyed. There is such a due balance of property, power, and dominion in our constitution, that, like the ancient government of Sparta, it may be called an empire of laws, and not of men; being the most excellent plan of limited monarchy in the world.

Governments are commonly divided into two classes, arbitrary and free governments; but there are many differed sorts of each. Thus the governments of France and Spain are generaly called arbitrary; tho' they differ as much from the governments of Turky and other eastern empires, where absolute dispoticism prevails, as they do from the government of England, and other European nations, where liberty is said to flourish in its fullest perfection.

Government is also a post or office which gives a person the power or right to govern or rule over a place, a city, or province, either supremely or by deputation.

Government is also used for the city, country, or place to which the power of governing is extended.

GOURD, in botany. See Cucurbita.

GOUT, in medicine. See Medicine.

GRABOW, or Grubow, a town of Lower Saxony and duchy of Mecklenburg: E. long. 11° 36′, N. lat. 53° 32′.

GRACE, among divines, is taken, 1st, For the free love and favour of God, which is the spring and source of all the benefits which we receive from him. 2dly, For the work of the spirit, renewing the soul after the image of God, and continually guiding and strengthening the believer to obey his will, to resist and mortify sin, and to overcome it.

Grace, in geography, a city of Provence, in France, fifteen miles south-west of Nice: E. long. 6° 50′, N. lat. 43° 40′.

Act of Grace, the appellation given to the act of parliament 1696, *c.* 32. which allows prisoners for civil debts to be set at liberty, upon making oath, that they have not wherewithal to support themselves in prison, unless they are alimented by the creditors upon whose diligences they were imprisoned, within ten days after intimation made for that purpose. See Scots Law, tit. 32.

Days of Grace, three days immediately following the term of payment of a bill, within which the creditor must protest it, if payment is not obtained, in order to intitle him to recourse against the drawer. See Scots Law, tit. 21.

Grace is also a title of dignity given to dukes, archbishops, and in Germany to barons and other inferior princes.

Graces, in heathen mythology, three goddesses, whose names were Aglia, Thalia, and Euphrosyne; that is, shining, flourishing, and gay; or, according to some authors, Pasithae, Euphrosyne, and Ægiale. Some make them the daughters of Jupiter, and Eurynome, or Eunomia, the daughter of Oceanus; but the most common opinion is, that they were the daughters of Bacchus and Venus.

They are sometimes represented dressed, but more frequently naked; to shew, perhaps, that whatever is truly graceful, is so in itself, without the aid of exterior ornaments. They presided over mutual kindness and acknowledgment; bestowed liberality, eloquence, and wisdom, together with a good grace, gaiety of disposition, and easiness of manners.

GRACULA, in ornithology, a genus belonging to the order of picæ. The bill is convex, cultrated, and bare at the point; the tongue is not cloven, but is fleshy and sharpish; it has three toes before, and one behind. There are eight species, principally distinguished by their colour.

GRACULUS, in ornithology. See Corvus.

GRADATION, in general, the ascending step by step, or in a regular and uniform manner.

GRADISKA, a city of Sclavonia, situated on the river Save, twenty-five miles west of Posega: E. long. 18°, N. lat. 45° 33′.

GRADUATE, a person who has taken a degree in the university. See Degree.

GRAFT, or Graff, in gardening, a cion or shoot of a tree inserted into another, so as to make it yield fruit of the same nature with that of the tree from whence the graft was taken. See Gardening.

GRAIES, a market-town of Essex, situated on the river Thames, seventeen miles east of London.

GRAIN, all sorts of corn, as wheat, barley, oats, rye, *&c.* See Corn, Wheat, *&c.*

GRAMMAR.

GRAMMAR.

GRAMMAR is *the art of ſpeaking or of writing any language with propriety.*

Grammar conſidered as an *Art*, neceſſarily ſuppoſes the previous exiſtence of language; and as its deſign is to teach any language to thoſe who are ignorant of it, it muſt be adapted to the genius of that particular language of which it treats.—A juſt method of grammar, therefore, ſuppoſing a language introduced by cuſtom, without attempting any alterations in it, furniſhes certain obſervations called rules, to which the methods of ſpeaking uſed in this language may be reduced; this collection of rules is what is called a grammar of any particular language. For the greater diſtinctneſs with regard to theſe rules, grammarians have uſually divided this ſubject into four diſtinct heads, *viz.* ORTHOGRAPHY, or *the art of combining letters into ſyllables, and ſyllables into words;* ETYMOLOGY, or *the art of deducing one word from another, and the various modifications by which the ſenſe of any one word can be diverſified;* SYNTAX, or what relates *to the conſtruction or due diſpoſition of the words of a language into ſentences or phraſes*; and PROSODY, or that which treats of *the quantities and accents of ſyllables, and the art of making verſes.*

But grammar conſidered as a *Science*, views language in itſelf: neglecting particular modifications, or the analogy which *words* may bear to *each other*, it examines the analogy and relation between *words* and *things*; diſtinguiſhes between thoſe particulars which are *eſſential* to language, and thoſe which are only *accidental*; and thus furniſhes a certain ſtandard by which different languages may be compared, and their ſeveral excellencies or defects pointed out. This is what is called PHILOSOPHIC or UNIVERSAL GRAMMAR.

OF UNIVERSAL GRAMMAR.

IT is not neceſſary here to inquire how language was originally invented, to trace the various changes it may have undergone, or to examine whether any one language may be conſidered as the original from which all others have been derived: it is ſufficient for our purpoſe to obſerve, that all mankind, however diverſified in other reſpects, agree in the common uſe of language; from which it appears, that language is not merely accidental and arbitrary, but founded in the nature of things, and within the reach of all mankind. It is therefore an object worthy of a philoſophic inquiry to diſcover the foundations upon which this univerſal fabric has been raiſed.

The deſign of ſpeech is to publiſh to others the thoughts and perceptions of our mind. The moſt acute feelings of man, as well as of every other animal, are expreſſed by ſimple inarticulate ſounds, which, as they tend to the preſervation of the individual, are univerſally underſtood. Theſe inarticulate but ſignificant ſounds, therefore, conſtitute a natural and univerſal language, which man, as a mere ſenſitive being, partakes in common with the other animals. But as man is not only endowed with ſenſation, but with the faculty of reaſoning, ſimple inarticulate ſounds are inſufficient for expreſſing all the various modifications of thought, or for communicating to others a chain of argumentation: it was therefore neceſſary to call in the aid of *articulation*; which by modifying theſe ſimple ſounds, and by fixing a particular meaning to theſe modifications, forms the language peculiar to man, and which diſtinguiſhes him from all other animals, and enables him to communicate with facility all that diverſity of ideas with which his mind is ſtored. Theſe ſounds, thus modified and having a determinate meaning, are called WORDS; and as all language is compoſed of ſignificant words variouſly combined, a knowledge of them is neceſſary previous to our acquiring an adequate idea of language.

But, as it is by words that we expreſs the various ideas which occur to the mind, it is neceſſary to examine how ideas themſelves are ſuggeſted, before we can aſcertain the various claſſes into which words may be diſtributed. With this view, therefore, let us ſuppoſe a reaſonable being, devoid of every prepoſſeſſion whatever, placed upon this globe. His attention would, in the firſt place, be directed to the various objects which he ſaw exiſting around him: theſe he would naturally endeavour to diſtinguiſh from one another, and give them names, by means of which the idea of them might be recalled when the objects themſelves were abſent. This is one copious ſource of words, and forms a natural claſs which muſt be common to every language; and which is diſtinguiſhed by the name of NOUNS. And as theſe nouns are the names of the ſeveral ſubſtances which exiſt, they have likewiſe been called SUBSTANTIVES.

It would likewiſe be early diſcovered, that every one of theſe ſubſtances were endowed with certain qualities or attributes, to expreſs which another claſs of words would be requiſite. Thus, *to be weighty*, is a quality of matter; *to think*, is an attribute of man. Therefore, in every language, words have been invented to expreſs the various qualities of the ſeveral objects which exiſt. Theſe may all be comprehended under the general denomination of ATTRIBUTIVES.

Theſe two claſſes of words muſt comprehend all things that exiſt; for whatever exiſts, muſt of neceſſity be either a ſubſtance, or the attribute of ſome ſubſtance; and hence theſe two claſſes muſt comprehend all thoſe words which are ſignificant of themſelves, and may be called WORDS SIGNIFICANT OF THEMSELVES. If any other words occur, they can only be ſignificant in ſo far as they tend to explain or connect the words of the two former claſſes.

But, although theſe words form the baſis or matter of a language, in the ſame manner as ſtones form the matter

E,

Subdivisions.

affection of nouns relating to the sex of the substance whose names they
ces either a male or a female, or something neither the one nor the other.
wing this idea, have divided the names of beings into three classes, call-
The Masculine gender; those which denote females, they have called
and those which denote neither one nor other, of the Neuter gender.
ect in nature single and alone, it is evident, that every noun ought to
e, whether it is one object, or which includes two, or many, or more than
nd, the nouns in every language have some method of expressing this;
called the SINGULAR number; if more, it is called the PLURAL number.
tion, called Cases, but this is only accidental, not essential.

ect to his own discussion. It appears under two different forms, be-
gularly, I has the plural WE, and ME, the plural US.
the second in all modern languages admits of two different forms;
THOU, having the plural YE, and THEE the plural YOU.
different from either the speaker or the person addressed, and as this subject
e HIM, for males; SHE, with its passive HER, for females; and IT,
he plural for all three when active, and THEM when passive.
s of this kind are the words ANY, SOME, WHICH, &c. When
equire the assistance of a noun as other articles do. The words, THIS,

relative of GENUS, species, or individual; as, the relative WHICH, the man
en we say, I WHO now write, you WHO now read, he WHO wrote, &c
ies, that it is not only a relative, but an article, &c.

e a difference in | 1st, ACTIVE, or those where the energizer leads
s speaker, as, I | the same, as, the MAN reads the BOOK.
| 2d, PASSIVE, where the object leads; as,
| The BOOK is READ.
ME WHEN THE | 3d, NEUTER, where the energizer is always of ne-
uk places which | cessity the passive subject; as, I walk.
as, I DO write. | 4th, RECIPROCAL, or VERBS MIDDLE, as the
| Greeks called them, where the energy returns
variations neces- | upon the energizer; as, Brutus killed himself.—
ct; as, I would | Of these different kinds of verbs, two distinctions
| only can be supposed necessary,—ACTIVE and NEU-
ers, and is used | TER;—because the passive is only a variation of
.—Verbs have | the first, as also the reciprocal.
wing kinds, viz.

e called adjectives WHICH EXPRESS THE SEVERAL QUANTITIES and
s which express them can in themselves admit of no variation whatever;

A GRAMMATICAL TABLE,

EXHIBITING

A Syſtematic View of WORDS naturally arranged into diſtinct CLASSES, with their ſeveral Subdiviſions.

All LANGUAGE is compoſed of WORDS; each of which may be thus defined, A SOUND SIGNIFICANT OF WHICH NO PART IS OF ITSELF SIGNIFICANT.---Theſe may be arranged into two general diviſions; which may be called

- **PRINCIPALS**, comprehending all ſuch words as ARE SIGNIFICANT OF THEMSELVES; which muſt be either
  - **SUBSTANTIVES**, which are all thoſe words that ARE EXPRESSIVE OF THOSE BEINGS WHICH EXIST OF THEMSELVES, AND NOT AS THE ENERGIES OF ANY THING ELSE. Theſe may be divided into two orders, *viz.*
    - **NOUNS**, properly ſo called, being the NAMES OF ALL THOSE BEINGS WHICH EXIST. Theſe may be divided into three kinds, each of which admit of the ſubdiviſions after-mentioned, *viz.*
      - NATURAL, or thoſe which are THE NAMES OF NATURAL SUBSTANCES; ſuch as
        - GENUS: ANIMAL, — SPECIES: MAN, — INDIVIDUAL: ALEXANDER, CYRUS, *&c.*
        - SPECIES: DOG, — INDIVIDUAL: CERBERUS, ARGUS, *&c.*
      - ARTIFICIAL. The ſeveral names of ARTIFICIAL OBJECTS; ſuch as
        - GENUS: EDIFICE, — SPECIES: HOUSE, — INDIVIDUAL: THE VATICAN, *&c.*
        - SPECIES: CHURCH, — INDIVIDUAL: ST PAUL's, THE ROTUNDO, *&c.*
      - ABSTRACT, or thoſe which are ABSTRACTED FROM QUALITIES; ſuch as
        - GENUS: MOTION, — SPECIES: FLIGHT, — INDIVIDUAL: THE FALCON's FLIGHT, *&c.*
        - SPECIES: COURSE, — INDIVIDUAL: THE COURSE OF A GREY-HOUND, *&c.*
      - Nouns of all kinds admit of the following ACCIDENTS, *viz.*
        - GENDER, which is a certain affection of nouns relating to the ſex of the ſubſtance whoſe names they are. For in nature every object is either a male or a female, or ſomething neither the one nor the other. Grammarians, therefore, following this idea, have divided the names of beings into three claſſes; calling thoſe that denote *males*, of the MASCULINE *gender;* thoſe which denote *females*, they have called of the FEMININE *gender;* and thoſe which denote neither one nor other, of the NEUTER *gender.*
        - NUMBER. As there is no object in nature ſingle and alone, it is evident, that every noun ought to have ſome variation to expreſs, whether it is one object of which mention is made, or more than one;---and accordingly we find, that nouns in every language have ſome method of expreſſing this.---If one is mentioned, it is called the SINGULAR *number;* if more, it is called the PLURAL *number.* Some languages have a variation, called CASES; but this is only accidental, not eſſential.
    - Or **PRONOUNS**, which are a ſpecies of words invented for SUPPLYING THE PLACE OF NOUNS IN CERTAIN CIRCUMSTANCES. They are of two kinds, *viz.*
      - PREPOSITIVE. So called becauſe they are capable of LEADING A SENTENCE. Theſe are divided into three orders, called the pronouns of the
        - FIRST PERSON; in Engliſh, I; ſo called, becauſe it is ſubſtituted in the name of the ſpeaker, who is always principal with reſpect to his own diſcourſe. It appears under two different forms, being I when the ſpeaker is the active cauſe of any effect, and ME when it is the paſſive ſubject.---Each of theſe admit of a plural; I has the plural WE, and ME the plural US.
        - SECOND PERSON,----THOU; ſo called, becauſe it is employed to denote the party addreſſed, who may be conſidered as the ſecond in diſcourſe. It likewiſe admits of two different forms; being THOU when it is the active cauſe, and THEE when it is the paſſive ſubject.---Each of theſe alſo admit of a plural; THOU having the plural YE, and THEE the plural YOU.
        - THIRD PERSON,----HE, SHE, IT: which words are employed to denote any object which may be the ſubject of the converſation, different from either the ſpeaker or party addreſſed: and as this ſubject may be either a *male*, or a *female*, or ſome object neither one nor other, it admits of a word for each; HE, with its paſſive HIM, for *males;* SHE, with its paſſive HER, for *females;* and IT, which admits of no paſſive, for *neuters:*---all of theſe, like the other pronouns-perſonal, admit of plurals;---THEY being the plural for all three when active, and THEM when paſſive.
        - IMPROPER; ſo called, becauſe although they are ſometimes employed as pronouns, yet at other times they appear as ARTICLES; of this kinds are the words ALL, ANY, SOME, THIS, *&c.* When theſe are employed as pronouns, they aſſume the power, and ſupply the place of a noun; when they are articles, they require the aſſiſtance of a noun as other articles do. The words, THY, MY, MINE, THINE, *&c.* have been improperly conſidered as pronouns, as they never are ſuch.
      - Or SUBJUNCTIVE. So called, becauſe it cannot lead a ſentence, but ſerves to SUBJOIN SOME OTHER WHICH WAS PREVIOUS. Of this kind are,
        - WHICH, WHO, and THAT. This ſubjunctive-pronoun may be ſubſtituted in the place of every noun whatever, whether expreſſive of *genus, ſpecies*, or *individual;* as, the *animal* WHICH, the *man* WHO, *Alexander* THAT, *&c.* Nay, this may even become the ſubſtitute of the *prepoſitive-pronouns themſelves;* as, when we ſay, *I* WHO *now write, you* WHO *now read, he* WHO *wrote, ſhe* WHO *ſpoke, &c.* Hence, therefore, this ſubjunctive is a real pronoun from ſubſtitution; and it has this peculiarity beſides, that it is not only a *ſubſtitute*, but withal a *connective.*
  - Or **ATTRIBUTIVES**, which are thoſe words which ARE EXPRESSIVE OF THOSE THINGS WHICH EXIST AS THE ATTRIBUTES OF SOMETHING ELSE. Theſe may be divided into two diſtinct claſſes, *viz.*
    - **ATTRIBUTIVES of the FIRST ORDER**, which comprehends all thoſe words that are expreſſive of the ATTRIBUTES OF SUBSTANCES. And as all attributes are either MUTABLE, as in the objects of ſenſation, or IMMUTABLE, as in the objects of intellection and ſcience; therefore theſe are divided into
      - VERBS, or thoſe words expreſſive of any attribute WHOSE ESSENCE CONSISTS IN MOTION OR ITS PRIVATION. Every attribute of this kind may be repreſented as exiſting in three different ſtates, to which grammarians have given theſe names;
        - 1. INFINITIVE MODE; in which the attribute is exhibited in a manner perfectly indefinite, MERELY AS AN ATTRIBUTE WHICH MAY BE JOINED WITH A SUBSTANTIVE; as in the words *to walk, to write*, &c.
        - 2. PARTICIPLE ACTIVE or PRESENT; in which the attribute is repreſented as actually in a STATE OF EXERTION; as in the word *writing.*
        - 3. PARTICIPLE PERFECT, or PAST; in which the attribute is repreſented as HAVING FINISHED ITS EXERTION; as in the word *written.*
        - But although verbs do not in ſtrictneſs admit of any other variations, except theſe three above mentioned; yet, as the connection is ſo intimate between the attribute and its energizer, and the ſpeaker, who unites theſe together, the contrivers of ſome languages have conſidered them as the ſame, and have invented certain variations to expreſs theſe different relations. The names and meaning of which are as follows,
          - MODES are thoſe variations which denote a difference in the PERCEPTION OR VOLITION of the ſpeaker; as, *I write, I* CAN *write, do* THOU *write.*
          - TENSES are thoſe variations to the TIME WHEN THE ACTION EXHIBITED BY THE VERB took place; which muſt be either paſt, preſent, or future; as, *I* DO *write, I* DID *write, I* SHALL *write, &c.*
          - PERSON, as the name implies, are the variations occaſioned by a difference of the energizer; as, I *wrote*, HE *wrote*, SHE *wrote, &c.*
          - NUMBER relates to the number of energizers, and is either ſingular or plural; as, I *write*, WE *write*, &c.---Verbs have likewiſe been diſtinguiſhed into the following kinds, *viz.*
            - 1ſt, ACTIVE, or thoſe where the energizer leads the ſentence; as when we ſay, *Cato loved.*
            - 2d, PASSIVE, where the paſſive object leads; as, *Portia is loved.*
            - 3d, NEUTER, where the energizer is always of neceſſity the paſſive ſubject; as, *Cæſar walketh.*
            - 4th, RECIPROCAL, or VERBS MIDDLE, as the Greeks called them, where the energy returns upon the energizer; as, *Brutus killed himſelf.*----Of theſe different kinds of verbs, two diſtinctions only can be ſuppoſed neceſſary,---ACTIVE and NEUTER;----becauſe the paſſive is only a variation of theſe, as alſo the reciprocal.
      - And ADJECTIVES, or thoſe words which denote any attribute WHOSE ESSENCE DOES NOT CONSIST IN MOTION OR ITS PRIVATION. Or, in other words, all thoſe words are called adjectives WHICH EXPRESS THE SEVERAL QUANTITIES and QUALITIES OF ALL THINGS; ſuch as *good* and *bad, black* and *white, large* and *ſmall*, &c.----As theſe attributes are in their own nature quite invariable, ſo the words which expreſs them can in ſtrictneſs admit of no variation whatever; ſo that where-ever we meet with variations of this ſort, we ought to conſider then as accidents, not as eſſential to language.
    - **ATTRIBUTIVES of the SECOND ORDER**, or thoſe words which denote the ATTRIBUTES OF ATTRIBUTES. Theſe are commonly called
      - ADVERBS, which may be divided into two kinds, *viz.*
        - I. Thoſe that are common to ALL ATTRIBUTIVES OF THE FIRST ORDER; and may be divided into adverbs
          - Of INTENSION and REMISSION, or of QUALITIES CONTINUOUS; as in the words MODERATELY, VASTLY, EXCEEDINGLY, *&c.* Theſe admit of the different degrees of compariſon.
          - Of QUANTITY DISCRETE; as, ONCE, TWICE, THRICE, *&c.*
          - Of RELATION; as, MORE, MOST, LESS, LEAST, EQUALLY, PROPORTIONALLY, *&c.*
          - Of QUALITY; as, HONESTLY, PRUDENTLY, WISELY, BRAVELY, *&c.*
        - II. Thoſe confined to VERBS, properly ſo called; and are of the following kinds, *viz.*
          - Of TIME; as, THEN, AFTERWARD, FORMERLY, JUST NOW, TO-DAY, TO-MORROW, *&c.*
          - Of PLACE; as, THERE, FAR, HENCE, *&c.* as alſo adverbs derived from prepoſitions; as, UPWARD, DOWNWARD, *&c.*
          - Of INTENSIONS and REMISSIONS PECULIAR to MOTION; as, SPEEDILY, HASTILY, SLOWLY, *&c.*
          - Of INTERROGATION or RELATION; as, WHEN, WHERE, WHENCE, WHITHER, *&c.*
- **ACCESSORIES**, comprehending all thoſe words which ONLY BECOME SIGNIFICANT BY RELATION TO OTHERS. Theſe are divided into
  - **DEFINITIVES**, which are all thoſe words which ſerve to DEFINE AND ASCERTAIN ANY PARTICULAR OBJECT, SO AS TO SEPARATE IT FROM OTHERS OF THE SAME CLASS, AND THUS DENOTE ITS INDIVIDUALITY. Theſe are commonly called
    - ARTICLES, which may be divided into two kinds, *viz.*
      - PROPER, or thoſe words which ALWAYS APPEAR AS ARTICLES ON ALL OCCASIONS. Theſe are, in Engliſh,
        - A, or AN, And THE — Theſe are both of them employed to DEFINE and ASCERTAIN INDIVIDUALS belonging to the ſeveral GENERA or SPECIES of ſubſtances. Thus, *houſe* is a term totally indefinite; A *houſe* denotes a particular houſe, ſeparated from others with which we may be totally unacquainted; THE *houſe*, denotes that it is now recollected as an object formerly known.
      - Or IMPROPER, or thoſe words which only SOMETIMES APPEAR AS ARTICLES. Theſe are either
        - PRONOMIAL, or thoſe pronouns which ſometimes ſtand as *definitives*, and ſometimes as *ſubſtitutes.* Of this kind may be reckoned THIS, ANY, ALL, SOME, and many others. Theſe, when they are employed as *articles*, never ſtand by themſelves, but require the aſſiſtance of a noun, which they define; whereas when they are pronouns, they muſt of neceſſity appear by themſelves, and ſupply the place of a noun. In this caſe likewiſe may be ranked theſe words which are commonly called *pronouns-poſſeſſive;* as, HIS, HERS, MY, MINE, THINE, *&c.* which, as they always ſerve to define a particular object, are more properly *definitives*, than either *pronouns* or *adjectives.*
        - Or, NOMIAL; ſo we could call thoſe nouns, which, laying aſide their nature as *nouns*, aſſume the character and office of *articles*, like them requiring the aſſiſtance of another noun which they ſerve to *define* and *aſcertain.* Of this kind may be reckoned all nouns in that ſtate which is commonly called the *genitive caſe* in the Engliſh language; as, ALEXANDER's, POMPEY's, *&c.* for theſe only ſerve to aſcertain the individuality of the noun with which they are aſſociated.
  - And **CONNECTIVES**, or thoſe words which are employed to CONNECT OTHER WORDS, AND OUT OF SEVERAL DISTINCT PARTS TO MAKE ONE COMPLETE WHOLE. Theſe may be divided into two kinds, *viz.*
    - CONJUNCTIONS; by which name are diſtinguiſhed all thoſe connectives whoſe office it is to CONJOIN SENTENCES. Theſe are divided into two kinds, *viz.*
      - CONJUNCTIVE, properly ſo called; or thoſe words which CONJOIN SENTENCES, AND THEIR MEANING ALSO. Theſe are either
        - COPULATIVE. The principal of which is the word AND.----As this only *couples* ſentences, it is applicable to all ſuch ſubjects whoſe natures are *not incompatible*, or where the coincidence may be only *accidental*, not *eſſential.* As in the ſentence, "*Leucippus* was a ſtatuary, AND *Priſcian* a grammarian;" here the coincidence is only accidental.
        - Or CONTINUATIVE, which conſolidate ſentences more intimately; and therefore are only applicable where the coincidence is *eſſential;* as, when we ſay, "The ſun ſhines BECAUSE the ſky is clear." Theſe may be divided into two kinds, *viz.*
          - SUPPOSITIVE, as in the word IF, which denotes *connection;* but does not ſuppoſe *actual exiſtence;* as in this example, "You will live happily, IF you live honeſtly."
          - POSITIVE, which not only denote connection, but alſo implies actual exiſtence. They are either
            - CASUAL, or thoſe which ſubjoin *effects* to *cauſes;* as the words BECAUSE, SINCE, *&c.* as in this example, "You live happily, BECAUSE you live honeſtly."
            - COLLECTIVE, or thoſe employed in demonſtrations and ſcience, properly ſo called, where the *cauſe* being firſt known, by its effects we diſcover the *conſequences;* as the words THEREFORE, THEN, *&c.* as in this example, "The moon intervenes, THEREFORE the ſun is in eclipſe."
      - And DISJUNCTIVE, or thoſe words which at the ſame time that they CONJOIN SENTENCES, DISJOIN THEIR MEANINGS. They are either
        - SIMPLE, or thoſe which do no more than merely disjoin; as, "EITHER it is day, OR it is night;" the alternative being left indefinite.
        - Or ADVERSATIVE, or thoſe which at the ſame time that they disjoin, *oppoſe* and *define.* Theſe are either,
          - ABSOLUTE; as the word BUT; as in this example, "*Brutus* was a patriot, BUT *Cæſar* was not."
          - COMPARATIVE; as in the words AS and THAN, *&c.* Theſe not only mark oppoſition, but that equality or exceſs which ariſes among ſubjects when compared; as for example, "*Virgil* was AS great a poet AS *Cicero* was an orator."
          - ADEQUATE, where the cauſe is ſuppoſed adequate to the effect. The principal of theſe is the word UNLESS; as in this example, "*Troy* will be taken, UNLESS the *palladium* be preserved." This ſuppoſes that the preſerving the palladium would be ſufficient to prevent it.
          - INADEQUATE, where the cauſe is ſuppoſed not to be ſufficient to produce the effect; as the word ALTHOUGH, in this example, "*Troy* will be taken ALTHOUGH *Hector* defend it." Here the efforts of Hector are ſuppoſed to be inefficacious.
    - And PREPOSITIONS, or thoſe auxiliary words, whoſe office it is to CONJOIN WORDS WHICH OF THEMSELVES REFUSE TO COALESCE. All of them denote ultimately ſome relation of PLACE; and are either
      - PROPER, or thoſe which literally denote different relations of PLACE, either
        - CONTIGUOUS; as when we ſay, "*Caius* walked WITH a *ſtaff;* the *ſtatue* ſtood UPON a *pedeſtal*," *&c.*
        - DETACHED; as when we ſay, "*he* is going TO *Italy;* the *ſun* is riſen ABOVE the *hills*," &c.
        - Of MOTION; as in this example, "to ſupport *uneaſy ſteps* OVER the *burning marle.*" Or
        - Of REST; as in this example, "*he*, with looks of cordial love, hung OVER *her* enamoured."
        - In theſe inſtances it is obvious, that when theſe prepoſitions denote *motion* or *reſt*, they vary their character with the verb to which they are joined.
      - Or METAPHORICAL. For, as thoſe who are above another in *place* have generally the advantage over them, theſe prepoſitions have been employed to denote that *ſuperiority* or *inferiority.* Thus, we ſay of a king, "*he* ruled OVER his *people;*" of a ſoldier, "*he* ſerved UNDER ſuch a *general*," &c.

INTERJECTIONS are a ſpecies of words which are not included under any of theſe claſſes above-mentioned; and indeed theſe can hardly be conſidered as a part of artificial language, and they may be rather called a part of that natural language with which man is endowed in common with other animals, by which we expreſs thoſe paſſions and natural emotions which ſpontaneouſly ariſe in the human ſoul upon the view of intereſting events.-----Theſe therefore do not, like other words, depend upon compact for their meaning, but are expreſſions of nature, and therefore univerſally underſtood;----the form which they aſſume by articulation being no part of their eſſence,----the tone with which they are uttered conſtituting their whole eſſence.----Of this kind are the words, *Ha! Alas! Fie!* &c.

of a building; yet, as stones cannot be arranged into a regular structure without a cement to bind and connect them, so these original words stand in need of others to connect them, before they can be made to express all the variety of our ideas. Another order of words, therefore, were necessary, which, although not of themselves significant, yet, when joined with others, might acquire a meaning. These form a second general class of words that may be called WORDS NOT OF THEMSELVES SIGNIFICANT, and which cannot acquire any meaning but so far as they serve either to EXPLAIN or CONNECT the others.

Hence, therefore, all words which can possibly be invented, may be divided into two general classes; those that are SIGNIFICANT OF THEMSELVES, and those that are NOT. Words which are significant of themselves, are either expressive of the names of substances, and therefore called SUBSTANTIVES; or, of qualities, which we call ATTRIBUTIVES. Words which are not significant of themselves, must acquire a meaning either as defining or connecting others, which we shall arrange under the two classes of DEFINITIVES and CONNECTIVES, each of which shall be examined in their order.

CHAPTER I.

Of SUBSTANTIVES.

SUBSTANTIVES may be divided into two classes, *viz.* those which are primary, commonly called NOUNS; and those of a secondary order, which are often substituted for nouns, and are hence called PRONOUNS: each of which we shall consider separately.

Section I. *Of* Substantives *of the First Order, called* NOUNS.

NOUNS are *all those words by which objects or substances are denominated, and which distinguish them from one another, by names applicable to each, without marking either quantity, quality, action, or relation.* And as all the objects which exist must be either in the same state that they were produced by *nature*, or changed from their original state by *art*, or *abstracted* from substances by the powers of imagination, this naturally suggests a division of nouns into NATURAL, as *man, vegetable, tree*, &c.; ARTIFICIAL, as *house, ship, watch*, &c.; or ABSTRACT, as *whiteness, temperance*, &c.

But the diversity of objects being so great as to render it impossible for any person to know the distinct names of every individual, therefore it has been found expedient to arrange them under certain general classes, the names of which may be more easily acquired, so that by referring any unknown object to the class to which it belongs, we in some measure supply the want of proper names. Hence, therefore, each of the above species of nouns are divided into those which denote genera, species, and individuals. Thus, in natural substances, *animal, vegetable*, and *fossile*, denote genera; *man, dog, tree, metal*, are species; and *Alexander, Cæsar, oak, gold*, are individuals. In artificial substances, *edifice* is a genus; *house, tower, church*, are species; and the *Vatican, Tron-church*, and *Herriot's hospital*, are individuals. In *abstract* substances, *motion* is a genus; *flight* and *course*, are species; the *flight of Mahomet*, the *course of a greyhound*, are individuals. Each of these general classes might be subdivided into many smaller; but as these lesser divisions can only relate to the particular genius of different languages, it does not fall within our plan to consider them. We therefore proceed to take notice of the accidents which accompany nouns. Of which kind may be reckoned *number* and *gender*.

As nouns are the names of substances, and as there may be many substances of the same kind, therefore nouns must be adapted to express whether there is one or more of those objects of which we speak. Nouns, therefore, in every language, admit of a certain variation to denote this circumstance, which is called *number*. Thus, in the English language, when we speak of a single place of habitation, we call it *a house*; but if of more, we call them *houses*. In the first of these cases the noun is said to be in the *singular*, and in the last case, the *plural* number: nor does the English, or any other language except the Greek, admit of any other variation but these two: and although the Greek language admits of a particular variation of the noun called the *dual* number, which is a plural limited to two objects; yet this cannot be considered as to language; and it is perhaps doubtful whether this variation ought to be considered as an elegance or a defect in that language.

But although number be a natural accident of nouns, it can only be considered as essential to those which denote genera or species, as it does not descend to individuals. Thus we say, *animal*, or *animals, vegetables*, and *fossils*; as also, *man*, or *men, dogs, trees*, &c. But we only say, *Xenophon, Cesar, Bucephalus*, &c. in the singular. Nor do these admit of a plural, excepting when we consider any proper name, as a general appellative under which many others are arranged, when it is no longer the name of an individual, but that of a species, and as such admits of a plural; as the *Alexanders*, the *Ptolemies*, the *Howards*, the *Pelhams*, the *Montagues*, &c. The reason of all which will be obvious, if we consider, that every genus may be found whole and entire in each of its *species*; for *man, horse*, and *dog*, are each of them an entire and complete *animal:* and every species may be found whole and entire in each of its individuals; for *Socrates, Plato*, and *Xenophon*, are each of them compleatly and entirely a *man*. Hence it is, that every *genus*, though ONE, is multiplied into MANY; and every *species*, though ONE, is also multiplied into MANY, *by reference to those beings which are their subordinates*. But as *no individual has any such subordinates*, it can never in strictness be considered as MANY, and so is truly an INDIVIDUAL as well in *nature* as in *name*, and therefore cannot admit of number.

Besides number, another accident of nouns is *gender*, the nature of which may be thus explained: As nouns are the names of the various objects in nature; and as the distinctions of sex is perceptible among all those objects which are animated; and as those which are inanimate cannot

cannot admit of any ſex at all; therefore all the beings which can become the objects of our ſpeculation, may be conſidered as either *males*, or *females*, or ſuch as admit of *no* ſex, and therefore may be ſaid to be neuter, or of *neither* ſex. Hence, therefore, grammarians have made a threefold diſtinction of nouns, into *maſculine genders*, or thoſe which denote *males*; *feminine*, or thoſe which denote *females*; and *neuters*, which denote thoſe ſubſtances that admit of no ſex. But, although the origin of genders is thus ſo clear and obvious; yet every language that we know of, except the Engliſh, deviates from the order of nature, and often attributes ſex to thoſe ſubſtances which are totally incapable of any; nay, ſome languages are ſo particularly defective in this reſpect, as to claſs every object inanimate as well as animate under either the *maſculine* or *feminine genders*, as they admit of no gender for thoſe that are of neither ſex. This is the caſe with the French, Italian, and Spaniſh. But the Engliſh, ſtrictly following the order of nature, puts every noun which denotes a male animal, and no others, in the *maſculine* gender; every name of a female animal, in the *feminine*; and every animal whoſe ſex is not obvious, or known, as well as every inanimate object whatever, in the *neuter* gender. Nor does this rule admit of any exceptions; although poets take the liberty of perſonifying any objects they think proper, and endow them with whatever ſex ſuits their purpoſe beſt; which ſerves admirably to diſtinguiſh between the cool language of philoſophy, and the enthuſiaſm of poetry.

Although *Caſes* are not neceſſary accidents of nouns; yet as they have been often conſidered as ſuch, it will perhaps be deemed proper to take ſome notice of them. —As natural objects remain the ſame, although viewed from many different points of view, they are not in their own nature altered, although they may be connected with others in many different ways: their names therefore ought to remain unchanged, although their relations to other words may be varied. However, there are certain circumſtances in which nouns may be conſidered with reſpect to their relation *to*, and connection *with* other words, which occur more frequently than others. Some languages, (particularly the Greek and Latin) expreſs *ſome* of theſe circumſtances, by a variation of the original noun, which variations are called CASES. But the Engliſh, and almoſt all the modern languages of Europe, have followed the order of nature, and allow the noun to remain the ſame, expreſſing its relation and connection with other words by the help of diſtinct words called prepoſitions.—Which of theſe methods is beſt, it is not our preſent purpoſe to inquire. See LANGUAGE.

It has been ſuppoſed the Engliſh nouns admit of one variation which anſwers to the genitive caſe of the Latins.—Thus the word *Alexander* is an Engliſh noun in its proper form, and in that caſe which in Latin would be called the *Nominative*. The variation which they called the *Genitive* Caſe, is expreſſed in Engliſh by adding the prepoſition OF before the noun; thus, OF *Alexander*. But the ſame meaning may be conveyed by the word *Alexander's*; for the meaning is the ſame if I ſay the houſe *of Alexander*, or *Alexander's* houſe. This, therefore, has been called a true inflection of the original noun. However, although this opinion has been adopted by all grammarians, it appears to have been adopted without ſufficient examination, as will be evident from the following conſiderations.

There are certain circumſtances in which this ſuppoſed genitive cannot be ſuſtituted inſtead of the other: for I may ſay, I ſpeak OF *Alexander*, I write OF *Cæſar*, I think OF *Pompey*; but I cannot ſay, I ſpeak *Alexander's*, I write *Cæſar's*, or I think *Pompey's*. Hence theſe two are not in all caſes ſynonymous terms; and therefore one of them muſt be conſidered as only accidentally coinciding with the other in particular circumſtances.

Again, every one of theſe ſuppoſed genitives can with propriety aſſume all the various ſigns of the different *caſes* in the Engliſh language: for we may ſay ſimply, as in the nominative caſe, *Alexander's* houſe; but we can alſo ſay, OF *Alexander's houſe*, TO, WITH, FROM, IN, BY, or FOR *Alexander's houſe*, &c. If this then be a real genitive, it requires the ſign of the genitive, as well as of the other caſes, to explain it; which would be an abſurdity too great to be admitted.—But it may be aſked, if theſe are not genitives, to what claſs of words can they be referred?

In anſwer to this, it has been already obſerved, that the variety of ſubſtances is ſo great, that it is impoſſible for any perſon to know the names of every one of them; and therefore they have been arranged under the ſeveral orders of genera and ſpecies. We now further obſerve, that as the individuals are ſo exceedingly numerous, it would be impoſſible even to invent proper names for each, and far leſs would it be poſſible to make theſe names be known to every perſon who might accidentally ſee them: therefore when we want to aſcertain any individual object, and diſtinguiſh it from all the other individuals of the ſame ſpecies, we are obliged to have recourſe to particular epithets, or definitives, to aſcertain that individual.—Thus, I ſee a particular houſe which I want to diſtinguiſh from other houſes; this has no particular name of its own; I muſt therefore aſcertain it in the beſt manner I can; and as the ſhorteſt is always the beſt, we moſt naturally denominate it from its owner or poſſeſſor if we know him, and therefore call it *Alexander's*, *James's*, or *John's* houſe.—Here then we ſee, that the words *Alexander's*, *James's*, and *John's*, do not ſtand as nouns, but as *articles* or *definitives* ſerving to aſcertain and point out the individuality of the noun with which they are joined, and are much nearer allied to adjectives than to ſubſtantives. Theſe, therefore, like other articles, do not alter the caſe of the noun; ſo that the term *Alexander's houſe*, is as much the proper name of a particular houſe, as *Alexander* or *James* are the proper names of particular men, and of conſequence may be varied thro' the different caſes as well as the other.—It is ſurpriſing, that this idea never occurred to grammarians; for *St Peter's* at Rome, and *St Paul's* at London, are as truly the proper names of theſe two noble edifices, as the *Rotundo* or the *Circus* are the proper names of two other ſtructures.—We may therefore ſafely conclude, that the Engliſh language admits of no caſes at all, and that the only eſſential accidents of nouns are gender and number.

Section II. *Of* Subftantives *of the Second Order, called* Pronouns.

All converfation paffes between individuals. When thefe individuals are unknown to each other, how fhall the one fpeaker addrefs the other, when he knows not his name; or how explain himfelf by his own name, of which the other is wholly ignorant? This might perhaps have been at firft effected by pointing; but as this method behoved to be extremely inconvenient and defective, it was neceffary that a particular clafs of words fhould be invented for this purpofe; and as thefe words always fupply the place of a noun, they have been called PRONOUNS;—the nature of which may be explained as follows.

Suppofe the parties converfing to be wholly unacquainted, and the fubject of the converfation to be the fpeaker himfelf: here, to fupply the place of pointing, the inventors of language have furnifhed the fpeaker with the pronoun *I*; *I write*, *I defire*; and as the fpeaker is always principal with refpect to his own difcourfe, they have therefore called this the *pronoun* of the FIRST perfon.

Again, fuppofe the fubject of the converfation to be the party addreffed: here, for fimilar reafons, they invented the pronoun THOU, THOU *writeft*, THOU *walkeft*; and as the party addreffed is next in dignity to the fpeaker, or at leaft comes next with reference to the difcourfe, they therefore called this the *pronoun* of the SECOND perfon.

But as the fubject of the converfation may be fome third object different from either the fpeaker or the party addreffed, another pronoun was neceffary; and as this object might be either a *male* or a *female*, or a *neuter*, it was neceffary to have one pronoun for each of the genders, HE for the *mafculine*, SHE for the *feminine*, and IT for the neuter: and this, in diftinction to the former, was called the *pronoun* of the THIRD perfon.—Hence the diftribution of pronouns into *perfons*.

We have already feen that nouns admit of number; pronouns, which are their fubftitutes, likewife admit of number. There may be many fpeakers of the fame fentiment, as well as one who including himfelf fpeaks the fame fentiment with MANY; fpeech may likewife be addreffed to MANY at a time as well as to ONE; and the fubject of the difcourfe may likewife be MANY; therefore the pronoun of every one of the *perfons* muft admit of number, to exprefs this fingularity or plurality. Hence, therefore, the pronoun of the firft perfon *I*, has the plural WE; that of the fecond perfon THOU, has the plural YOU; and that of the third perfon HE, SHE, or IT, has the plural THEY, which is equally applied to all the three genders.

With regard to gender, we do not find in any language that the pronouns of the *Firft* or *Second* perfons admit of any diftinction in this refpect: nor was it neceffary that they fhould; as the fpeaker and party addreffed are ufually prefent with one another, this diftinction is generally obvious from drefs and external appearance. But this is not the cafe with regard to the pronoun of the *Third* perfon; of whofe character and diftinctions we often know no more than what we learn from the difcourfe itfelf; and hence it is, that in almoft all languages the pronoun of the third perfon admits of genders, as we have already feen the Englifh admits of the triple diftinction of mafculine, feminine, and neuter.—The utility of which threefold diftinction will be beft fhewn by an example. Suppofing there was no fuch diftinction, and that we fhould read in any hiftory HE caufed HIM to deftroy HIM, and were told that the pronoun which is here thrice repeated ftood each time for fomething different; that is to fay, for a man, for a woman, and for a city, whofe names were Alexander, Thais, and Perfepolis. Taking the pronoun thus divefted of its genders, it does not appear which of the three was deftroyed, which the deftroyer, or which the caufe that moved to the deftruction. But there is no ambiguity when we hear the genders diftinguifhed; and when, inftead of the ambiguous fentence, *he* caufed *him* to deftroy *him*, we are told with the proper diftinctions that SHE caufed HIM to deftroy IT. Then we know with certainty, that the promoter was the *woman*, that her inftrument was the *hero*, and that the fubject of her cruelty was the unfortunate *city*.—From this example we would be furprifed how the *Italian*, *French* and *Spanifh* could exprefs themfelves with precifion or elegance, with no more than two variations of this perfon.

From the fame caufes as a diftinction of gender is unneceffary in the pronouns of the firft and fecond perfons, we fee the reafon why a fingle pronoun to each perfon, an *I* for the firft, and a THOU for the fecond, are fufficient for all the purpofes of language, as thefe are always fuppofed prefent and obvious. But it is not fo with refpect to the third perfon, as the various relations of different objects made it neceffary to have not *one*, but *many*; fuch as, HE, SHE, IT, THIS, THAT, OTHER, SOME, ALL, ANY, *&c.*

Although we have faid that there is only one pronoun for each of the firft and fecond perfons, yet the Englifh reader may perhaps be puzzled with finding two diftinct words applied to each; I and ME, for the firft perfon; THOU and THEE, for the fecond. The learned reader will at once fee that thefe two words ME and THEE are equivalent to the *accufative* cafe of the Latin pronoun: but, in order to make the meaning of this as plain as poffible without embarraffing ourfelves about unneceffary terms, we fhall only obferve, no effect can be produced without a caufe, and no action can be performed without producing fome effect. The fame perfon may in different circumftances be either the active and efficient caufe *of*, or the paffive fubject who fuffers *by* an action: fome languages have therefore formed different words to exprefs the fame object in thefe different circumftances. Thus in the Latin fentences, *Brutus amavit Caffium*, Brutus loved Caffius; and *Caffius amavit Brutum*, Caffius loved Brutus; the word *Brutus* in the firft, and *Caffius* in the fecond, is the form which the noun affumes when it is ufed as the efficient caufe; and *Brutum* and *Caffium* the forms which the fame nouns affume when they are reprefented as the paffive fubjects. This laft then was what was called the *accufative* cafe of the noun, and the firft was called the *nominative*. We have already feen that the Englifh noun admits of no cafes, the active fubject always preceding the verb, and the paffive following it, as is plain from the above fentences, where *Brutus* and *Caffius* remain changed in both fituations; and the fame might be obferved of all other modern languages: yet

yet the English and all modern languages admit of a different word to exprefs the different ftate of the pronouns. Thus, we fay, I *efteem* THEE, I *admire* HIM, I *love* HER: in all of which fentences *I*, the pronoun of the firft perfon, is the *active*, and THEE of the fecond perfon, and HE and HER of the third, are the *paffive* fubjects, and are therefore expreffed by the words THEE, HIM, and HER. But if the cafe be reverfed, and the pronoun of the firft perfon becomes the paffive fubject, and the others the active, they affume a different form; thus, THOU *efteemeft*, HE *admires*, SHE *loves*—ME. Hence, therefore, it appears that we have two diftinct words for each of thefe pronouns to exprefs the different ftates in which they may be reprefented, exactly analogous to the nominative and accufative cafes of the Romans—Whether thefe are to be admitted as cafes of our pronouns, or whether they may not rather be confidered as diftinct words formed for that particular purpofe, is of little confequence for us to enquire; as, in whatever light they may be confidered, this variation cannot be looked upon as an effential part of language, but only as a particular refinement, invented to prevent the difagreeable repetition of the pronoun, which behoved frequently to have happened without this contrivance. This feems to be the only reafon why pronouns have been endowed with this variety, and not nouns. For as nouns are in themfelves greatly diverfified, the famenefs of founds does not here fo often occur as it would have done in the pronouns, where the fame I, THOU, HE, SHE, or IT, anfwers for the name of every object which occurs in nature; but, by this diverfity in the form of the words, this circumftance is in fome meafure obviated. And it is probably for the fame reafon, that the plural of each of thefe pronouns is fo very different from the fingular. Thus, from I of the firft perfon is formed WE in the plural, and from ME the plural US; from THOU and THEE the plurals YE and YOU; from HE, SHE,—HIM, HER, and IT, the plurals THEY, and THEM. In all of which there is not the leaft refemblance between the fingular and plural of any one word; and, except in HE and HIM, THEY and THEM, there is not any fimilarity between what may by fome be thought to be the different *cafes* of the fame word.

We have feen that the fame object may fometimes be the caufe of an action, and fometimes the object which fuffers by it. We now obferve, that the fame object may fometimes be, with regard to the fame action, both the active caufe and paffive fubject; as when we fay, *Brutus killed himfelf*. In which cafe it is evident, that Brutus was both the caufe that produced, and the object that fuffered by the action; the pronoun himfelf being put for his name; for, were it not for the famenefs of the found, and the ambiguity which would be occafioned by it, we might furely fay *Brutus killed Brutus*. It was therefore neceffary to have a particular pronoun for the paffive fubject, in all thofe cafes where the fame object was the agent; and on this account the word SELF has been invented, having the plural SELVES. This pronoun therefore, which ferves on all occafions to reprefent the action as returning upon the agent that produced it, may be called the reciprocal pronoun; which has this peculiarity, that it can never ftand by itfelf, but muft alway have the affiftance of the pronoun in whofe place it is fubftituted; as, MYSELF, THYSELF, HIMSELF, HERSELF, ITSELF, with their plurals. But although this feems to have been the original ufe of this pronoun; yet, in the Englifh language, its ufe has been extended further; and, from its always having a reference to the agent of any action, it has been employed to denote that agent by way of emphafis, as performing the action without the aid or affiftance of any other; as, *he himfelf went*. And from this circumftance it has been further extended to denote any object as performing or fuffering any thing which we would not naturally have expected from its known character or nature; as in this fentence: "The moft daring of mankind are fometimes ftartled before they venture upon the commiffion of any extraordinary crime; even Cæfar HIMSELF felt the utmoft perturbation of mind before he dared to pafs the Rubicon."

Thefe are all that can be properly called *perfonal pronouns*; but there are others which are derived from them, called *poffeffive pronouns*, as, MY, THY, MINE, HIS, HERS, ITS, *&c.* the nature of which it will be neceffary here to explain. We have already fhewn how nouns, when they came to denote poffeffion, were no longer to be confidered as nouns, but rather as definitives or articles; fo the pronouns which we here confider, being the real fubftitutes of *nominal* articles, ought alfo to be confidered as a diftinct clafs of pronomial articles: for as thefe never, in any cafe, can be fubftituted for a noun, they cannot be confidered as pronouns. Grammarians have been led into the miftake of placing them under this head, becaufe they are the fubftitutes of thefe words, which, altho' they affume the appearance of nouns, only perform the part of definitives. Thus we have feen, that when we fay, *Alexander's houfe*; the word *Alexander's* can only be confidered as a definitive: and, in the fame manner, if Alexander was the fpeaker, he might fay, MY *houfe*; if the party addreffed, it would be THY *houfe*; or if any third perfon, HIS, and in the fame manner HERS or ITS *houfe*. In all which cafes this poffeffive pronoun is fubftituted for that word which only ferves to define and afcertain the identity of the noun, and not for the noun itfelf, which muft always be either expreffed or underftood. Hence the reafon why one pronoun becomes the fubftitute of this noun and its proper definitive, whether that definitive appears in the form of a noun or pronoun: for I can fay, "*Alexander's houfe* is more elegant than *Mary's*, or *his houfe* is more elegant than *hers*, although IT neither is fo commodious nor agreeable to live in." In which example it is plain, that the words *his* and *hers* are ftrictly the fubftitutes only of *Alexander's* and *Mary's*, and nothing more; whereas the pronoun IT is the fubftitute of the whole noun with its definitive *Alexander's houfe*. The other clafs of pronouns poffeffive, MINE, THINE, *&c.* as they do not fo much ferve to diftinguifh individuals, as to afcertain the property of the thing fpoken of, which may, in a certain fenfe, be confidered as an attribute thereof, are more nearly allied to attributives, and have therefore by fome been called adjectives. And

it must be acknowledged, that these two classes of words are so nearly allied to one another, that it is difficult to ascertain, in all cases, the precise boundary between them.

Besides these, there are other words which sometimes assume the province of pronouns, and are generally considered as belonging to this class, although in many cases improperly; such as, THIS, THAT, ANY, SOME, THESE, THOSE, ALL, and some others; which may be called *improper* pronouns. To distinguish when they may be considered as pronouns, we may observe, that when they stand by themselves, and supply the place of a noun, as when we say, THIS *is virtue*, *give me* THAT, then are they pronouns. But when they are associated to some noun, as when we say, THIS HABIT *is virtue*, or THAT MAN *defrauded me*; then, as they do not supply *the place* of a noun, but only serve to *ascertain* one, they fall rather under the species of *definitives*, or *articles*. And indeed it must be confessed, that these, as well as the possessive pronouns, are more properly adapted to define and ascertain individuals among nouns, than to supply their place; and therefore are oftener to be considered as articles than as pronouns. The best rule to distinguish when they are to be considered as the one or the other, is this. The genuine PRONOUN *always stands* by *itself*, assuming the power of a NOUN, and supplying its *place*. The genuine ARTICLE *never stands* by *itself*, but appears at all times *associated to something else*, requiring a noun for its support, as much as *attributives* or *adjectives*.

The three orders of pronouns already mentioned, may be called *prepositive*; because they are capable of introducing or leading a sentence, without having reference to any thing previous. But there is another order of pronouns which can never be employed but to *connect* sentences, and must therefore always have a reference to some sentence that precedes them; as, WHO, WHICH, WHAT. The nature of which may be explained as follows.

Suppose I say, LIGHT *is a body*; LIGHT *moves with great celerity*; these would apparently be two distinct sentences. But if, instead of the second LIGHT, I were to place the prepositive pronoun IT, and say, LIGHT *is a body*, IT *moves with great celerity*; the sentences would still be distinct, and two. But if I add a *connective* (as for example AND) saying, LIGHT *is a body*, AND IT *moves with great celerity*; I then, by connection, make the two into *one*. Now it is *in the united powers of a connective and another pronoun*, that we may see the force and character of the pronoun here treated of. For if, instead of the words AND IT, we substitute THAT or WHICH; saying, LIGHT *is a body* WHICH *moves with great celerity*; the sentence still retains its *unity*, and becomes, if possible, more compact than before. We may therefore call this pronoun the SUBJUNCTIVE; because it cannot introduce an original sentence, but only serves *to subjoin one to some other which is previous*.

The application of this *subjunctive*, like the other pronouns, is universal. It may be the substitute of all kinds of substantives, natural, artificial, or abstract; general, special, or particular: for we may say, The *man who*, the *ship which*; *Alexander who*, *virtue which*, &c. Nay, it may even be the substitute of all the other pronouns and is therefore of course expressive of all the three persons. Thus we say, I WHO *now write*; THOU WHO *now readest*; HE WHO *now heareth*, &c. And thus the SUBJUNCTIVE is truly a *pronoun* from its *substitution*; there being no substantive existing in whose place it may not stand. At the same time it is essentially distinguished from the other pronouns by this particular, that it is not only a *substitute*, but likewise a *connective*.

As to the accidents of this pronoun: From its performing the part of a connective, it of course follows, that neither *gender* nor *number* can be considered as essential to it; because these are always expressed in the preceding parts of the sentence to which it refers; nor do we in fact find, that this pronoun, at least in modern languages, admits of any distinction to denote *number*, although the English language admits of one variation for the *gender*; as we employ WHO for the *masculine* and *feminine*, and WHICH for the *neuter* gender, thus: *The man*, or *the woman* WHO *went to Rome*; *the* TREE *which stands on yonder plain*, *&c.* It likewise admits of a variation similar to that of the accusative case; at least when applied to males or females. For when the object which it represents is the efficient cause of action, it is WHO; as, *the man* WHO *fell*, *&c.*; but when it is the passive subject, it then, in certain circumstances, takes the form of WHOM; as, *the man of* WHOM *I speak*; although this is not universal; as we likewise say, *the man* WHO *was beaten*. But the neuter admits of no such distinctions, as we equally say, *the tree* WHICH *fell*, or *the tree of* WHICH *I spoke*. But both of these admit of a variation to denote possession or qualities, which is the word WHOSE for all genders. Thus, we say, *Socrates* WHOSE *only study was virtue*; *Elizabeth* WHOSE *reign was glorious*.

To conclude: We have seen that substantives are either *primary* or *secondary*; or, in other words, NOUNS or PRONOUNS. The NOUNS denote substances, either *natural*, *artificial*, or *abstract*; and these either *general*, *special*, or *particular*. The PRONUNS, their substitutes, are either *prepositive* or *subjunctive*: the PREPOSITIVE is distinguished into three orders, called the *first*, the *second*, and the *third* persons: the SUBJUNCTIVE includes the powers of all the three, having *superadded*, as of its own, the peculiar force of a connective.

CHAPTER II.

Of ATTRIBUTIVES.

As all attributives must either be expressive of the attributes of SUBSTANCES, or of other ATTRIBUTES, we divide this class into two kinds; calling those of the first kind, ATTRIBUTIVES of the FIRST ORDER; and those of the second kind, ATTRIBUTIVES of the SECOND ORDER.

Section I. Attributives *of the First Order*.

Attributives are all those *principal* words that denote *attributes* considered as attributes. Such, for example, are

are the words, *black, white, great, little, wise, eloquent, to write, to walk, to speak,* &c. all of which are the *attributes of substances*. Thus *black* is an attribute of *jett, white* of *snow;—wise* and *eloquent,* as also, *to write* and *speak,* are attributes of *men.*

In examining the different attributes of substances, we readily perceive that some of them have their essence in *motion*; such are, *to walk, to fly, to strike, to live, &c.* Others have it in the *privation* of *motion*; as, *to stop, to rest, to cease, to die, &c.* And others have it in subjects that have *nothing to do* with either *motion* or its *privation*; such are the attributes of *great* and *little, wise* and *foolish, white* and *black,* and, in a word, the several *quantities* and *qualities* of all things. This therefore furnishes a natural division of attributives of this order; and grammarians have called all those, whose essence consists in *motion* or its *privation,* VERBS; and all the others have been called ADJECTIVES; each of which we shall consider separately.

I. Of Verbs.

VERBS are all those principal words which denote *attributes,* whose essence consists in *motion,* or *energies,* (for we chuse to make use of this last term, as it implies the exertions of the mind as well as those of the body), or their *privation.* This order of attributives differs from the other called *adjectives*; not only in the particular above-mentioned, but also because adjectives denote only qualities or quantities, which do not admit of any change of state; whereas the verbal attributives may be considered as in several different states, and therefore admit of several variations in the term employed to express these. It may, in the first place, be considered as a simple attribute or energy, without particularizing any circumstance relating to the state it may be in; as in the word WRITE. Or, in the second place, as these are all attributes which denote motions or energies, they may be represented as in the state of actual motion or exertion; as in the word WRITING. Or, lastly, the motion or energy may be finished, and its effect completed; as in the word WRITTEN. Hence, therefore, every verb admits of a threefold variation in every language, in each of which languages they are distinguished by some particular names. Our grammarians have given the name of the INFINITIVE MODE to the original verb itself, and the other two variations of it are both distinguished by the name of PARTICIPLES; that variation which exhibits the verb in its state of energy being called the PARTICIPLE PRESENT or ACTIVE, and the other variation is called the PARTICIPLE PERFECT or PAST.

These variations of the verb are founded in the nature of things, and therefore must be found in every language under some form or other. As to the other supposed variations of verbs relating to person, number, time, *&c.* the slightest reflection on this subject will shew, that a verb, considered as a simple attributive, can admit of none of these affections, but must for ever remain the same at all times and in all situations whatever; for who does not see, that the attribute *to write* is the same whether it is possessed by *you,* by *me,* or by any number of different persons? Nor does this attribute suffer any change, whether it is represented as having been exerted a *thousand years ago,* or at *this present moment,* or at *any other* assignable period of duration; but, like every other attribute, it must remain for ever the same. For however *substances* may vary with time, and be incessantly changing; yet *attributes* of every sort are altogether beyond its power. And we must easily perceive, that the attribute which is expressed by the word GOOD, is the same now as it was at the creation, or will be while the world exists. And in the same manner, *to walk, to write, to fly,* denote attributes, which must each of them preserve their own particular nature during all the successive ages of time. Hence therefore we see, that the verbal attribute must for ever remain in that state, or modification, in which it is at first represented. Nor can it suffer any change, however different the circumstances may be in which it can be applied in language. All, therefore, that can be said of these several variations with which grammarians have usually endowed verbs, is this, That, as an attributive, it hath such an intimate connection with a substantive, as necessarily to be united with one, before it can make a principal figure in language: And as that union may be represented as taking place at different times, and under different circumstances, the inventors of some languages have contrived to express these different connections by a single word, instead of doing it by different words, as the thing in itself would naturally require; in the same manner as those who use the short-hand method of writing, make a single character express a whole word, or sentence: And as it was most natural for the contrivers of these words to derive them from the verb itself of which they are compounded, they have each of them become a *real* variation of the original *word* which expresses the verbal attribute; and, from thus being a variation of the verbal *word,* they have at last come to be considered as an *essential* variation of the *verb itself,* which has occasioned those contradictory definitions, and that confusion of ideas which we meet with among all writers on this subject. But as we here consider language as in itself, without regarding the particular forms under which it may appear, we must reject all these variations of *persons, numbers, modes,* and *tenses,* which the verb itself has usually been supposed to undergo; and consider them, not as essential variations of the verb itself, but as variations produced in language by the combination of the verb with other parts of speech; and therefore relating to *syntax,* and of course belonging to those grammatical disquisitions alone which treat of the peculiarities of any particular language. But as these variations have been so universally considered as essential parts of the verb itself, and as the terms which this division of the verb have introduced into grammar are so frequently to be met with, it will be necessary to explain in some measure the meaning of these several terms.

In the natural world, no attribute can possibly exist without a substance to which it belongs, nor any substance without possessing certain attributes. So necessary and intimate is the connection between these, that it is as impossible

impoffible to feparate them, as to create or annihilate the feveral fubftances that poffefs thefe attributes. But although we are thus circumfcribed as to our bodily powers, the mind admits not of fuch limitation; but can with the utmoft facility feparate every quality from every object whatever, and confider them apart; as, *colour* without *fuperficies*, *fuperficies* without *folidity*, or *weight* without *matter*, &c. and, when thus feparated, apply them to what objects, and in what manner, it pleafes. In this manner the mind abftracts thofe attributes which denote *motions* or *energies* from their *agents* or *energizers*, in the fame way as it abftracts *qualities* from their *fubftances*. And it is thefe energies thus abftracted, which form that fpecies of words called *verbs*; in the fame manner as thofe attributes which denote *quantities* and *qualities* abftracted from their neceffary fubftances, form *adjectives*. Thus, the term *to walk*, denotes a particular *energy* as confidered perfectly apart from every *energizer*, in the fame manner as the word *good* denotes a certain *quality* without regard to any particular *fubftance*.

Here then we difcover a moft effential difference between the order of nature, and that reprefentation of it which man makes by means of words. For in *nature*, every quality muft at all times be united with fome fubftance, nor can ever be exhibited feparate from it; but in *language*, every attributive, if it be confidered at all, muft be feparated from the object to which it naturally belongs. Hence we fee the reafon why, in language, every *energy* and energizer, not only *may* be confidered feparately, but *muft* for ever remain feparate, unlefs they be united by fome other power than what is neceffarily their own. For the attribute *to write*, can no more be united to *man* its proper energizer, than a motion could commence without a caufe; and till this attribute is united to its proper energizer, it muft remain in a great meafure dead and inefficacious in language.—To communicate life and energy, therefore, to this inert attribute, it muft be united to its proper energizer; which can only be effected by the help of an affertion of the fpeaker himfelf; which may be confidered as the fame with regard to language, as life is in the natural world.

It is evident that, by the affiftance of an affertion, the fpeaker is enabled to write any energy to any particular energizer, and thus, without making any change upon the attribute itfelf, reprefent a variety of changes produced upon other bodies by its means.—Thus, if I fay, *I write*, what do I more than affert that I myfelf am poffeffed of that particular attribute denoted by the verb *to write*? If I fay, *You write*, or *He writes*, what do I more than affert that another perfon is poffeffed of that particular attribute or energy?—If I fay, *He* DID *write*, I only affert that the fame attribute was poffeffed at another time, by the fame perfon, as before. Hence therefore, by the help of this affertion of the fpeaker, we are enabled to join this particular attribute to many different energizers, as well as to reprefent thefe different combinations as occurring at many different times; fo that the fame atribute may thus be made to appear under a great many different circumftances, and exhibit a great variety of changes upon other objects, although itfelf remains unchanged; the feveral variations which we perceive, only relating to the objects with which it is combined, or the means by which that union is effected.—In the fame manner it often happens, that any object in nature, a houfe for example, may appear extremely different when viewed from different fituations.

From the intimate connection that takes place between the energy, the energizer, the affertion, and time, thefe feveral acceffories have been confidered as effential parts of the verb; and therefore fome grammarians have defined a verb to be *A word denoting an energy, with time, and an affertion*. But if we were thus to confound things with thofe which may neceffarily accompany them, we could never arrive at a clear perception of any fubject whatever. But not to enter into the arguments that might be produced to fhew the impropriety of this definition, we fhall only obferve, that by the univerfal acknowledgment of all grammarians this cannot be juft. For they unanimoufly agree, that the *infinitive mode* is not only *a part* of every verb, but the *moft effential part*; as it forms the root from which all the other parts are derived. But as this mode neither denotes either time or an affertion, it is evident that thefe, even by their own acknowledgment, can be at beft but acceffories, and not effential parts of the verb.

From thefe arguments, therefore, we muft conclude, that the verb itfelf admits of no other variations but thofe already taken notice of;—that before it can produce any active effect in language, like every other attribute, it muft be united to fome proper energizer;—that this union in language can never be effected but by means of an exertion of the vital powers of the fpeaker, whereby he either publifhes his perception thereof, or his will that it fhould be;—and that this union may be reprefented as taking place at all the different times that can be affigned. Thefe, therefore, are each of them neceffary accompaniments of a verb, but each of them feparate and diftinct in their own nature, not only from this verb, but from one another; and it becomes an effential part of the fyntax of every language, to confider the various ways in which thefe can be combined and affect one another.—Nay, fo intimate has this connection been thought to be by fome, that the contrivers of certain languages have arranged them under particular claffes, for the fake of diftinctnefs and precifion.—The form which a verb affumed, when thus varied in all the ways that their particular language would admit of, was called the CONJUGATION of the verb; the feveral parts of which may be underftood from the following fketch.

When the verb is confidered under the compound form of which we now fpeak, it can admit of variations chiefly in three refpects. For, firft, fuppofing the *attribute*, the *energizer*, and the *time* when that attribute was exerted by the energizer, to be the fame; a variation may be occafioned by a change being produced in the *perception* or *volition* of the fpeaker, (which, for brevity, we will call the *affertion*,) as in thefe examples: *I write*, SCRIBO; *I may write*, SCRIBAM; *do you write*, SCRIBE. The variations produced by this means have been called MODES. Secondly, Suppofing the *attribute*, the *energizer*, and the *affertion*, to be the fame; a change may be produced in the *time*, as in thefe examples: *I do write*,

write, SCRIBO; *I did write*, SCRIPSI; *I ſhall write*, SCRIBAM, *&c.* The variations produced from this cauſe have been called TENSES. And, thirdly, Suppoſing the *attribute*, the *time*, and the *aſſertion*, to remain unchanged, there may be a difference in the *energizer*; and this likewiſe admits of a diviſion: for as the energizer may be only *one* or more perſons, it muſt have a variation into *ſingular* and *plural* on theſe accounts; as in theſe examples: *I write*, SCRIBO; *thou writeſt*, SCRIBAS; *he writes*, SCRIBAT; and in the plural, *we write*, SCRIBAMUS; *ye write*, SCRIBATIS; *they write*, SCRIBANT. The variations produced from this cauſe have been called PERSON and NUMBER.——Theſe are all the variations which have been made in the Latin or Greek languages; and therefore our grammarians, who have adopted every idea they have of grammar from theſe languages, mention no more: but it was not neceſſary that they ſhould have ſtopt here, for an attribute is ſurely as ſuſceptible of the diſtinction of ſex as of perſon, ſo that they might have had a variation for *Gender* alſo; and inſtead of having one word SCRIBAT to anſwer for all the three genders, *he*, *ſhe*, or *it wrote*, they might have had three different words —The compoſers of the Hebrew language have adopted this plan, and admit of two variations on this account; and the Ruſſian language admits of a like variation in their verb for theſe genders; as in this example: ON ZOHELAL, *he has done*; ONA ZOHELALA, *ſhe has done*, &c. But as the two languages above mentioned do not admit of this diſtinction, therefore all the variations that our verbs are ſaid to admit of are MODES, which include within them TENSES, which include under them PERSONS, under which head is included NUMBER; and theſe are all the parts into which a CONJUGATION has been divided.—As to what concerns the nature and leſſer diſtinctions of each of theſe, the following general remarks may be ſufficient.

With regard to MODES; as this relates ſolely to the *perception* or *volition* of the ſpeaker, it neceſſarily follows, that there ought to be a diſtinct and particular MODE for each diverſity that there can can be in his manner of perceiving or willing any thing whatever, the principal of which are the following.

If we ſimply declare that we perceive any object, or that ſuch a thing is or will be, without any limitation or contigency, it forms what has been called the DECLARATIVE OR INDICATIVE MODE; as, *I write.*—Again, if we ſimply repreſent it to be within our *power*, or to depend upon our choice, it forms two other modes, which may be called the POTENTIAL, as, *I can write;* or the ELECTIVE, as, *I may write.*—In the ſame manner, if the ſpeaker repreſents himſelf, or any other object, as *determined* to perform any action, or as *compelled* to it, or as it is his *duty* to perform it; theſe form ſo many diſtinct modes, which may be called the DETERMINATIVE, as, *I will write*; the COMPULSIVE, as, *I muſt write*; and OBLIGATIVE, as, *I ſhould write.* But although each of theſe repreſents the ſpeaker as perceiving the agent under a different light with reſpect to the action; yet as all of them, except the indicative, agree in this, that however much they may repreſent it as the *duty* or *inclination*, &c. of the agent to perform any action with which they are aſſociated, yet as they are ſtill of the nature of contingents which may never take effect, they are frequently ſubjoined to any other verb; therefore the Latins have comprehended all of theſe under one mode which they have called the SUBJUNCTIVE. We only take notice of this circumſtance here, to ſhew, that however naturally *ſentences* may be diſtinguiſhed into modes, according to the different ſituation of the ſpeaker; yet as the whole order of the variation of words in the conjugation of a verb is merely arbitrary, thoſe who invent them may arrange them into what order they pleaſe, and call them by what names they may think moſt proper. But however they may vary the names or external arrangement, this does not affect the things themſelves. For by whatever name the *mode* may be known which comprehends the words expreſſive of theſe ſeveral meanings, the ſentences formed by theſe will be either *potential*, *obligative*, *compulſive*, &c. as above explained.

All theſe modes above mentioned only relate to the different *perceptions* of the ſpeaker. But as man is not only endowed with the powers of *perception*, but thoſe of *volition* alſo, he muſt have words to expreſs theſe; which forms another order of modes. As he is not only dependent himſelf, but has others depending upon him, he may *command*, *intreat*, *beg*, *pray*, *wiſh*, *inquire.*—Hence, therefore, ſo many different orders of modes, the IMPERATIVE, REQUISITIVE, PRECATIVE, OPTATIVE, INTERROGATIVE, *&c.* to which may be added the VOCATIVE. But although each of theſe diſplay a diſtinct affection of the ſpeaker, yet grammarians have allotted only one variation of their verb for all of theſe purpoſes, called the IMPERATIVE MODE; all the other volitions being expreſſed by this, or ſome other modes, by the help of particular contrivances, which are different in different languages.

With regard to that variation of the verb which relates to *time*, called TENSES: As an action or event may be repreſented as happening at any aſſignable period of time, it is neceſſary to divide that duration into certain parts, that we may be able to repreſent the different relations which events bear to one another with reſpect to this particular. The firſt and moſt obvious diviſion of time is into *preſent*, *paſt*, and *future*. But we may go farther ſtill in our diviſions of time. For as time paſt and future may be infinitely extended, we may in *univerſal time paſt* aſſume *many particular times paſt*, and in *univerſal time future many particular times future*, ſome more, ſome leſs remote, and correſponding to each other under different relations. Even *preſent time*, however, in ſtrict phyſical truth, it may be incapable of it, is by the power of the imagination brought to admit of theſe differences, and as neceſſarily implies *ſome degree of extenſion*, as every given line however minute: And hence it is not ſufficient for language to denote INDEFINITELY mere *paſt*, *preſent*, or *future* times; but on many occaſions to DEFINE with more preciſion what *kind* of *paſt*, *preſent*, or *future* is meant.

Tenſes, therefore, or thoſe variations of a verb which denote a difference of *time* only, may be all divided into PRESENT, PAST, and FUTURE; each of which may be ſubdivided into DEFINITE and INDEFINITE. The *definite*

definite tenses are those where the particular instant of time, whether present, past, or future, is pointed out. The indefinite are those where past, present, or future time is indicated in general, without confining it to a particular instant in either of these cases. These have been distinguished among grammarians by the name of AORISTS.—Thus when Milton makes Adam say,

Millions of spiritual creatures WALK *the earth,*
Unseen, both when we wake and when we sleep,

the verb WALK means not that they were walking at that instant only when Adam spoke, but *indefinitely* in any instant whatever. So likewise, when the same author calls hypocrisy,

—— *the only evil which* WALKS
Invisible except to God alone.

the verb WALKS has the like aoristical signification. *He* WENT, *he* FELL, are *aorists* of the past, as they do not specify any particular instant, but refer to past time in general. So likewise in the legislative sentences, *thou shalt not kill, thou shalt not steal, &c* the same aoristical meaning is perceived, as the prohibition does not relate to any *particular time future*, but is extended indefinitely to *every* time *future*.

But it is not sufficient for a language to denote time in this indefinite manner: it is necessary likewise that it should be capable of specifying any particular instant of time in an exact and definite manner. Thus, if, instead of the word WALK in the first sentence above quoted, we were to put ARE WALKING, it brings down the verb to denote a particular time, and specifies that these *spiritual creatures* are, at that very *instant* in which Adam speaks, walking upon the earth unseen. In like manner, in the second sentence, if the word WALKS were changed to IS WALKING, it denotes, that hypocrisy, at that *particular instant* in which the sentence was pronounced, was walking invisible upon the earth. And in the same manner, WAS WALKING, or WILL BE WALKING, each of them denote, that these energies *were* or *will be* exerted at a particular specified time. These, therefore, form so many distinct definite tenses, under whatever technical name these may be known.

Here then we see the use of that distinction of the different states of the verb, into the *verb properly so called*, and *participles*. For as the verb itself exhibits the word as altogether *indefinite*; when this is joined to its proper energizer, it forms all these INDEFINITE TENSES which our language requires. Thus, *I write, I did write, I will write, I may write, I can write, &c.* each of them, although they represent the attribute as united to the energizer in some *past, present*, or *future* time, do not specify any particular instant, and are therefore so many aorists or indefinite tenses. Whereas in the *participle* the attribute is represented as in a state of exertion, it necessarily follows, that if it be ever united to its energizer, it must point out the particular instant when that union took effect, and of consequence form as great a variety of DEFINITE TENSES as the verb forms of indefinite. Thus, *I am writing*, necessarily implies that I am actually exerting this particular energy at the *very instant* that I declare it. So likewise if I say *I was writing*, it indicates, that at one *particular instant* of past duration, to which this has a reference, I was actually employed in that particular occupation. This instant is generally fixed by some collateral circumstance; as, "upon the twentieth day of August last, at 12 o'clock, *I was writing*;" or, "when the thunder broke upon the tower in my neighbourhood, *I was writing*," *&c.* And the same may be said of future time; as, "to morrow at ten o'clock *I shall be writing*," *&c.* In all of which cases it is obvious, that a particular *now* or *instant* is pointed out, in which the attribute is represented as united to its proper energizer. We might here proceed to shew the various times that each of these different states of the verb might be made to indicate; the number of *tenses* that each mode admitted of; the several changes that might be produced by joining the *participle perfect* with any object; which cannot be here called the *energizer*, but the *subject*; for as the energy is by this participle represented as compleated, if it has any connection with any person, as the attribute cannot be affected by any energizer after it is compleated, it must of necessity affect the person, instead of being affected by it; and hence it is that the several variations produced by this participle perfect have been called the PASSIVE VOICE of the verb. But as all these particulars only relate to the construction of one particular language, it would lead us a great deal too far from the particular subject of which this article treats. We shall therefore only observe, that besides the above variations of the verb, which the Greeks and Romans have thought proper to make, the terms of which we have adopted; there are many others that they might with equal propriety have made, but which they rather chose to express by the help of other words called *adverbs* But some other languages have gone further in this respect, and endowed their verbal word with several variations to express several other circumstances than they do. This is particularly the case with the Hebrew language, which, besides the variation for gender above mentioned, has allotted certain other variations of its verb to express several other circumstances. Thus, PAKAD in that language signifies *he visited*; PAKEDA, *she visited, &c.* PIKKED, *he visited diligently*; HEPHKED, *he made him visit*; and HETHPEKED, *he visited himself*. In this manner is every verb in that language varied; and each of these different conjugations of their verb admits of a particular variation for the passive of each —Hence, therefore, the conjugation of a verb in that language admits of a great many variations which neither the Greeks nor Romans were acquainted with: for besides the distinctions of *modes, tenses, persons*, and *number*, they have divided their verb into so many distinct divisions to answer for these distinctions above mentioned, which they have denominated KAL, PIHEL, HIPHIL, and HITHPAHEL, with their passives NIPHAL, PUHAL, and HOPHAL; each of which admits of variations through all the *modes, tenses, persons, numbers*, and *genders* which any of their verbs admit of.

The only use which we meant to make of these observations on the Hebrew verbs, is this: That as the authors, who have formed their idea of grammar from the forms which the several parts of speech admit of in the Greek and Latin languages, have supposed that every variation which these languages admitted of was a natural and necessary part of language; and that therefore every language which did not admit of the same number of variations,

tions with theirs in every part of fpeech, was in fo far defective and incomplete. So, for the fame reafon, an author who had formed his idea of grammar upon the model of the Hebrew tongue, would as naturally fuppofe, that the feveral variations which the verb admitted of in his own favourite language, were effential and neceffary; and that, of confequence, every language which did not admit of as many variations was imperfect and incomplete. But to any one who confiders this matter with attention, it will appear, that there could be no end to thefe unneceffary difcuffions and groundlefs claims of fancied fuperiority: for if compound words have fuch an advantage over fimple, the Chinefe language, in which we are told almoft every fentence has a particular compound character to exprefs it, muft be by far the moft perfect in the world; but fo far is this from being the cafe, that every one allows it to be the moft imperfect and incomplete. The only method, therefore, which remains for us to confider this fubject is, to diregard every particular form of language, and confider the words in themfelves, as divefted of every extraneous circumftance, and obferve what variations they neceffarily require, allowing every particular language to compound thefe with one another in what manner they fhall think moft proper. It is in this manner we have confidered the verbal attributives, and endeavoured to difentangle them from thefe unneceffary fetters with which they have been loaded, and reftore them to their own original freedom.

Befides the variations above-mentioned, verbs have been diftinguifhed from one another in a different manner; the names and nature of which may be thus explained.

We have already feen, that all verbs, as they denote *energies*, neceffarily have reference to certain *energizing fubftances*. For, how could there be fuch energies as *to love*, *to fly*, *to wound?* &c. were there not fuch beings as *men*, *birds*, *fwords*, &c. Farther, every energy not only requires an energizer, but is neceffarily converfant about fome fubject. For example, if we fay, *Brutus loves*, we muft needs fupply—loves *Cato*, *Caffius*, or fome one. And thus it is, that every energy is neceffarily fituated between two fubftantives, an energizer which is *active*, and a fubject which is *paffive*. If the energizer leads the fentence, the energy has been faid to follow its character, and becomes what we call a VERB ACTIVE: thus we fay, BRUTUS AMAT, *Brutus loves*. On the contrary, if the paffive fubject be principal, it is faid to follow the character of this too, and becomes what we call a VERB PASSIVE: thus we fay, PORTIA AMATUR, *Portia is loved*. But in fome verbs it happens, that the energy *always keeps within the energizer*, and never paffes out to any extraneous fubject. Thus, when we fay, *Cæfar walketh*, *Cæfar fitteth*, it is impoffible that the energy *fhould pafs out*, becaufe both the *energizer* and the *paffive fubject* are united in the *fame perfon*. For what is the caufe of this walking or fitting? it is the *will* and *vital powers* belonging to *Cæfar:* and what is the fubject made fo to move or fit? it is the *body* and *limbs* belonging alfo to the fame *Cæfar*. This fpecies of verbs have been by grammarians diftinguifhed by the name of VERBS NEUTER, as if they were void both of *action* and *paffion*, when perhaps they may be rather faid to imply both. It is in this manner, that verbs have been diftinguifhed into the three claffes of *active*, *paffive*, and *neuter*. Thefe, however, might with more propriety be divided into two claffes, which might be called verbs TRANSITIVE, and NOT TRANSITIVE; the firft clafs including all thofe verbs which are ufually called *active*, with the *paffives* belonging to them; for it is evident, that thefe paffives are not verbs themfelves, but a variation only of a verb; and the fecond clafs including thofe verbs commonly called *neuter*.

Some languages, as the Greek and French, have another clafs of verbs, which are called by the firft VERBS MIDDLE, and by the laft RECIPROCAL VERBS; which are employed to denote that ftate of any tranfitive verb, when the energizer himfelf becomes the fubject; as thus, *Brutus killed himfelf*, &c. But as thefe only exprefs a flight variation of an accompaniment of a verb, they have no claim to be confidered as a diftinct fpecies.

II. Of ADJECTIVES.

ADJECTIVES are all thofe words which denote attributes whofe effence does not confift in motion or its privation: or, in other words, they are thofe words which denote the attributes of quantity, quality, and relation; fuch as, *many*, *few*, *great* and *little*, *black* and *white*, *good* and *bad*, *double*, *treble*, *quadruple*, &c.

As thefe attributes admit of no change of ftate, nor can be effected by the variations of time, or any other accident, but are in their own nature perfectly fixed and invariable, the words which exprefs them ought to be in all fituations and on all occafions the fame. For as the qualities *good* or *bad*, *black* or *white*, admit of no change in their own nature, whether they be applied to a *man*, to a *woman*, to *many*, or to *few*; neither ought the word which expreffes any one of thefe attributes in ftrictnefs to admit of any alteration, whether it be joined to one or other of thefe fubftantives. So that although in fome languages, from the particular conftruction of the other parts of fpeech, it has been found neceffary to endow their adjectives with the threefold diftinction of *gender*, *number*, and *cafe*; yet this muft only be confidered as an accidental variation occafioned by particular circumftances, and not in the leaft effential to language, but rather a deviation from the order of nature, which would require them to be kept invariably the fame in all cafes. This order, the Englifh language (which in this and almoft every other cafe is moft ftrictly conformable to the nature of things than any other language we are acquainted with) moft ftrictly obferves; as we fay equally, *a good man*, or *a good woman*, *a good houfe*; or *good men*, *good houfes*, &c.

It has probably been from obferving, that the adjectives in fome particular languages are endowed with variations conformable to the *gender*, *number*, and *cafe* of their fubftantives, that grammarians have been led into the ftrange abfurdity of ranging them with nouns, and feparating them from verbs; though with refpect to verbs they are pefectly homogeneous, and with refpect to nouns they are quite the contrary. Adjectives are homogeneous with refpect to verbs, as both forts denote *attributes;*

attributes; they are heterogeneous with respect to nouns, as *never properly denoting substances*.

Besides original adjectives, there is another class which are formed from substantives. Thus when we say, *the party of Pompey, the style of Cicero, the philosophy of Socrates*; in these cases, the party, the style, and philosophy spoken of, receive a stamp and character from the persons they respect, and actually pass into attributives, and as such assume the form of *adjectives*. And hence we say *the Pompeian party, the Ciceronian style*, and *the Socratic philosophy*. In like manner, for a trumpet of brass, we say, *a brasen trumpet*; for a crown of gold, *a golden crown*, &c. Even pronomial substantives admit the like mutation; as, instead of saying the book *of me, of thee*, or *of him*, we say, *my* book, *thy* book, *his* book, *&c*. Yet it must be acknowledged, that these, as they often serve rather to define a noun than to denote any quality appertaining it, they partake more of the nature of *articles* than *adjectives*; so that it is in many cases difficult to ascertain exactly to which class they are to be referred. But of this we have already taken particular notice, p. 713. col. 2. & 716. col. 2.

The nature of these variations of adjectives which have been called *degrees of comparison*, will be more properly explained under the following section.

Section II. *Of* Attributives *of the Second Order, called* ADVERBS.

As the attributives hitherto mentioned denote the *attributes* of *substances*, so there is an inferior class of them which denote the *attributes* only of *attributes*. To explain these by examples of either kind: when we say, "*Cicero* and *Pliny* were both of them *eloquent*; *Statius* and *Virgil* both of them *wrote*;" in these instances, the attributes *eloquent* and *wrote*, are immediately referable to the substantives *Cicero, Virgil*, &c.: As, therefore, denoting the *attributes of substances*, we call them ATTRIBUTIVES OF THE FIRST ORDER. But when we say, "*Pliny* was *moderately* eloquent, but *Cicero exceedingly* eloquent; *Statius* wrote *indifferently*, but *Virgil* wrote *admirably*:" in these instances, the attributives *moderately, exceedingly, indifferently*, and *admirably*, are not referable to *substantives*, but to *other attributes*; that is, to the words *eloquent* and *wrote*: As, therefore, denoting *atributes* of *attributes*, we call them ATTRIBUTIVES OF THE SECOND ORDER. These have been, by grammarians, called ADVERBS. And indeed, if we take the word VERB in its most comprehensive signification, as including all the words which denote the *attributes* of *substances*, (which was the sense in which Aristotle and many of the most ancient grammarians employed it) we shall find the name ADVERB to be a very just appellation, as denoting a *part of speech the natural appendage of verbs*. So great is this dependence in grammatical syntax, that an *adverb* can no more subsist without its *verb*, than a *verb* can subsist without its *substantive*.

Among the attributes of substances are reckoned quantities and qualities. Thus we say, *a white garment, a high mountain*, &c. Now some of these quantities and qualities are capable of *intension* and *remission*. Thus we say, *a garment* EXCEEDINGLY *white, a mountain* TOLERABLY OF MODERATELY *high*. Hence, then, one copious source of secondary attributives, or adverbs, to denote these two, that is, *intension* and *remission*; such as, *greatly, vastly, extremely, sufficiently, moderately, tolerably, indifferently*, &c.

But where there are different intensions of the same attribute, they may be *compared* together: thus, if the garment A be EXCEEDINGLY *white*, and the garment B be MODERATELY *white*, we may say, the garment A is MORE *white* than the garment B. In these instances, the adverb MORE not only denotes intension, but *relative intension*. Nay, we stop not here, as we not only denote intension *merely relative*, but *relative intension than which there is none greater*. Thus we not only say, the *mountain* A *is* MORE *high than the mountain* B, but that *it is the* MOST *high of all mountains*. Even *verbs*, properly so called, as they admit of *simple intensions*, so they admit also of these *comparative ones*. Thus, in the following example, *Fame he* LOVETH MORE *than riches, but virtue of all things he* LOVETH MOST; the words MORE and MOST denote the different *comparative intensions* of the verbal attribute *loveth*.

Hence the rise of COMPARISON of adjectives, and of its different *degrees*, which cannot well be more than the two species above-mentioned; one to denote *simple excess*, and one to denote *superlative*. Were we indeed to introdnce more degrees than these, we ought perhaps to introduce *infinite*, which is absurd. For why stop at a limited number, when in all subjects susceptible of intension the intermediate excesses are in a manner infinite? There are infinite degrees of *more white*, between the *first simple white*, and the superlative *whitest*; and the same may be said of *more* great, *more* strong, *more* minute, &c. The doctrine of grammarians about three such degrees of comparison, which they call the *positive*, the *comparative*, and the *superlative*, must be absurd; both because in their positive there is no comparison at all, and because their superlative is a comparative as much as their comparative itself. Examples to evince this may be met with every where; *Socrates was the* MOST WISE *of all the Athenians*; *Homer was the* MOST SUBLIME *of all poets*, &c.

The authors of language have in some instances contrived a way to retrench these comparative adverbs, by expressing their force by an inflection of the primary attributive. Thus, instead of *more fair*, they say, FAIRER; instead of *most fair*, FAIREST: and the same method of composition takes place both in the Greek and Latin languages; with this difference however between the genius of these languages and ours, that we are at liberty to form the comparison, either in the one method or the other: but in these languages, the comparison is almost never formed by the assistance of the adverb, but always by the inflection of the adjective; and hence this inflection is always considered by them as a necessary accident of the adjective. But this method of expressing the power of the adverb has reached no farther than to adjectives,

adjectives, or to their participles, which were ſo nearly allied to adjectives. Verbs were perhaps thought to be too much diverſified, to admit of more variations without perplexity.

Some qualities admit of compariſon, others admit of none: ſuch, for example, are thoſe which denote *that quality of bodies ariſing from their figure*; as, when we ſay, a *circular* table, a *quadrangular* court, a *conical* piece of metal, *&c.* The reaſon is, that a million of things participating the ſame figure, participate it *equally* if they do it at all. To ſay, therefore, that while A and B are both quadrangular, that A is more or leſs quadrangular than B, is abſurd. The ſame holds in all attributives denoting *definite quantities* of whatever nature. For, as there can be no *compariſon* without *intenſion* or *remiſſion*, and as there can be no intenſion and remiſſion in things *always definite*, therefore theſe attributives can admit of no compariſon. By the ſame method of reaſoning, we diſcover the cauſe why *no ſubſtantive is ſuſceptible of theſe degrees of compariſon.* A *mountain* cannot be ſaid MORE TO BE or TO EXIST than a *mole-hill*; nor the *lion* A cannot be *more a lion* than the lion B: but the *more* or *leſs* muſt be ſought for in their quantities or qualities; a mountain is *more bulky* than a mole-hill, and the lion A is *more fierce* than the lion B; the exceſs being always derived from their attributes.

Of the adverbs or ſecondary qualities already mentioned, thoſe denoting intenſion and remiſſion may be called adverbs of QUANTITY CONTINUOUS; *once*, *twice*, *thrice*, &c. are adverbs of QUANTITY DISCRETE; *more* and *moſt*, *leſs* and *leaſt*, to which may be added *equally*, *proportionally*, &c. are adverbs of RELATION. There are others of QUALITY; as when we ſay, HONESTLY *induſtrious*, PRUDENTLY *brave*, *they fought* BRAVELY, *he painted* FINELY, *&c.*

The adverbs hitherto mentioned, are common *to verbs of every ſpecies*; but there are ſome which are confined to *verbs* properly ſo called, that is to ſay, to ſuch as denote *motions* or *energies* with their *privations*. All *motion* and *reſt* imply *time* and *place* as a kind of neceſſary coincidence. Hence, if we would expreſs the *place* or *time* of either, we muſt needs have recourſe to adverbs formed for this purpoſe; of PLACE, as when we ſay, *he ſtood* THERE, *he went* HENCE, *he travelled* FAR, *&c.*; or of TIME, as when we ſay, *he ſtood* THEN, *he went* AFTERWARD, *he travelled* FORMERLY, *&c.* Should it be aſked, Why *adverbs of time*, when verbs have *tenſes?* The anſwer is, though tenſes may be ſufficient to denote the greater diſtinctions of time, yet to denote them all by tenſes would be a perplexity without end. What a variety of forms would be neceſſary to denote *yeſterday*, *to day*, *to-morrow*, *formerly*, *juſt now*, *now*, *immediately*, *preſently*, *ſoon*, *hereafter?* &c.

To theſe adverbs juſt mentioned may be added thoſe which denote the *intenſions* and *remiſſions peculiar to* MOTION, ſuch as *ſpeedily*, *haſtily*, *ſwiftly*, *ſlowly*, &c.; as alſo adverbs of *place* made out of *prepoſitions*, ſuch as *upward* and *downward*, from *up* and *down*. In ſome inſtances the prepoſition ſuffers no change, but becomes an adverb by nothing more than its application; as when we ſay, *he rides* ABOUT, *he was* NEAR *falling*, &c.

There are likewiſe adverbs of INTERROGATION; ſuch as, *where*, *whence*, *whither*, *how*, &c. of which there is this remarkable, that when they loſe their *interrogative power*, they aſſume that of a *relative*, ſo as to repreſent the *relative* or *ſubjunctive pronoun*; as in this doggerel tranſlation of a line from Virgil,

And corn doth grow WHERE *Troy town ſtood*;

that is to ſay, *corn groweth in that place* IN WHICH *Troy ſtood*, the power of the relative being implied in the adverb. It is in like manner, that the *relative pronoun* becomes an *interrogative*; as in this line from Milton,

WHO *firſt ſeduc'd them to that foul revolt?*

The reaſon of this is as follows: the *pronoun* and *adverbs* here mentioned are all, in their original character, RELATIVES. Even when they become interrogatives, they loſe not this character, but are ſtill relatives as much as ever: the difference is, that *without* an interrogation they have reference to a ſubject which is *antecedent*, *definite*, and *known*; *with* an interrogation, to a ſubject which is *ſubſequent*, *indefinite*, and *unknown*, and which it is expected the anſwer ſhould expreſs and aſcertain. WHO *firſt ſeduc'd them?* The queſtion itſelf ſuppoſes a ſeducer, to which, though *unknown*, the pronoun *who* has a reference—*Th' infernal ſerpent.* Here, in the anſwer, we have the ſubject, which was *indefinite*, *aſcertained*; ſo that we ſee WHO, in the *interrogation*, is as much a *relative* as if it had been ſaid originally, without any interrogation at all, *It was the infernal ſerpent* WHO *firſt ſeduced them*: and thus interrogatives and relatives mutually paſs into one another.

Having thus conſidered all thoſe parts of ſpeech which ARE SIGNIFICANT OF THEMSELVES, we proceed to thoſe AUXILIARY PARTS, which are ONLY SIGNIFICANT WHEN ASSOCIATED WITH OTHERS, which we have already ſaid are either DEFINITIVES or CONNECTIVES. Of which in their order.

CHAPTER III.

Concerning DEFINITIVES commonly called ARTICLES.

THE knowledge of man is at beſt but limited and confined. Although we have invented words to denominate almoſt all the ſubſtances which exiſt, yet as it is impoſſible for any perſon to be acquainted with all of theſe, it was neceſſary to fall upon ſome contrivance in language to obviate the difficulties which would ariſe from this cauſe. With this view, we have already ſeen, that ſubſtances have been diivded into general claſſes, each of which includes under it ſeveral leſſer ſubdiviſions; the names of which general claſſes, being but few, may be more eaſily retained, as *animal*, *edifice*, *motion*, &c. for by referring the ſeveral objects that we may accidentally ſee, and with which we are unacquainted, to the ſeveral claſs to which they may belong, we are in ſome meaſure enabled to communicate our ideas without the know-

ledge

ledge of the particular names. But as this particular object must in some manner be distinguished from others of the same class to which it belongs, a particular class of words was found necessary to define and ascertain these individuals, which has given rise to this order of words of which we now treat, and which we have called *definitives*, because they serve to *define and ascertain any particular object, so as to separate it from the general class to which it does belong, and, of course, denote its individuality*. The principal of these definitives have been usually called ARTICLES, the nature of which may be explained as follows.

Supposing I see an object with which I am totally unacquainted, having a head and limbs, and appearing to possess the powers of self-motion and sensation. If I know it not as an individual, I refer it to its proper species, and call it *a dog*, *a horse*, *a lion*, or the like; and if none of the names of any species with which I am acquainted fit it, I refer it to the genus, and call it *an animal*.

But this is not enough. The object at which we are looking, and want to distinguish, is perhaps an individual.—Of what kind? *Known* or *unknown?* Seen now *for the first time*, or *seen before* and now remembered? It is here we shall discover the use of the two articles A and THE; for the article A respects our *primary* perception, and denotes individuals as *unknown*; whereas THE respects our *secondary* perception, and denotes individuals as *known*. To explain this by an example, I see an object pass by which I never saw till then: What do I say? *There goes* A *beggar with* A *long beard*. The man departs, and returns a week after: What do I then say? *There goes* THE *beggar with* THE *long beard*. Here the article only is changed, the rest remains unaltered. Yet mark the force of this apparently minute change. The individual *once vague* is now recognised as *something known*, and that merely by the efficacy of this latter article, which tacitly insinuates a kind of *previous* acquaintance, by referring a present perception to a like perception already past. Hence therefore we see, that although the articles A and THE are both of them *definitives*, as they circumscribe the latitude of genera and species, by reducing them, for the most part, to denote individuals; yet they differ in this respect, that the article A leaves the individual itself *unascertained*, but the article THE *ascertains the individual also*, and is for that reason the more accurate definitive of the two. They differ likewise in this respect, that as the article A serves only to separate one particular object from the general class to which it belongs, it cannot be applied to plurals. But as the article THE serves to define objects, or refer to them as already known, without relation to number, or any other circumstances, it is applicable to both numbers indiscriminately, as well as nouns of every *gender*, without suffering any sort of change; for it is evident, that no variation of the nature of the noun can make any difference in those words which serve to define or denote a certain reference to them. So that although we find some modern languages which admit of a variation of their article, which relates to the gender of the noun with which it is associated, yet this cannot be considered as essential to this species of words: and so far is this from being an improvement to the language, that it only serves to perplex and confuse, as it always presents a particular idea of sex, where in many cases it is not in the least necessary.

Of all the parts of speech which may be considered as essential to language, there is none in which we find so many languages defective as in this. For we know of no language, except our own, which has the particular article A; and the Latin language has no word of the same import with the word THE. The reason of which deficiency is, that as other parts of speech may be so easily converted from their original meaning, and be made to assume the character of definitives, they have made some of these perform both of these offices; and as the article A only separates a particular object, and is therefore so nearly allied to a *numeral*, many languages, as the *French*, *Italian*, *Spanish*, and *German*, have made the numeral word ONE supply its office, while others, as the Greek, have denoted this particular object by a mere negation of the other article; and as the article THE agrees with pronouns in this respect, that they both *denote reference*, the Latins made their pronoun, by a forced periphrasis, supply the place of this. But all of these methods of supplying the want of the genuine article are defective, as will appear more particularly by and by.

As articles are by their nature definitives, it follows of course, that they cannot be united with such words as are in their own nature *as definite as they may be;* nor with such words which, *being indefinite, cannot properly be made otherwise*; but only with those words *which, tho' indefinite, are yet capable, through the article, of becoming definite*. Hence we see the reason why it is absurd to say THE I, or THE THOU, because nothing can make these pronouns more *definite* than they are; and the same may be said of proper names. Neither can we say THE BOTH, because these words are *in their own nature* each of them perfectly defined. Thus, if it be said, "I have read BOTH poets," this plainly indicates *a definite pair*, of whom some mention has been made already. On the contrary, if it be said, "I have read TWO poets," this may mean *any pair* out of all that ever existed. And hence this numeral, being in this sense *indefinite*, (as indeed are all others as well as itself,) is forced *to assume the article* whenever it would become *definite*. Hence also it is, that as TWO, when taken alone, has reference to some *primary* and *indefinite* perception, while the article THE has reference to some perception *secondary* and *definite*, it is bad language to say TWO THE MEN, as this would be *blending of incompatibles*, that is to say, of a *defined substantive* with an *undefined attributive*. On the contrary, to say BOTH THE MEN, is good and allowable; because the substantive cannot possibly be less apt, by being defined, to coalesce with an attributive which is defined as well as itself. So likewise it is correct to say, THE TWO MEN; because here the article, being placed at the beginning, *extends its power* as well through substantive as attributive, and equally tends to *define* them both.

As some of the words above admit of no article, *because*

cause they are by nature as definite as may be; so there are others which admit it not, *because they are not be defined at all.* Of this sort are all INTERROGATIVES. If we question about substances, we cannot say THE WHO IS THIS; but WHO IS THIS? And the same as to *qualities*, and both kinds of *quantities*: for we say, without an article, WHAT SORT OF, HOW MANY, HOW GREAT? The reason is, the article THE respects beings *already known*, and interrogatives respect beings *about which we are ignorant*; for as to what we know, interrogation is superfluous. In a word, the *natural associators with articles* are ALL THOSE COMMON APPELLATIVES WHICH DENOTE THE SEVERAL GENERA AND SPECIES OF BEINGS. It is these, which, by assuming a different article, serve either to explain an individual upon its first being perceived, or else to indicate, upon its return, a recognition or repeated knowledge.

But although proper names do not admit of the article, being in their own nature *definite*; yet as these often fall into *homonymic*, that is, different persons often go by the same name, it is necessary to distinguish these from one another, to prevent the ambiguity that this would occasion. For this purpose we are obliged to have recourse to *adjectives* or *epithets*. For example, there were two *Grecian chiefs* who bore the name of *Ajax*; and was it not without reason that *Mnestheus* uses *epithets*, when his intention was to distinguish the one from the other: "If both *Ajaxes* cannot be spared, (says he) "at least let mighty *Telamonian Ajax* come." But as epithets are in their own nature perfectly *indefinite*, seeing the same adjective may be applied to infinite subjects, it is necessary to define these when we want to apply them to any particular object; so that it is necessary to endow these with an article, that they may have a *reference to some single person only*. And thus it is we say, *Trypho* THE *grammarian*, *Appolodorus* THE *Cyrenian*, &c. It is with reason, therefore, that the article is here also added, *as it brings the adjective to an individuality as precise as the proper name.* Even common appellatives, by the help of an article, come to have the force of proper names, without the assistance of any epithet whatever. Thus, in English, *city* is a name common to many places, and *speaker* a name common to many men. Yet if we prefix the article, THE CITY means our metropolis; and the THE SPEAKER, a high officer in the British parliament. And hence, by an easy transition, the article, from denoting *reference*, comes to denote *eminence* also; that is to say, from implying an *ordinary* pre-acquaintance, to presume a kind of *general and universal notoriety.* Thus, among the Greeks, THE POET meant *Homer*, and THE STAGYRITE meant *Aristotle*; not but that there were many poets beside *Homer*, and many *stagyrites* besides *Aristotle*, but none equally illustrious.

The articles already mentioned are those strictly so called; but, besides these, there are the PRONOMIAL ARTICLES, such as *this*, *that*, *any*, *some*, *all*, *other*, *none*, &c. Of these we have already spoken in the chapter upon pronouns, where we have shewn when they may be taken as pronouns, and when as articles. Yet, in truth, if the essence of an article be to *define* and *ascertain*, they are much more strictly articles than any thing else, and ought to be considered as such in universal grammar. Thus, when we say, "THIS picture I approve, but THAT I dislike;" what do we perform by the help of these definitives, but bring down the common appellatives to denote individuals? So when we say, "SOME men are virtuous, but ALL men are mortal;" what is the natural effect of this ALL and SOME, but to define that *universality* and *particularity* which would remain indefinite were we to take them away? The same is evident in such sentences as these: "SOME substances have sensation, OTHERS want it; choose ANY way of acting, and SOME men will find fault, *&c.*" For here, SOME, OTHER, and ANY, serve all of them to *define* different parts of a given whole; SOME, to denote a *definite part*; ANY, to denote an *indefinite*; and OTHER, to denote the *remaining part*, when a part has been already assumed. Even the attributive pronouns, *my*, *thy*, *his*, *her's*, &c. are, in strictness, more properly articles than any thing else, seeing each of them serve only to define and ascertain the individual object to which they are applied. As when we say, "MY house is less commodious than YOUR'S; HER form is more elegant than HIS, *&c.*" For in these examples what do the words MY and YOUR'S do, but ascertain two individual *houses*; or the words HIS and HER'S, but ascertain two individual *forms*, which are compared with one another? In the same manner we have already seen nouns sometimes lay aside their own proper character, and become definitives, as in the words ALEXANDER'S, CÆSAR'S, POMPEY'S, *&c.* which may be said to form so many NOMIAL ARTICLES. But of these we have spoken so fully in the chapter of nouns, that it is unnecessary to say more of them in this place.

Before we leave this subject, we shall produce one example to shew the utility of this species of words; which, although of themselves insignificant, and seemingly of small importance; yet, when properly applied, serve to make a few general terms be sufficient for the accurate expression of a great variety of particulars, and thus makes language capable of expressing things *infinite*, without wandering into infinitude itself.——To explain this, let the general term be MAN, which I have occasion to employ for the denoting of some particular. Let it be required to express this particular, as *unknown*; I say, A *man*:—*Known*; I say, THE *man*:—*Definite*; A CERTAIN *man*:—*Indefinite*; ANY *man*:—*Present and near*; THIS *man*:—*Present and distant*; THAT *man*:—*Like like to some other*; SUCH *a man*:—*Different from some other*; ANOTHER *man*:—*An indefinite multitude*; MANY *men*:—*A definite multitude*; A THOUSAND *men*:—*The ones of a multitude, taken throughout*; EVERY *man*:—*The same ones, taken with distinction*; EACH *man*:—*Taken in order*; FIRST *man*, SECOND *man*, &c.—*The whole multitude of particulars taken collectively*; ALL *men*:—*The negation of that multitude*; NO *man*:—*A number of particulars present, and at some distance*; THESE *men*:—*At a greater distance, or opposed to others*; THOSE *men*:—*A number present and near*; THESE *men*:—*A number of individuals different from another number*;

ber; OTHER *men*:—*A great number of individuals taken collectively*; MANY *men*:—*A small number*; FEW *men*:—*A proportionally greater number*; MORE *men*:—*Smaller number*; FEWER *men*:—And so on we might go almost to infinitude. But not to dwell longer upon this article, we shall only remark, "that minute changes in PRINCIPLES, lead to mighty changes in EFFECTS; so that PRINCIPLES are well entitled to regard, however trivial they may appear.

CHAPTER IV.

Of CONNECTIVES.

CONNECTIVES, according as they connect either *sentences* or *words*, are called by the different names of CONJUNCTIONS, OR PREPOSITIONS. Of these names, that of the *preposition* is taken from a mere accident, as it commonly stands in connection before the part which it connects. The *conjunction*, as is evident, has reference to its *essential character*. We shall treat of these two separately.

Section I. *Of* CONJUNCTIONS.

A CONJUNCTION is *a part of speech void of signification itself, but so formed as to help signification, by making* TWO *or more significant sentences to be* ONE *significant sentence*. As, therefore, it is the *essence* of a conjunction to *connect sentences*; at the same time that they do this, they must either *connect* their *meaning* or *not*. For example, let us take these two sentences, *Rome was enslaved,—Cæsar was ambitious*, and connect them together by the conjunction BECAUSE; *Rome was enslaved*, BECAUSE *Cæsar was ambitious*. Here the *meanings*, as well as the *sentences*, appear to be connected. But if I say, *manners must be reformed*, OR *liberty will be lost*; here the conjunction OR, though it join the sentences, yet, as to their respective *meanings*, is a perfect *disjunctive*. And thus it appears, that though all conjunctions *conjoin sentences*, yet, with respect to the *sense*, some are CONJUNCTIVE, and others are DISJUNCTIVE.

Those *conjunctions which conjoin both sentences* and their meanings are either COPULATIVES OF CONTINUATIVES. The principal copulative in *English* is AND. The continuatives are much more numerous; IF, BECAUSE, THEREFORE, WHEREFORE, HENCE, THAT, &c. The difference between these is this: The *copulative* does no more than barely *couple* sentences, and is therefore applicable to all subjects whose natures are *not incompatible*: *Continuatives*, on the contrary, by a more intimate connection, consolidate sentences *into one continuous whole*; and are therefore applicable only to subjects which have an *essential coincidence*: For example, it is no way improper to say, *Lysippus was a statuary*, AND *Priscian a grammarian*; *the sun shineth*, AND *the sky is clear*; because these are things that may co-exist, and yet imply no absurdity. But it would be absurd to say, *Lysippus was a statuary*, BECAUSE *Priscian was a grammarian*; though not to say, *the sun shineth* BECAUSE *the sky is clear*. The reason is, with respect to the first, the *co-incidence* is merely *accidental*: with respect to the last, it is *essential*, and founded in nature.

As to the *continuatives*, they are SUPPOSITIVE, such as *if*; or POSITIVE, such as *because, therefore, as, &c.* Take examples of each:—*You will live happily* IF *you live honestly*:—*You live happily* BECAUSE *you live honestly*:—*You live honestly*, THEREFORE *you live happily*. The difference between these *continuatives* is this: The *suppositives* denote *connection*, but do not assert actual existence; the *positives* imply both the *one* and the *other*.

These *positives* above-mentioned are either CASUAL, such as *because, since, as, &c.* or COLLECTIVE, such as *therefore, wherefore, &c.* The difference between which is this: The *casuals* subjoin *causes* to *effects*; "*the sun is in ecclipse* BECAUSE *the moon intervenes*:" The *collectives* subjoin *effects* to *causes*; "*the moon intervenes*, THEREFORE *the sun is in eclipse*." We therefore use *casuals* in those instances where the *effect* being conspicuous we seek for its *cause*; and *collectives*, in demonstrations and science, properly so called, where the *cause* being first known, by its help we discern *effects*.

All these *continuatives* are resolvable into *copulatives*: For, instead of saying, BECAUSE *it is day, it it is light*; we may say, *It is day*, AND *it is light*. Instead of IF *it is day, it is light*; we may say, *It is at the same time necessary to be day*, AND *to be light*. The reason is, That the power of the *copulative* extends to all connections, as well to the *essential* as to the *casual*. Hence the continuative may be resolved into a *copulative and something more*; that is to say, into a *copulative* implying an *essential* coincidence in the subjects conjoined.

As to *casual conjunctions*, we may further observe, that there is no one of the four species of causes which they are not capable of denoting. For example, *the* MATERIAL *cause*; *The trumpet sounds*, BECAUSE *it is made of metal*. *The* FORMAL; *The trumpet sounds*, BECAUSE *it is long and hollow*. *The* EFFICIENT; *The trumpet sounds*, BECAUSE *an artist blows it*. *The* FINAL; *The trumpet sounds*, THAT *it may rouse our courage*. It is worth observing, that the three first causes are expressed by the strongest affirmation; because, if the *effect* actually be, that must be also. But this is not the case with respect to the last, which is only affirmed as a thing that *may* happen. The reason is, That however this may be the end which set the artist first to work, it may still be beyond his power to obtain, and which, like all other contingents, may either happen or not. Hence also it is connected by a particular conjunction, THAT, absolutely confined to this *cause*.

We now come to the DISJUNCTIVE CONJUNCTIONS; a species of words which bear this contradictory name, because, while they DISJOIN *the sense*, they CONJOIN *the sentences*.

With respect to these, we may observe, that as there is a principle of UNION diffused through all things by which THIS WHOLE is kept together and preserved from dissipation; so there is, in like manner, a principle of DI-

VERSITY diffused through all, the source of *distinction*, of *number*, and of *order*. Now, it is to express in some degree the *modifications of this diversity*, that DISJUNCTIVE CONJUNCTIONS seem at first to have been invented.

Of these *disjunctives*, some are SIMPLE, some ADVERSATIVE. *Simple*; as when we say, EITHER *it is day*, OR *it is night*:—*Adversative*; as when we say, *It is not day*, BUT *it is night*. The difference between these is, that the *simple* do no more than *merely* disjoin; the *adversative* disjoin with a concomitant *opposition*. Add to this, that the *adversative* are *definite*; the *simple indefinite*. Thus, when we say, *the number three is not an even number*, BUT *an odd*; we not only *disjoin* two opposite attributes, but we *definitely* affirm one, and deny the other. But when we say, *the number of the stars is* EITHER *even* OR *odd*; though we assert one attribute *to be*, and the other *not to be*, yet the alternative is notwithstanding left *indefinite*.

As to *adversative disjunctives*, it has been already said, that they imply OPPOSITION. Now, there can be no opposition of the *same* attribute in the *same* subject; as when we say, *Nereus was beautiful*: but the opposition must be either of the *same* attribute in different subjects, as when we say, "*Brutus* was a *patriot*, BUT *Cæsar* was not;" or of *different* attributes in the *same* subject, as when we say, "*Gorgius* was a *sophist*, BUT not a *philosopher*;" or of *different* attributes in *different* subjects, as when we say, "*Plato* was a *philosopher*, BUT *Hippias* was a *sophist*." The conjunctions used for all these purposes may be called *absolute* adversatives.

But there are *other* adversatives besides these; as when we say, "*Nereus* was more beautiful THAN *Achilles*;—*Virgil* was AS great a *poet* AS *Cicero* was an *orator*." The character of these latter is, that they go farther than the former, by marking not only *opposition*, but that *equality* or *excess* which arises from the comparison of subjects; and therefore they may be called *adversatives of comparison*.

Besides the adversatives here mentioned, there are two other species, of which the most eminent are UNLESS and ALTHOUGH: For example, "*Troy* will be taken, UNLESS the *Palladium* be preserved; *Troy* will be taken, ALTHOUGH *Hector* defend it." The nature of these adversatives may be thus explained. As every *event* is naturally allied to its *cause*, so, by parity of reason, it is opposed to its *preventive*; and as every cause is either *adequate* or *inadequate*, (inadequate, when it endeavours, without being effectual), so in like manner is every *preventive*. Now, *adequate* preventives are expressed by such adversatives—as UNLESS: "*Troy* will be taken, UNLESS the *Palladium* be preserved;" that is, that this alone is *sufficient* to prevent it. The *inadequate* are expressed by such adversatives as ALTHOUGH: "*Troy* will be taken, ALTHOUGH *Hector* defend it;" that is, *Hector*'s defence will prove *ineffectual*. These may be called adversatives ADEQUATE and INADEQUATE.

Before we leave this subject, we may observe, that the words *when* and *where*, and all others of the same nature, such as *whence*, *whether*, *whenever*, *where-ever*, *&c.* may be called ADVERBIAL conjunctions; because they participate the nature both of adverbs and conjunctions; of *conjunctions*, as they *conjoin* sentences; of *adverbs*, as they denote the attributes either of *time* or *place*. And these *adverbial* conjunctions (contrary to the character of *accessary* words, which have strictly no signification but when associated with other words) have a kind of *obscure* signification when taken alone, by denoting these attributives of time and place. And hence it is, that they appear in grammar like *zoophytes* in nature, a kind of middle beings, of amphibious character, which, by sharing the attributes of the higher and the lower, conduce to link the whole together.

Section II. *Of those* Connectives, *called* PREPOSITIONS.

A PREPOSITION *is a part speech devoid itself of signification, but so formed as to unite two words that are significant and that refuse to coalesce of themselves.* This connective power (which relates to words only, and not to sentences) will be better understood by the following observations.

Some things naturally coalesce and unite of *themselves*, while others refuse to do so *without help*, and as it were by compulsion. For example, all quantities and qualities coalesce immediately with their substances: thus it is we say, *a fierce lion*, *a vast mountain*, &c. In like manner actions coalesce with their agents, and passions with their patients: thus it is we say, *Alexander conquers*, *Darius is conquered*. Nay, as every energy is a kind of medium between its agent and patient, the whole three, agent, energy, and patient, coalesce with the same facility; as when we say, *Alexander conquers Darius*. Farther than this, as the greatest part of attributives themselves may be characterised, as when we say of such attributives as *ran*, *beautiful*, *learned*, &c. "he ran *swiftly*, she was *very* beautiful, he was *moderately* learned," *&c.* these must readily coalesce with the attributes which they thus characterise. From all which it appears, that *those parts of speech unite of themselves in grammar whose original archetypes unite of themselves in nature*. Hence, therefore, it is, that although substances naturally coincide with their attributes, yet they absolutely refuse doing so one with another: and hence those known maxims in physics, that *body is impenetrable*, that *two bodies cannot possess the same place*, &c.

From these principles it follows, that when we form a sentence, the substance without difficulty coincides with the verb, from the natural coincidence of substance with energy; *the* SUN WARMETH: so likewise the energy with the subject on which it operates; WARMETH *the* EARTH: so likewise both substance and energy with their proper attributes; *the* SPLENDID SUN GENIALLY WARMETH *the* FERTILE EARTH. But suppose we are to add other substantives, as, for instance, *air*, or *beams*; how could these coincide, or under what character be introduced? not either as the *energizer* of the verb, nor as *the subject on which it operates*; for both of these places are already filled up, the first by the word SUN, and the last by the substance EARTH: not as *attributes* to these last, or to any other thing; for attributes by nature

ture they neither *are* nor *can be made*. Here, then, we perceive the rise and use of *prepositions*: by these we connect those substantives to sentences, which, at the time, are unable to *coalesce of themselves*. Let us assume, for instance, a pair of these connectives, THROUGH and WITH, and mark their effect upon the substances here mentioned; *the splendid sun* WITH *his beams genially warmeth* THROUGH *the air the fertile earth*: the sentence, as before, remains entire and one; the substantives required are both introduced, and not a word which was there before is displaced from its proper station.

It must be here observed, that *most* if not *all* prepositions seem originally formed to denote the relations of *place*; because this is that grand *relation* which *bodies* or *natural substances* maintain at all times to one another, whether they are contiguous or remote, whether in motion or at rest: thus we have prepositions to denote the *contiguous relation of body*; as when we say, *Caius walked* WITH *a staff*; *the statue stood* UPON *a pedestal*; *the river ran* OVER *a precipice*: others for the *detached relation*; as when we say, *he is going* TO *Italy*; *the sun is risen* ABOVE *the hills*; *these figs came* FROM *Turkey*: So as to *motion* and *rest*; only with this difference, that here the preposition varies its character with the verb: thus if we say, *that lamp hangs* FROM *the ceiling*, the preposition FROM assumes the character of *quiescence*: but if we say, *that lamp is falling* FROM *the ceiling*, the preposition assumes a character of *motion*. So in Milton;

——*To support uneasy steps*
OVER *the burning marle*——

Again,

——*He with looks of cordial love*
Hung OVER *her enamour'd.*——

In the first of these examples, OVER denotes *motion*, and in the last it denotes *rest*.

But though the original use of prepositions was to denote the relations of *place*, they could not be confined to this office only; but by degrees extended themselves to subjects *incorporeal*, and came to denote relations as well *intellectual* as *local*. Thus because, in *place*, he who is *above* has commonly the advantage of him who is *below*, we transfer OVER and UNDER to *dominion* and *obedience*: of a king we say, *he ruled* OVER *his people*; of a common soldier, *he served* UNDER *such a general*: so too we say, WITH *thought*; WITHOUT *attention*; *thinking* OVER *a subject*; UNDER *anxiety*; FROM *fear*; OUT OF *love*; THROUGH *jealousy*, &c. All which instances, with many of the like kind, shew, that the *first words* of men, like their *first ideas*, had an immediate reference to *sensible objects*; and that, in after days, when they began to discern with their *intellect*, they took these words which they found already made, and transferred them, by *metaphor*, to *intellectual conceptions*. There is indeed no method to express new ideas, but either by *metaphor*, or by *coining new words*; both which have been practised by philosophers, according to the nature and exigence of the occasion.

In the foregoing use of prepositions, we have seen how they are employed by way of *juxta-position*; that is to say, where they are prefixed to a word without becoming a part of it: but they may be also used by way of *composition*; that is, they may be prefixed to a word so as to become a part of it: thus, to UNDER*stand*, to FORE*tell*, to OVER*act*, to UNDER*value*, to OUT*go*, &c. are so many distinct words formed by prepositions joined intimately with some other word: in all which cases, the prepositions commonly transfuse something of their own meaning into the word with which they are compounded; and this imparted meaning, in most instances, will be found resolvable into some of the relations of *place*, as used either in its *proper* or *metaphorical* acceptation.

BESIDES the above parts of speech, there is another, which cannot be comprehended under any of the foregoing classes, called INTERJECTIONS: of this kind are the words, AH! ALAS! FIE! *&c.* *This species of words coincide with no part of speech, but are either uttered alone, or else thrown into a sentence, without altering its form either in syntax or signification.* It may be therefore objected, that as we say, that all language is divided into the several parts above enumerated, and this class cannot be comprehended in any of these divisions; of course, the analysis that we have made cannot be just, because it does not comprehend the whole. To this objection it may be answered, that the language of which we have been treating, is that which has been formed by mutual compact, for the purposes of reasoning and speculation; that besides this artificial language, man, like every other sensitive animal, is endowed with a natural language, by which he can express any strong sensation. This language does not owe its characteristical expression to the arbitrary form of articulation; but derives its whole force from the tone of voice, and modification of countenance and gesture: and of consequence these tones and gestures express the same meaning without any relation to the articulation which they may assume, and are therefore universally understood by all mankind. Now, *interjection* is the name by which we distinguish these natural expressions: these cannot be properly called words, or parts of speech; but certain adventitious sounds, or voices of nature, expressing those passions and natural emotions which spontaneously arise in the mind upon the view or narrative of interesting events. We must, therefore, still conclude, that all language properly so called is composed of *words*, all of which may be arranged into the several classes above-mentioned; and as a recapitulation of the whole that we have said, we subjoin the following table, which presents at one view the several classes and subdivisions of words.

GRAMMONT, a town of the Auftrian Netherlands, in the province of Flanders, fituated on the river Dender: E. long. 3° 50′, and N. lat. 50° 55′.

GRAMPOUND, a borough-town of Cornwal, thirty-eight miles fouth-weft of Launcefton: W. long. 5° 25′, and N. lat. 50° 20′. It fends two members to parliament.

GRAMPUS, in ichthyology. See DELPHINUS.

GRANADA, a province of Spain, bounded by Andalufia on the north, by Murfia and the Mediterranean on the eaft, by the fame fea on the fouth, and by Andalufia on the weft.

GRANADA, the capital city of the provine of Granada in Spain, fituated two hundred miles fouth of Madrid: W. long. 3° 40′, and N. lat. 37° 15′.

GRANADA, a province of Terra Firma, in South America, bounded on the north by the provinces of Carthagena and St Martha, on the eaft by Zeneguela, by Popoyan on the fouth, and by Darien on the weft.

GRANADA, a city of Mexico, in North America, fituated on the fide of the lake Nicaragua: W. long. 89°, and N. lat. 11° 8′.

GRANADA is alfo the moft foutherly of the Caribbee-iflands, fituated one hundred and fifty miles fouth-weft of Barbadoes: W. long. 61° 30′, and N lat. 12° 15.

GRANADIER, a foldier armed with a fword, a firelock, a bayonet, and a pouch full of hand-granadoes. They wear high caps, are generally the talleft and brifkeft fellows, and are always the firft upon all attacks.

Every battalion of foot has generally a company of granadiers belonging to it, or elfe four or five granadiers belong to each company of the battalion; which, on occafion, are drawn out, and form a company of themfelves. Thefe always take the right of the battalion.

GRANADILLA. See PASSIFLORA.

GRANADILLOS, fome of the Caribbee-iflands, fituated between the ifland of St Vincent and Granada; but fo inconfiderable, that no nation has thought them worth poffeffing.

GRANADO, a hollow ball or fhell, of iron or other metal, about two inches and a half in diameter; which, being filled with fine powder, is fet on fire by means of a fmall fufee, faftened to the touch-hole, made of the fame compofition as that of a bomb: as foon as the fire enters the fhell, it burft into many pieces, much to the damage of all that ftand near.

GRANARY, a building to lay or ftore corn in, efpecially that defigned to be kept a confiderable time.

Sir Henry Wotton advifes, to make it look towards the north, becaufe that quarter is the cooleft and moft temperate. Mr Worlidge obferves, that the beft granaries are built of brick, with quarters of timber wrought in the infide, to which the boards may be nailed, with which the infide of the granary muft be lined fo clofe to the bricks, that there may not be any room left for vermin to fhelter themfelves. There may be many ftories one above another, which fhould be near the one to the other; becaufe the fhallower the corn lies, it is the better, and more eafily turned.

GRAND JURY, in Englifh law, is the jury who find bills of indictment before juftices of peace and goal-delivery, or of oyer and terminer, *&c.* againft any offenders that may be tried for the fact.

GRANDE, a branch of the river Niger in Africa, which difcharges itfelf into the Atlantic ocean, in 15° W. long. and 11° N. lat.

GRANDE, is alfo a river of Brafil, in the province of Del Rey, in South America, which difcharges itfelf into the Atlantic ocean, in 51° W. long. and 32° S. lat.

GRANDEE, a defignation given to a nobleman of Spain or Portugal.

The grandees are fuffered to be covered before the king, who treats them like princes, ftyling them Illuftrious, in his letters; and in fpeaking to them, or of them, they are ftyled Eminences.

GRANDENTZ, or GRAUDENTZ, a city of Poland, forty-two miles fouth of Dantzick: E. long. 19°, and N. lat. 53° 30′.

GRANDPRE, a town of Champaign, in France, thirty miles eaft of Rheims: E. long. 4° 56′, and N. lat. 49° 18′.

GRANICUS, a little river near the Hellefpont, in the Leffer Afia, where Alexander fought the firft battle with the forces of Darius.

GRANITE, in natural hiftory, a diftinct genus of ftones, compofed of feparate and very large concretions rudely compacted together; of great hardnefs, giving fire with fteel, not fermenting with acids, and flowly and imperfectly calcinable in a great fire.

Of this genus there are three fpecies: 1. The hard white granite, with black fpots, commonly called moor-ftone: this is a very valuable kind, confifting of a beautiful congeries of very varioufly conftructed and differently coloured particles, not diffufed among or running in one another, but each pure and diftinct, though firmly adhering to whichever of the others it comes in contact with, and forming a very firm mafs: it is much ufed in London for the fteps of public buildings, and on other occafions where great ftrength and hardnefs are required. 2. The hard red granite, variegated with black and white, and common in Egypt and Arabia. 3. The pale whitifh granite, variegated with black and yellow. This is fometimes found in ftrata, but more frequently in loofe nodules, and is ufed for paving the ftreets.

GRANIVOROUS, an appellation given to animals which feed on corn or feeds. Thefe are principally of the bird-kind.

GRANT, in law, a conveyance in writing of fuch things as cannot pafs or be conveyed by word only; fuch are rents, reverfions, fervices, *&c.*

GRANTHAM, a borough-town of Lincolnfhire, twenty-two miles fouth of Lincoln. It fends two members to parliament.

GRANVILLE, a port-town of Normandy, from whence the noble family of Carteret take the title of earl.

GRANULATED, fomething that has undergone granulation. See the next article.

GRANULATION, according to Cramer, is the reducing

cing metals to ſmall particles, in order to promote their fuſion and mixture with other bodies.

GRAPE, the fruit of the vine. See VINE.

GRAPHOMETER, a mathematical inſtrument, otherwiſe called a ſemi-circle, the uſe of which is to obſerve any angle whoſe vertex is at the centre of the inſtrument in any plane (though it is moſt commonly horizontal, or nearly ſo), and to find how many degrees it contains. See GEOMETRY, p. 696. and Plate XCV. fig. 14.

GRAPNELS, a ſort of anchors with four flooks, ſerving for boats to ride by.

There is alſo a kind called fire and chain grapnels, made with four barbed claws inſtead of flooks, and uſed to catch hold of the enemy's rigging, or any other part, in order for boarding them.

GRASS, in botany, &c. a name given to ſeveral diſtinct plants; as, the agroſtis, or couch graſs; the briza, or quaking-graſs, &c. Under the term graſs are alſo comprehended all manner of herbaceous plants ſerving for the food of cattle, as clover, ryegraſs, &c.

GRASSHOPPER, in zoology. See GRYLLUS.

GRATIOLA, in botany, a genus of the diandria monogynia claſs. The corolla is irregular; the capſule has two cells; and the calix conſiſts of ſeven leaves. There are four ſpecies, noneof them natives of Britain.

GRATZ, a city of Germany, and capital of the duchy of Stiria, ſixty-five miles ſouth of Vienna: E. long. 15° 55′, and N. lat 47° 20′.

GRAVE, in muſic, is applied to a ſound, which is of a low or deep tone.

GRAVE, in geography, a ſtrong city of the Netherlands, in the province of Dutch Brabant, eight miles ſouth of Nimeguen: E. long. 5° 45′, N. lat. 51° 50′.

GRAVEL, in natural hiſtory and gardening, a congeries of pebbles, which, mixed with a ſtiff loam, makes laſting and elegant gravel walks; an ornament peculiar to our gardens, and which gives them the advantage over thoſe of other nations.

GRAVEL, in medicine. See MEDICINE.

GRAVESEND, a port-town of Kent, ſituated on the ſouthern ſhore of the river Thames, twenty miles eaſt of London.

GRAVINA, a city and biſhop's ſee of the kingdom of Naples, twenty-ſeven miles ſouth-weſt of Barri: E. long. 17°, and N. lat. 41°.

GRAVITATION. See MECHANICS.

GRAVITY. See MECHANICS.

Specific GRAVITY. See HYDROSTATICS.

GRAY, in geography, a city of Franche Compte in France, twenty-two miles north-weſt of Beſançon: E. long. 5° 32′, N lat. 47° 30′.

GREASE, a ſwelling and gourdineſs of the legs of a horſe. See FARRIERY.

GREECE, the preſent Rumelia, and the ancient Hellas, is ſituated between 20° and 26° E. long and between 36° and 44° N. lat.

It reaches from the Adriatic ſea eaſtward to the Archipelago, and is generally a healthy and fruitful country.

GREEK, or GRECIAN, any thing belonging to ancient Greece.

The Greek language, as preſerved in the writings of the celebrated authors of antiquity, as Homer, Heſiod, Demoſthenes, Ariſtotle, Plato, Xenophon, &c. has a great variety of terms and expreſſions, ſuitable to the genius and occaſions of a polite and learned people, who had a taſte for arts and ſciences.

GREEK BIBLE. See BIBLE.

GREEK CHURCH. See CHURCH.

GREEK MONKS and NUNS, of whatever order, conſider St Baſil as their founder and common father, and eſteem it the higheſt crime to deviate in the leaſt from his conſtitutions. There are ſeveral beautiful convents with churches, in which the monks perform divine ſervice day and night. Some of the monks are cœnobites, or live together, wear the ſame habit, eat at the ſame table, and purſue the ſame exerciſes and employments.

GREEN, one of the original colours, exhibited by the rays of light. See OPTICS.

GREEN, among painters. See BOTANY, p. 634.

Gamboge will give five or ſix ſorts of green with verdigreaſe. But the yellow, which ſome prefer before all others, is made of French berries; which is either deeper or fainter, according as the liquor is more or leſs ſtained by them. In like manner, a yellow, drawn from the roots of the barberry or mulberry, will anſwer the ſame purpoſe, being mixed with tranſparent verdigreaſe. As to verdigreaſe itſelf, it produces a fine bluiſh green, flows readily in the pencil, and may even ſerve as an ink to write with; but is ſubject to decay. Mountain-green is uſed for a graſs colour. Verditer is a light green, ſeldom uſed but to colour landſkips that ſeem afar off. Sap-green is dark and dirty, and therefore never uſed but to ſhadow over greens in the darkeſt places. Copper-green is an excellent tranſparent and ſhining graſs-green, if thickened in the ſun ſhine, or over a gentle fire. It is the moſt uſed of any green in waſhing of prints or maps.

GREEN-CLOTH, a board, or court of juſtice, held in the compting-houſe of the king's houſhold, compoſed of the lord ſteward, and officers under him, who ſit daily. To this court is committed the charge and overſight of the king's houſhold in matters of juſtice and government, with a power to correct all offenders, and to maintain the peace of the verge, or juriſdiction of the court royal; which is every way about two hundred yards from the laſt gate of the palace where his majeſty reſides.

It takes its name, *board of green cloth*, from a green cloth ſpread over the board where they ſit.

Without a warrant firſt obtained from this court, none of the king's ſervants can be arreſted for debt.

Clerks of the GREEN CLOTH, are two officers of the board of green-cloth, who appoint the diet of the king and his houſhold; and keep all records, ledgers and papers relating thereto; make up bills, parcels and debentures for ſalaries, and proviſions and neceſſaries for the officers of the pantry, buttery, cellar, &c.

They

They alſo wait upon foreign princes when entertained by his majeſty.

Green finch, in ornithology, the Engliſh name of the greeniſh fringilla, with the wings and tail variegated with yellow. See Fringilla.

GREEN-HOUSE, or conſervatory, a houſe in a garden contrived for ſheltering and preſerving the moſt tender and curious exotic plants, which, in our climate, will not bear to be expoſed to the open air during the winter ſeaſon. Theſe are generally large and beautiful ſtructures, equally ornamental and uſeful.

GREENLAND, or *Weſt* Greenland, extends from the meridian of London to 50° W. long. and from 60° to 80° N. lat.

The Danes have ſome colonies here, and pretend to the property of the whole. However, the Dutch make very free with the fiſhery on this coaſt, notwithſtanding the repreſentations and even menaces of the Danes on that head.

GREENWICH, a town of Kent, ſituated on the ſouthern ſhore of the Thames, five miles eaſt of London; remarkable for its royal and magnificent hoſpital, erected for decayed or diſabled ſeamen who have ſerved their country, and for its palace and moſt delightful park.

On the top of a ſteep hill in the park, ſtands the royal obſervatory, built by Charles II. and furniſhed with all manner of inſtruments for aſtronomical obſervations, and a deep dry well for obſerving the ſtars by day.

GREGARIOUS, among zoologiſts, a term applied to ſuch animals as do not live ſolitary, but in herds, flocks, or coveys.

GREGORIAN calendar, that which ſhews the new and full moon, with the time of Eaſter, and the moveable feaſts depending thereon, by means of epacts, diſpoſed through the ſeveral months of the Gregorian year. See Astronomy, p. 490.

Gregorian year. See Astronomy, p. 490.

GRENOBLE, a city of France, capital of Dauphiny, forty-five miles ſouth-eaſt of Lyons, and thirty-ſix miles ſouth-weſt of Chamberry: E. long. 5° 28′, and N. lat. 45° 12′.

GRENOCK, or Greenock, a port-town of Scotland, near the mouth of the river Clyde; being the principal ſtation for the herring-fiſhery.

GREWIA, in botany, a genus of the gynandria polyandria claſs. The calix conſiſts of five leaves; the petals are five; at the baſe of each petal there is a nectariferous ſcale; and the berry has four cells. There are two ſpecies, none of them natives of Britain.

GREY, or Gray, a mixed colour partaking of the two extremes, black and white.

GRIFFON, in heraldry, an imaginary animal, feigned by the ancients to be half eagle and half lion; by this form they intended to give an idea of ſtrength and ſwiftneſs joined together, with an extraordinary vigilance in guarding the things intruſted to its care. Thus the heathen naturaliſts perſuaded the ignorant, that gold mines were guarded by theſe creatures with incredible watchfulneſs and reſolution.

GRIMPERG, a city of Germany, in the circle of the Lower Rhine, and earldom of Triers: E. long. 6° 35′, N lat. 49° 40′.

GRIMSBY, a borough and port-town of Lincolnſhire, ſituated at the mouth of the Humber: E. long. 4′, N. lat. 53° 34′. It ſends two members to parliament.

GRINDING, the reducing hard ſubſtances to fine powders.

Method of Grinding *optic glaſſes*. Mr Huygens directs, in general, to make the breadth of the concave tool, plate, diſh, or form, in which an object-glaſs muſt be ground, almoſt three times the breadth of the glaſs. Though in another place he ſpeaks of grinding a glaſs whoſe focal diſtance was 200 feet, and breadth 8¼ inches, in a plate only fifteen inches broad. But for eye-glaſſes, and others of leſſer ſpheres, the tools muſt be broader in proportion to the breadth of theſe glaſſes, to afford room enough for the motion of the hand in poliſhing. Mr Huygens made his tools of copper, or of caſt braſs, which, for fear they ſhould change their figure by bending, can hardly be caſt too thick: however, he found by experience, that a tool fourteen inches broad, and half an inch thick, was ſtrong enough for the forming glaſſes to a ſphere of thirty-ſix feet diameter; when the tool was ſtrongly cemented upon a cylindrical ſtone an inch thick, with hard cement made of pitch and aſhes.

In order to make moulds for caſting ſuch tools as are pretty much concave, he directs, that wooden patterns ſhould be turned in a lathe, a little thicker and broader than the tools themſelves; but for tools that belong to ſpheres above twenty or thirty feet diameter, he ſays it is ſufficient to make uſe of flat boards turned circular to the breadth and thickneſs required. When the plates are caſt, they muſt be turned in a lathe exactly to the concavity required; and for this purpoſe it is requiſite to make a couple of braſs gages in the manner following, according to the directions of Mr Molyneux.

Take a wooden pole, a little longer than the radius of the ſpherical ſurface of the glaſs to be formed; and through the ends of it ſtrike two ſmall ſteel points, at a diſtance from each other equal to the radius of the ſphere intended; and by one of the points hang up the pole againſt a wall, ſo that this upper point may have a circular motion in a hole or ſocket made of braſs or iron, fixt firmly to the wall. Then take two equal plates of braſs or copper, well hammered and ſmoothed, whoſe length is ſomewhat more than the breadth of the tool of caſt braſs, whoſe thickneſs may be about a tenth or a twelfth of an inch, and whoſe breadth may be two or three inches. Then having faſtened theſe plates flat againſt the wall in a horizontal poſition, with the moveable point in the pole, ſtrike a true arch upon each of them. Then file away the braſs on one ſide exactly to the arch ſtruck, ſo as to make one of the braſs edges convex, and the other concave; and to make the arches correſpond more exactly, fix one of the plates flat upon a table, and grind the other againſt it with emery. Theſe are the gages to be made uſe of in turning the braſs tools exactly to the ſphere required.

GRINDSTEAD, or *East* GRINDSTEAD, a borough-town of Suffex, twenty-four miles directly fouth of London, which fends two members to parliament.

GRIPSWALD, a town of Germany, in the circle of Upper Saxony, and province of Swedifh Pomerania, fituated on a bay of the Baltic fea: E. long. 13° 40′, N. lat. 54° 15′.

GRISONS, allies of Switzerland; their country is almoft of a circular form, about fixty miles over every way, and is bounded on the north by Tyrol and part of Switzerland; on the eaft, by Tyrol and Trent; on the fouth, by Italy; and by the Swifs cantons on the weft.

GRIST, in country-affairs, denotes corn-ground, or ready for grinding.

GROATS, in country-affairs, oats after the hulls are off, or great oat-meal.

GROCERS, anciently were fuch perfons as engroffed all merchandize that was vendible; but now they are incorporated, and make one of the companies of the city of London, which deals in fugar, foreign fruits, fpices, *&c.*

GROENLAND, or SPITZBERGEN, a cold miferable country without inhabitants, and with very few animals or vegetables, fituated between 10° and 30° E. long. and between 77° and 82° N. lat.

GROGRAM, a kind of ftuff, made of filk and mohair.

GRONINGEN, the capital of a province of the fame name, which makes one of the feven united provinces: E. long. 6° 40′, N. lat. 53° 20′.

GRONOVIA, in botany, a genus of the pentandria monogynia clafs. The petals are five, inferted along with the ftamina into a bell-fhaped calix; and the berry is dry, contains one feed, and fituate below the flower. There is but one fpecies.

GROOM, a name particularly applied to feveral fuperior officers belonging to the king's houfehold, as groom of the chamber, groom of the ftole. See STOLE, and WARDROBE.

GROOM is more particularly ufed for a fervant appointed to attend on horfes in the ftable.

GROOVE, among miners, is the fhaft or pit funk into the earth, fometimes in the vein, and fometimes not.

GROOVE, among joiners, the channel made by their plough in the edge of a moulding, ftyle, or rail, to put their pannels in, in wainfcotting.

GROSS-BEAK, in ornithology. See LOXIA.

GROSSULARIA. See RIBES.

GROTESQUE, or GROTESK, in fculpture and painting, fomething whimfical, extravagant, and monftrous; confifting either of things that are merely imaginary, and have no exiftence in nature; or of things fo diftorted, as to raife furprize and ridicule.

GROTSKA, a city of Silefia, and capital of a duchy of the fame name, thirty miles fouth of Breflaw: E. long. 17°, N. lat. 50° 40′.

GROTTO, a large deep cavern or den in a mountain or rock.

Of thefe we find feveral remarkable ones in different parts of the world. The moft celebrated one of our own country, is that called Ookley-hole, on the fouth fide of Mendip hills. Its length is about two hundred yards, and its height various; being in fome places very low, and in others eight fathoms. There is another at Puzzoli, about four leagues from Naples, called the Dog's Grotto; becaufe a dog thrown into it is immediately killed, by a deftructive vapour equally fatal to all animals within its reach. The milky grotto, *crypta lactea*, about a mile from the ancient village of Bethlehem, is faid to have been thus called from the holy virgin's letting fall fome drops of her milk in it; on which account the earth of this cavern has been fuppofed to poffefs the virtue of reftoring womens milk.

GROTTO is alfo ufed for a fmall artificial edifice made in a garden, in imitation of a natural grotto.

The outfides of thefe grottos are ufually adorned with ruftic architecture, and their infide with fhell-work, coral, *&c.* and alfo furnifhed with various fountains, and other ornaments.

The following is recommended as a good cement for grotto-work. Take two parts of white rofin, melt it clear, add to it four parts of bees-wax; when melted together, add fome flower of the ftone you defign to cement, two or three parts, or fo much as will give the cement the colour of the ftone; to this add one part of the flower of fulphur: firft incorporate all together over a gentle fire, and afterwards knead it with your hands in warm water. With this faften the ftones, fhells, *&c.* after they are well dried, and warmed before the fire.

GROVE, in gardening, a fmall wood impervious to the rays of the fun.

Groves are not only great ornaments to gardens, but are alfo the greateft relief againft the violent heats of the fun, affording fhade to walk under in the hotteft parts of the day, when the other parts of the garden are ufelefs.

GROUND, in agriculture, is much the fame with earth or foil. See AGRICULTURE, p. 50.

GROUND-IVY, in botany. See GLECHOMA.

GROUND-PINE, in botany. See TEUCRIUM.

GROUP, in painting and fculpture, is an affemblage of two or more figures of men, beafts, fruits, or the like, which have fome apparent relation to each other.

GROUSE, or GROWSE. See TETRAO.

GRUBS, in medicine, certain unctuous pimples arifing in different parts of the face, but chiefly in the alæ of the nofe.

GRUBBING, in agriculture, the digging or pulling up the ftubs and roots of trees.

GRUBENHAGEN, a town and caftle of Lower Saxony, and duchy of Brunfwic, remarkable for its mines of filver, copper, iron, and lead: E. long. 9° 36′, and N. lat. 51° 45′.

GRUME, in medicine, denotes a concreted clot of blood, milk, or other fubftance. Hence grumous blood is that which approaches to the nature of grume, and by its vifcidity, and ftagnating in the capillary veffels, produces feveral diforders.

GRUMOSE *roots*, fuch as are knotty, and faftened to one head, like thofe of celandine and anemonies.

GRUS, in ichthyology. See ARDEA.

GRYLLUS, in zoology, the name of the cricket and locust kind, which, together with the grasshoppers, make only one genus of insects, belonging to the order of hemiptera: the characters of which are these: the antennæ are setaceous and filiform; the exterior wings are membranaceous, narrow, and have much of the appearance of the wings of some of the fly kind; the thorax is compressed and angulated; and the legs are formed for leaping. There are no less than 64 species. See Plate LXXXVI. fig. 3. 4. 5.

GRYPHITES, in natural history, an English CROW'S STONE, an oblong fossile shell, very narrow at the head, and becoming gradually wider to the extremity, where it ends in a circular limb; the head or beak of this is very hooked or bent inward.

GUADALAJARA, a city of Mexico, in North America, and the capital of Guadalajara, or New Galicia: W. long 108°, and N. lat. 20° 45′.

GUADALAVIAR, a river of Spain, which rises in the province of Arragon, and runs south-east through the province of Valencia, falling into the Mediterranean a little below the city of Valencia.

GUADALAXARA, a city of Spain, in the province of New Castile, twenty eight miles north-west of Madrid: W long. 2° 50′, and N. lat. 40° 40′.

GUADALUPE, one of the largest of the Caribbee-islands, eighty miles north of Martinico, subject to France: W. long. 61°, and N. lat. 16° 30′.

GUADIANA, a river of Spain, which rises in the middle of New Castile, and running through Estremadura, enters Portugal; where, passing through the provinces of Alentejo and Algarva, it discharges itself into the Atlantic ocean.

GUADILBARBAR, a river of Africa, which rises in the mountains of Atlas, runs through the kingdom of Tunis, and falls into the Mediterranean sea near Bona.

GUADILQUIVIR, a river of Spain, which rises in the mountains of Segura in New Castile, runs the whole length of Andalusia, and passing by Cordova and Seville falls into the Atlantic ocean at St Lucar.

GUADIX, a city of Spain, in the province of Granada: W. long 3°, and N. lat. 37° 15′.

GUAJACUM, in botany, a genus of the decandria-monogynia class. The calix consists of five unequal segments; the petals are five, and inserted into the calix; and the capsule is angular, and has from three to five cells. There are three species, all natives of the Indies.

The wood is very ponderous, of a close compact texture; the outer part is of a yellow colour. the heart of a deep blackish green, or variegated with black, green, pale, and brown colours: the bark is thin, smooth, externally of a dark greyish hue: both have a lightly aromatic, bitterish, pungent taste; the bark is somewhat the weakest. The resin (which exsudes from incisions made in the trunk of the tree) is brought to us in irregular masses, usually friable, of a dusky greenish, and sometimes of a reddish cast, with pieces of the wood among them: its taste is more acrid and pungent than that of the wood or bark.

Their general virtues are those of a warm, stimulating medicine: they strengthen the stomach and other viscera; and remarkably promote the urinary and cuticular discharge: hence in cutaneous defedations, and other disorders proceeding from obstructions of the excretory glands, and where sluggish serous humours abound, they are eminently useful: rheumatic and other pains have often been relieved by them. The resin is the most active of these drugs; and the efficacy of the others depends upon the quantity of this part contained in them: the resin is extracted from the wood in part by watery liquors, but much more perfectly by spiritous ones; the watery extract of this wood, kept in the shops, proves not only less in quantity, but considerably weaker than one made with spirit. This last extract is of the same quality with the native resin, and differs from that brought to us only in being purer. The gum, or extracts, are given from a few grains to a scruple or half a dram; which last dose proves for the most part considerably purgative.

GUALEOR, a city of the Hither India, and the capital of the province of Gualeor, situated forty miles south of Agra: E. long. 79°, and N. lat. 26°.

GUAM, the chief of the Ladrone-islands, in the Pacific ocean: E long. 140°, and N. lat. 14°.

GUANIHANI, or St SALVADOR, now called Catt-island, one of the Bahama islands in the Atlantic ocean, in North America: W. long. 76°, N. lat. 24°.

GUANUCO, a town of Peru, in South America, one hundred and eighty miles north-east of Lima: W. lon. 75° 15′, and S. lat. 10°.

GUARANTY, in matters of polity, the engagement of mediatorial or neutral states, whereby they plight their faith, that certain treaties shall be inviolably observed, or that they will make war against the aggressor.

GUARD, in a general sense, signifies the defence or preservation of any thing; the act of observing what passes, in order to prevent surprize; or the care, precaution, and attention, we make use of, to prevent any thing happening contrary to our intention or inclinations.

GUARD, in the military art, is a duty performed by a body of men, to secure an army or place from being surprised by an enemy.

Advanced GUARD, is a party of either horse or foot, that marches before a more considerable body, to give notice of any approaching danger.

Artillery GUARD, is a detachment from the army, to secure the artillery: their corps de garde is in the front, and their centries round the park. This is a forty-eight-hours guard: and upon a march, they go in the front and rear of the artillery, and must be sure to leave nothing behind; if a gun or waggon break down, the captain is to leave a part of his guard to assist the gunners and matrosses in getting it up again.

Corps de GARDE, are soldiers entrusted with the guard of a post, under the command of one or more officers.

Forrage-GUARD, a detachment sent out to secure the forragers, which are posted at all places, where either the enemy's party may come to disturb the forragers, or where they may be spread too near the enemy, so as

es to be in danger of being taken. They confift both of horfe and foot, and muft ftay at their pofts till the forragers all come off the ground.

Grand GUARD, three or four fquadrons of horfe, commanded by a field officer, pofted at about a mile and a half from the camp, on the right and left wings, towards the enemy, for the fecurity of the camp.

Main GUARD, that from whence all the other guards are detached.

Picquet-GUARD, a good number of horfe and foot always in readinefs in cafe of an alarm: the horfe are all the time faddled, and the riders booted. The foot draw up at the head of the battalion, at the beating of the tattoo; but afterwards return to their tents, where they hold themfelves in readinefs to march, upon any fudden alarm. This guard is to make refiftance, in cafe of an attack, till the army can get ready.

Quarter-GUARD, a fmall guard, commanded by a fubaltern officer, pofted by each battalion, about an hundred yards before the front of the regiment.

Rear-GUARD, that part of the army which brings up the rear, which is generally the old grand-guards of the camp. The rear-guard of a party is fix or eight horfe, that march about four or five hundred paces behind the party. The advanced-guard of a party on its going out, make the rear-guard on its return.

Standard-GUARD, a fmall guard, under a corporal, out of each regiment of horfe, and placed on foot, in the front of each regiment.

Van GUARD, that part of the army which marches in the front.

GUARD is more particularly underftood of a foldier detached from a company or corps,, to protect, detain, or fecure any perfon, *&c.*

GUARDS, are alfo troops kept to guard the king's perfon, called alfo royal-guards, life-guards, gardes du corps, *&c.* Thefe are diftinguifhed into horfe, foot, granadiers, and yeomen.

The Englifh horfe-guards are diftinguifhed by troops, and the foot-guards by regiments.

Yeomen of the GUARDS. See YEOMAN.

The French GUARDS are divided into thofe within, and thofe without the palace: the firft confifts of the guards du corps, or body-guard, which confifts of four companies of horfe, the firft of which companies was anciently Scotch, and ftill retains the name, though it now confifts wholly of Frenchmen. The guards without, are the gens d'armes, light horfe, mufqueteers, and two other regiments, the one of which is French and the other Swifs. See GENDARMES.

GUARD, in fencing, is a pofture proper to defend the body from an enemy's fword.

GUARDIAN, in law, a perfon who has the charge of any thing; but more commonly it fignifies one who has the cuftody and education of fuch perfons as have not fufficient difcretion to take care of themfelves and their own affairs, as children and ideots.

GUBEN, a town of Germany, in the circle of Upper Saxony: E. long. 15°, and N. lat. 51° 50′.

GUDGEON, in ichthyology. See GOBIUS.

GUENGA, a great river of the Hither India, which rifing in the mountains of Balagate, runs north-eaft, and falls into the weft branch of the river Ganges in Bengal.

GUERET, a town of France, in the province of Lionois: E. long 2°, and north lat. 46° 5′.

GUERNSEY, or GARNSEY, an ifland in the Englifh channel, on the coaft of Normandy, fifty-eight miles fouth of Portland, in Dorfetfhire, and twenty two weft of cape la Hogue, in Normandy; about ten miles long and as many broad. containing ten parifhes. The natives, who fpeak French, are ftill governed by the Norman laws, but are fubject to England.

GUIAQUIL, a city and port-town of Peru, fituated near the Pacific ocean: W. long. 80°, and S. lat. 3°.

GUIARA, a port-town on the Caracoa-coaft, in Terra Firma, in South America: W. long. 66°, and N. lat. 10° 35′.

GUIDON, a fort of flag or ftandard, borne by the king's life-guards; being broad at one extreme, and almoft pointed at the other, and flit or divided into two.

GUIDON, alfo denotes the officer who bears the guidon. He is the fame in the horfe-guards that the enfign is in the foot. The guidon of a troop of horfe takes place next below a cornet.

GUIENNE, a province of France, bounded by the Orleannois on the north, by Gafcony, from which it is feparated by the river Garonne, on the fouth, by Languedoc on the eaft, and by the bay of Bifcay on the weft.

GUILANDINA, in botany, a genus of the decandria monogynia clafs. The calix confifts of one leaf; the petals are inferted into the neck of the calix; and the capfule is angular, and contains from three to fix cells. There are five fpecies, none of them natives of Britain.

GUILD, a fraternity or company. As to the original of thefe guilds or companies, it was a law among the Saxons, that every freeman of fourteen years of age fhould find fureties to keep the peace, or be committed; upon which the neighbours enter into an affociation, and become bound for each other, either to produce him who committed any offence, or to make fatisfaction to the injured party; in order to which they raifed a fum among themfelves, which they put into a common ftock; out of which they, upon occafion, made a pecuniary compenfation according to the quality of the offence committed. Thefe guilds are now companies joined together with laws and orders made by themfelves, by the licence of the prince.

Dean of Guild, in Scots law, a magiftrate of a royal borough, who is head of the merchant-company. See SCOTS LAW, title 4.

GUILDFORD, or GULDEFORD, a borough-town of Surry, fituated on the river Wye, thirty miles fouth-weft of London. It fends two members to parliament.

GUILLESTRE, a city of France, in the province of Dauphiny: E. long. 6° 20′, and N. lat. 44° 45′.

GUINEA, a large country of Africa. fituated between 15° E. and 15° W. long. and between 4° and 10° N. lat.

lat. The British, Dutch, French, and other nations, have forts and factories on this coast.

GUINEA is also the name of a British gold coin, value 1 l. 1 s. Sterling.

GUINEA-PIG, in zoology. See MUS.

GUIPUSCOA, the north-east division of the province of Biscay, in Spain, situated on the confines of Navarre in France.

GUIRA, or GUARA GUAINUMBI, in ornithology, the Brasilian name of the green ispida, with a crested head and very long tail.

GUISE, a town of France, in the province of Picardy, situated on the river Oyse: E. long $3^{\circ} 36'$, and N. lat. $49^{\circ} 55'$.

GUITAR, GUITARRA, a musical instrument of the string-kind, with five double rows of strings, of which those that are bass are in the middle, unless it be for the burden, an octave lower than the fourth.

This instrument was first used in Spain, and by the Italians.

GULA, or GOLA, in architecture, a wavy member, the contour of which resembles the letter S, which the Greeks call cymatium, and our architects an ogee. See ARCHITECTURE.

GULES, in heraldry signifies the colour red, which is expressed in engraving by perpendicular lines falling from the top of the eschutcheon to the bottom. See Plate CI. fig. 6.

It is the first of all colours in armory, and was formerly prohibited to be worn by any person in his coat-armour, unless he were a prince, or had a permission from him. This colour is a symbol of charity, valour, and generosity, and represents blood colour, and true scarlet.

The Romans, according to Spelman, painted the bodies of their gods, and generals that triumphed, with vermilion; and under the consuls, their soldiers were clad in red; hence called russati. And we are told, that the Lacedemonians wore scarlet, to prevent seeing the blood issue from their wounds. Those who bear this colour are obliged to relieve such as are in danger of being oppressed by injustice.

GULL. See LARUS.

GULPH, or GULF, in geography, a part of the sea, almost surrounded by lands, the gulph of Mexico, gulph of Venice, of Lyons, *&c.*

GUM, in pharmacy, a concreted vegetable juice, which transudes through the bark of certain trees, and hardens upon the surface.

GUM ARABIC. See *Gum* ARABIC.

GUM SENECA, is a gum extremely resembling gum arabic. It is brought to us from the country through which the river Senega runs, in loose or single drops, but these are much larger than those of the gum arabic usually are; sometimes it is of the bigness of an egg, and sometimes much larger: the surface is very rough, or wrinkled, and appears much less bright than the inner substance, where the masses are broken. It has no smell, and scarce any taste. We are not acquainted with the tree which produces it. The virtues of it are the same with the gum arabic; but it is rarely used in medicine, unless as mixed with the gum arabic: the dyers and other artificers consume the great quantities of it that are annually imported here. The negroes dissolve it in milk, and in that state make it a principal ingredient in many of their dishes; and often feed on it thus alone.

GUM TRAGACANTH. See TRAGACANTH.

GUM MANNA. See MANNA.

Other substances known by the name of gums, are as follow.

GUM ALOES, a preparation of aloes, as set down in the London Dispensatory.

It is made thus: Take of succotrine aloes, four ounces; of water, a quart: boil the aloes till it is dissolved as much as may be; and set all by for a night: the resin will be precipitated to the bottom of the vessel; the liquor poured off and strained, being evaporated, will have the gum. The intention of this separation of the resin, is to procure, in the gum, a medicine less purgative, but more agreeable to the stomach, than the crude aloes.

GUM AMMONIAC. See AMMONIAC.

GUM ELEMI. See ELEMI.

GUM GUAIACUM. See GUAIACUM.

GUM LACCA. See LACCA.

GUMS, in anatomy, See ANATOMY, p. 305.

GUN, a fire arm, or weapon of offence, which forcibly discharges a ball, shot, or other offensive matter, thro' a cylindrical barrel, by means of gun-powder. See GUN-POWDER.

Gun is a general name, under which are included divers or even most species of fire-arms. They may be divided into great and small.

Great guns, called also by the general name cannons, make what we also call ordinance, or artillery; under which come the several sorts of cannons, as cannon-royal, demi-cannon, *&c.* Culverins, demi-culverins, sakers, minions, falcons, *&c.* See CANNON.

Small guns include musquets, musquetoons, carabines, blunderbusses, fowling-pieces, *&c.* See MUSQUET, *&c.*

Pistols and mortars are almost the only sort of regular weapons, charged with gun-powder, that are excepted from the denomination of guns. See PISTOL and MORTAR.

The advantage of large guns, or cannons, over those of a smaller bore, is generally acknowledged. Robins observes, that this advantages arises from several circumstances, particularly in distant cannonading. The distance to which larger bullets fly with the same proportion of powder, exceeds the flight of the smaller ones, almost in proportion to their diameters; so that a thirty two pound shot, for instance, being somewhat more than six inches in diameter, and a nine pound shot but four inches; the thirty-two pound will fly near half as far again as that of nine pound, if both pieces are so elevated as to range to the farthest distance possible. Another and more important advantage of heavy bullets is, that with the same velocity they break holes in all solid bodies, in a greater proportion than their weight.

weight. Finally, large cannons, by carrying the weight of their bullet in grape or lead-ſhot, may annoy the enemy more effectually than could be done by ten times the number of ſmall pieces. See GUNNERY.

The author here quoted, has propoſed to change the fabric of all the pieces employed in the Britiſh navy, from the twenty four pounders downwards, ſo that they may have the ſame or leſs weight, but a larger bore. He thinks the thirty-two pounders in preſent uſe would be proper models for this purpoſe. Theſe being of fifty-two or fifty-three hundred weight, have ſomewhat leſs than a hundred and two thirds for each pound of bullet. And that this proportion would anſwer in ſmaller pieces, in point of ſtrength, ſeems clear from theſe conſiderations: 1. That the ſtrength of iron or any other metal, is in proportion to its ſubſtance. 2. That the leſſer quantity of powder fired in a ſpace it fills, has proportionably leſs force than a larger quantity; ſo that if two pieces, a large and a ſmall one, be made in the ſame proportion to their reſpective bullets, and fired with a proportionable quantity of powder, the larger piece will be more ſtrained, will heat more, and recoil more than the ſmaller.

On this ſcheme our preſent twenty-four pounders will be eaſed of ſix or eight hundred weight of uſeleſs metal; and ſome pieces of a leſs caliber, as nine and ſix pounders, would be ſometimes eaſed by fourteen hundred: hence much larger guns of the ſame weight might be borne. Thus, inſtead of ſix, nine, twelve, and eighteen pounders, our ſhips might carry twelve, eighteen, and twenty-four pounders: guns would be kept cooler and quieter, and would be of more ſervice, in many reſpects, if their uſual charge of powder were diminiſhed.

GUNELLUS, in ichthyology. See BLENNIUS.

GUNNER, an officer appointed for the ſervice of the cannon; or one ſkilled to fire the guns.

In the tower of London, and other garriſons, as well as in the field, this officer carries a field-ſtaff, and a large powder-horn in a ſtring over his left ſhoulder: he marches by the guns; and when there is any apprehenſion of danger, his field-ſtaff is armed with match: his buſineſs is to lay the gun to paſs, and to help to load and traverſe her.

Maſter-GUNNER, a patent-officer of the ordnance, who is appointed to teach all ſuch as learn the art of gunnery, and to certify to the maſter general the ability of any perſon recommended to be one of the king's gunners. To every ſcholar he adminiſters an oath, not to ſerve, without leave, any other prince or ſtate; or teach any one the art of gunnery, but ſuch as have taken the ſaid oath.

GUNNERY, is the art of charging, directing, and exploding fire-arms, as cannons, mortars, muſkets, *&c.* to the beſt advantage.

To the ART of GUNNERY belongs the knowledge of the force and effects of gun-powder, (ſee GUN POWDER), the dimenſions of cannon, *&c.* and the proportion of the powder and ball they carry, with the method of *managing*, *charging*, *pointing*, *ſpunging*, &c.

A cannon is a military engine, or fire-arm, for throwing iron, lead, or ſtone bullets, by force of gun-powder, to a place exactly oppoſite to the axis of the cylinder whereof it conſiſts.

Cannons are made cylindrical, that the motion of the ball might not be retarded in its paſſage; and that the powder, when on fire, might not ſlip between the ball and the ſurface of the cannon, which would hinder its effect. With regard to the names, dimenſions, weight, *&c.* of cannons, ſee CANNON.

Each ſort of ordnance is more or leſs fortified; which fortification is reckoned by the thickneſs of the metal at the touch-hole, at the trunnions, and at the muzzle, in proportion to the diameter of the bore.

There are three degrees uſed in fortifying each ſort of ordnance, both cannons and culverines: Firſt, ſuch as are ordinarily fortified, which are called legitimate pieces; ſecondly, ſuch whoſe fortifications are leſſened, which are called baſtard pieces; thirdly, double fortified pieces, or extraordinary pieces.

The cannons double fortified have full one diameter of their bore in thickneſs of metal at their touch-hole, and $\frac{11}{16}$ at their trunnions, and $\frac{7}{8}$ at their muzzle. The leſſened cannons have, at their touch-hole, but $\frac{3}{4}$ or $\frac{11}{16}$ of the diameter of their bore in thickneſs of metal, and $\frac{9}{16}$ at their trunnions, and $\frac{5}{16}$ at their muzzle. The ordinary fortified cannons, have $\frac{7}{8}$ at the touch hole, $\frac{5}{8}$ at the trunnions, and $\frac{3}{8}$ at the muzzle. All the double fortified culverines, and all leſſer pieces of that kind, have one diameter and $\frac{1}{8}$ at the touch-hole, $\frac{15}{16}$ at the trunnions, and $\frac{9}{16}$ at the muzzle. And all the ordinary fortified culverines, are fortified every way as the double fortified cannons; and the leſſened culverines, as the ordinary cannons in all points.

With regard to bullets, or balls, wherewith cannons are loaded, they are of various kinds, *viz.* 1. Red-hot bullets, intended to ſet fire to places, where combuſtible matters are found. The bullet is made red-hot, by digging a place in the earth, and lighting in it a great quantity of charcoal, or ſea coal, and placing over it a ſtrong iron grate. When the fire is well lighted, the bullets are placed on the grate, where, in a very ſhort time, they grow red hot; they are taken out with tongs, or iron ladles for the purpoſe, and carried into the piece; having before put ſome clay over the powder the cannon is loaded with, leſt it ſhould be ſet on fire by the red hot bullet: then the piece is fired. Where-ever the bullet paſſes, and meets with combuſtible matters, it ſets them on fire. But when a trench is before the battery of red-hot bullets, hay is rammed over the powder; becauſe, if it was clay, the pieces of it would wound and kill the workmen.

Red-hot bullets are never fired but with eight or four pounders. For if they were of a ſtronger caliber, the bullets could not be ſerved eaſily.

2. Hollow bullets are ſhells made cylindrical, with an aperture and fuſee at one end, which giving fire to the inſide, when in the ground, it burſts, and has the ſame effect with a mine.

3. Chain-bullets confift of two balls joined by a chain, three or four foot a-part.

4. Branch bullets are two balls joined by a bar of iron, five or fix inches a-part.

5. Two-headed bullets, called alfo angels, being two halves of a bullet, joined by a bar or chain: thefe are chiefly ufed at fea, for cutting of cords, cables, fails, *&c.*

As bullets, as well as the pieces of ordnance, are of different caliber, which caliber, in a piece of ordnance, is the diameter of the mouth thereof; and in a bullet, its circumference; there are means found to proportion thefe two calibers to one another, *viz.* with an inftrument called a caliber-rule, wherein a right line is fo divided, as that the firft part being equal to the diameter of an iron or leaden ball of one pound weight, the other parts are to the firft, as the diameters of balls of two, three, four, *&c.* pounds, are to the diameter of one ball of one pound.

The caliber confifts of two thin pieces of brafs, fix inches long, joined by a rivet, fo as to move quite round each other: the head, or one end of the piece, is cut circular, and one half of its circumference divided into every fecond degree. On the other half are divifions from one to ten; each again fubdivided into four: the ufe of which divifions and fubdivifions, is when the diameter of a bullet, *&c.* not exceeding ten inches, is taken, the diameter of the femicircle will, among the divifions, give the length of the diameter, taken between the points of the calibers, in inches and fourth parts.

The degrees on the head ferve to take the quantity of an angle, the method of which is obvious. If the angle be inward, apply the outward edges to the planes that form the angle; the degree cut by the diameter of the femicircle, fhews the quantity of the angle fought. For an outward angle, open the branches till the points be outward, and applying the ftreight edges to the planes that form the angle, the degrees cut by the diameter of the femicircle fhew the angle required; reckoning from 180, towards the right hand.

On one branch of the calibers, on the fame fide, are, firft, fix inches; and each of thefe fubdivided into ten parts. Secondly, a fcale of unequal divifions, beginning at two and ending at ten, each fubdivided into four parts. Thirdly, two other fcales of lines, fhewing, when the diameter of the bore of a piece is taken with the points of the calibers outwards, the name of the piece, whether of the iron or brafs, *i. e.* the weight of the bullet it carries, or that it is fuch or fuch a pounder, from one to forty-two pounds.

On the other branch of the calibers, on the fame fide, is a line of cords to about three inches radius; and a line of lines on both branches, as on the fector; with a table of the names of the feveral pieces of ordnance. On the fame face is a hand graved, and a right line drawn from the finger towards the centre of the rivet, fhewing, by its cutting certain divifions made on the circle, the weight of an iron fhot, when the diameter is taken by the points of the calibers. Laftly, on the circle or head, on the fame fide, are graved feveral geometrical figures, infcribed in each other, with numbers; as a cube, whofe fide is fuppofed one foot; a pyramid on the fame bafe or altitude, and the proportions of their weight, *&c.* a fphere infcribed in a cube; a cylinder, cone, circle, fquare, *&c.*

The outfide of the caliber ferves to take the diameter of the mouth of the piece; and the infide, called the heel, that of the bullet.

There is another method of taking the caliber of the pieces, which is to have a rule very well divided, on which are graved the calibers both of the pieces and bullets. That rule muft be applied on the mouth of the piece, and the caliber is prefently found.

Sometimes, in lieu of bullets, the pieces are charged with cartouches, which are cafes loaded with mufket-balls, nails, chains, and pieces of old iron; fometimes, alfo, with fmall cannon-balls. See Plate XCVIII.

There are cartouches made in form of grapes, which are mufket-balls joined together with pitch, and difpofed on a fmall board, in a pyramidal form round a wooden ftick, which arifes from the middle of the board. (*ibid.*)

The cartouches made of tin are the beft, becaufe they carry further.

There are alfo cartouches made in form of pine apples, whofe figure is pyramidal. Their bafe is equal to the caliber of a bullet, propofed for the piece they are to be fired with; their height is of a caliber and a half; they are dipped in tar, and afterwards rolled on mufket-balls, and when well covered with thofe balls, dipped again in the fame tar, after which they may be ufed, thrufting the biggeft foremoft into the piece. Thefe pine-apples are very good at fea, becaufe, befides that the mufket-balls flying about wound a great number of people, the bullet which is at the bottom of the cartouch does alfo much execution.

There are feveral forts of carriages for ordnance, *viz.* baftard carriages, with low wheels, and high wheels. Sea-carriages, made in imitation of thofe for fhip guns: and carriages for field-pieces, of which there are two kinds.

The carriages muft be proportioned to the pieces mounted on them.—The ordinary proportion is, for the carriage to have $1\frac{1}{2}$ of the length of the gun; the wheels to be half the length of the piece in height; four times the diameter or caliber, gives the depth of the planks the fore end, in the middle $3\frac{1}{2}$.

The piece thus mounted on its carriage, feveral inftruments are employed, fome to prepare the piece to be loaded, fome to load it, others to point it, and others to cleanfe it, *&c.* Thofe inftruments have each their proper name, which are as follows:

The lantern or ladle (*ibid.*) which ferves to carry the powder into the piece, and which confifts of two parts. *viz.* of a wooden box, appropriated to the caliber of the piece for which it is intended, and of a caliber and a half in length with its vent; and of a piece of copper nailed to the box, at the height of a half caliber.

This lantern muft have three calibers and a half in length, and two calibers in breadth, being rounded at the end to load the ordinary pieces.

The rammer, (*ibid.*) which is a round piece of wood, commonly called a box, faftened to a ftick twelve foot long,

long, for the pieces from twelve to thirty three pounders; and ten for the eight and four pounders; which serve to drive home the powder and ball to the breech.

The spunge, (*ibid.*) which is a long staff or rammer, with a piece of sheep or lamb skin wound about its end, to serve for scouring the cannon when discharged, before it be charged with fresh powder; to prevent any spark of fire from remaining in her, which would endanger the life of him who should load her again.

Wad-screw, (*ibid.*) which are two points of iron turned serpent-wise, to extract the wad out of the pieces, when one wants to unload them, or the dirt which had chanced to enter into it.

The botefeux, (*ibid.*) which are sticks two or three feet long, and an inch thick, split at one end, to hold an end of the match twisted round it, to fire the cannon.

The priming iron, (*ibid.*) which is a pointed iron rod, to clear the touch hole of the pieces of powder or dirt; and also to peirce the cartridge, that it may sooner take fire.

The primer, (*ibid.*) which must contain a pound of powder at least, to prime the pieces.

The quoin of mire, which are pieces of wood with a notch on the side to put the fingers on, to draw them back or push them forward, when the gunner points his piece. They are placed on the sole of the carriage.

Leaden plates, which are used to cover the touch-hole, when the piece is charged, lest some dirt should enter it and stop it.

Before you charge the piece, spunge it well, to clean it of all filth and dirt within-side; then the proper weight of gunpowder, which powder drive in and ram down; taking care that the powder be not bruised in ramming, which weakens its effect; run over it a little quantity of paper, hay, or the like; and then throw in the ball.

To point, level, or direct the piece, so as to play against any certain point, is done by the help of a quadrant with a plummet; which quadrant consists of two branches made of brass or wood; one about a foot long, eight lines broad, and one line in thickness; the other four inches long, and the same thickness and breadth as the former. Between these branches is a quadrant, divided into 90 degrees, beginning from the shorter branch, and furnished with thread and plummet.

Place the longest branch of this instrument in the cannon's mouth, and elevate or lower it till the thread cuts the degree necessary to hit the proposed object. Which done, prime the cannon, and then set fire to it.

To point a cannon well, so as to do the execution proposed, we must know the path of a bullet, or the line it describes, from the mouth of the piece to the point where it lodges, which path is commonly called range.

If the piece be laid in a line parallel to the horizon, it is called the right or level range; and if it be mounted to 45 degrees, the ball is said to have the utmost range, and so proportionably; all others between 00 degrees and 45, being called intermediate ranges.

A shot made when the muzzle of a cannon its raised above the horizontal line, and is not designed to shoot directly or point blank, is called random-shot.

The utmost random of any piece is about ten times as far as the bullet will go point blank; and the bullet will go farthest when the piece is mounted to about 45 degrees above the level range.

Mr Norton observes, that

	Paces. *Level.*	Paces. *Utmost Random.*
A *Base* shoots ——	60	600
A *Rabinet*, —— —	70	700
A *Falconet*, — —	90	900
A *Falcon*, — —	120	1300
Minion ordinary —	120	1200
Minion largest, ——	125	1250
Sacker least, — —	150	1500
Sacker ordinary, —	160	1600
Sacker old sort, — —	163	1630
Demi-culverine least,	174	1740
Demi-culverine ordinary,	175	1750
Demi-culverine old sort,	178	1780
Culverine least, ——	180	1800
Culverine ordinary, —	181	1810
Culverine largest, ——	183	1830
Demi-cannon least, —	156	1560
Demi-cannon ordinary,	162	1620
Demi-cannon large, —	180	1800
Cannon-royal, ——	185	1850

A 24 pounder may very well fire 90 or 100 shots, every day in summer; at 60 or 75 in winter. In case of necessity, it may fire more And some French officers of artillery assure, that they have caused such a piece to fire every day 150 shots in a siege.

A 16 and a 12 pounder fire a little more, because they are easier served. There have even been some occasions, where 200 shots have been fired from these pieces, in the space of nine hours, and 138 in the space of five.

To range pieces in a battery, take care to reconoitre well the ground where it is to be placed, and the road to convey it, in the night time, the cannon and the munitions.

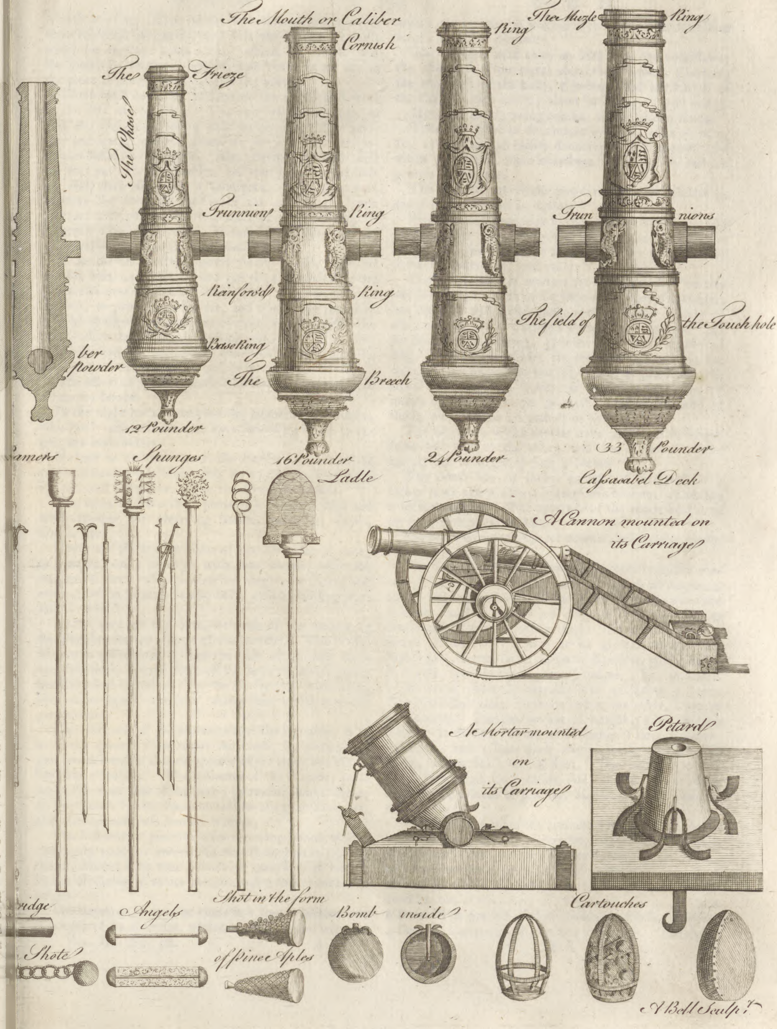
The pieces must be armed, each with two lanterns, or ladles, a rammer, a spunge, and two priming irons. The battery must also be provided with carriages, and other implements, necessary to remount the pieces which the enemy should chance to dismount.

To serve expeditiously and safely a piece in battery, it is necessary to have to each a sack of leather, large enough to contain about twenty pounds of powder to charge the lanterns or ladles, without carrying them to the magazine; and to avoid thereby making those trains of powder in bringing back the lantern from the magazine, and the accidents which frequently happen thereby.

A battery of 3 pieces must have 30 gabions, because six are employed on each of the two sides or epaulments, which make twelve, and nine for each of the two merlons.

There ought to be two gunners and six soldiers to each piece, and four officers of artillery.

The gunner, posted on the right of the piece, must take care to have always a pouch full of powder, and two priming-irons; his office is to prime the piece, and load


The Mouth or Caliber
Cornish
The Frieze
The Chase
The Muzle Ring
Ring
Trunnion
Ring
Trun nions
Reinforc'd
Ring
The field of the Touch hole
Base Ring
ber
powder
The Breech
12 Pounder
16 Pounder
24 Pounder
33 Pounder
Cassacabel Deck
amers
Spunges
Ladle
A Cannon mounted on its Carriage
A Mortar mounted on its Carriage
Petard
ridge
Angels
Shot in the form of Pine Aples
Bomb
inside
Cartouches
Shote
A Bell Sculp.t

it with powder. That on the left fetches the powder from the little magazine, and fills the lantern or ladle which his comrade holds; after which, he minds that the match be very well lighted, and ready to set fire to the piece at the first command of the officer.

There must be three soldiers on the right, and three on the left of the piece. The two first to take care to ram and spunge the piece, each on his side. The rammer and spunge must be placed on the left, and the lantern or ladle on the right. After having rammed well the wad put over the powder, and that put over the bullet, they then take each a handspike, which they pass between the foremost spokes of the wheel, the ends whereof will pass under the head of the carriage, to make the wheel turn round, leaning on the other end of the handspike, towards the embrasure.

It is the office of the second soldier on the right, to provide wad, and to put it into the piece, as well over the powder as over the bullet; and that of his comrade on the left, to provide 50 bullets, and every time the piece is to be charged, to fetch one of them and put it into the piece, after the powder has been rammed. Then they both take each an handspike, which they pass under the hind part of the wheel, to push it in battery.

The officer of artillery must take care to have the piece diligently served.

In the night he must employ the gunners and soldiers, who shall relieve those who have served 24 hours to repair the embrasures.

If there be no water near the battery, care must be taken to have a cask filled with it, to dip the spunges in it, and cool the pieces, every ten or twelve rounds.

The MORTAR is a short piece of ordnance, thick and wide, proper for throwing bombs, carcasses, shells, stones, *&c.*

There are chiefly two kinds of mortars: the one hung or mounted on a carriage with low wheels, after the manner of guns, called *pendent* or *hanging mortars*; the other fixed on an immoveable base, called *standing mortars*. (*ibid.*)

At the head of the bore, or chase of the mortar, is the chamber for the charge of the powder. This is usually made cylindrical, all but the base which they make hemispherical: though some of the later engineers prefer hemispherical chambers; as the surface of those being less, under equal capacities, make less resistance to the gun-powder.

The thickness of the mortar about the chamber, is to be much greater than about the chase, by reason the gun-powder makes a much greater effort about the chamber than elsewhere. The diameter of the chamber to be much less than that of the bore; by reason bombs, shells, *&c.* are much lighter than the bullets of equal diameters, and consequently less powder suffices.

The first mortar-piece used for throwing stones, weighs commonly 1000 lb. and whose utmost random is 150 fathoms, loaded with two pounds of powder; it has 15 inches of diameter at its mouth, and 2 foot 7 inches in height.

The depth of its bore or chase is 1 foot 7 inches, and the depth of its chamber, without including the entrance where the tampion is placed, 8 inches. The tourillons have 5 inches of diameter,

The chamber must enter an inch into the tourillons; the thickness of the metal about the chamber, 3 inches; the thickness of the belly, 2 inches; and the length of the chase, 1 inch and $\frac{1}{2}$; about each ring, 1 inch and $\frac{3}{4}$.

Mortars, for throwing bombs, are of several kinds.

There are some in the ancient manner, of 6, 7, 8, 9, 10, 11, 12, and 18 inches diameter at their mouth, and which contain in their chambers 3, 4, 5, 6, and 12 pounds of powder.

The chamber where the powder is put is cylindrical, and a little rounded at bottom.

Those of new invention have a concave chamber. And of these there are some which have 12 inches and $\frac{1}{2}$ at the mouth, and contain in their chambers 18 pounds of powder; others 12, and others 8.

The proportions of mortars are as follow: The mortar which throws a bomb of 17 inches 10 lines of diameter, has the bore $27\frac{1}{2}$ inches long, and 18 inches 4 lines of diameter: it has in thickness between the bourelet, and its small reinforced ring, $3\frac{1}{2}$ inches; its small reinforced ring, is $3\frac{1}{4}$ inches thick; its great one, 4 inches; the entrance of its chamber has $5\frac{1}{2}$ inches of diameter; the chamber, in form of a pear, is 13 inches long, and $7\frac{1}{2}$ inches of diameter at its greatest breadth; and also $7\frac{1}{2}$ thick, and contains 12 pounds of powder.

The tourillons of the mortar have 32 inches in length from one end to the other, and 9 of diameter. The mortar has in height 4 foot 4 inches.

The bomb has 17 inches 10 lines of diameter, is 2 inches thick every where, except the bottom, which has 2 inches 10 lines. The aperture of the touch-hole is of 20 lines within and without.

The bomb contains 48 lb. of powder, and weighs 490 lb. and a little more.

The bore of the concave mortar, whose chamber contains 18 pounds of powder, has $12\frac{1}{2}$ inches of diameter, and is $18\frac{1}{2}$ inches long. It has in thickness between the bourelet, and its reinforced ring, $3\frac{1}{2}$ inches; and its reinforced ring is $4\frac{1}{2}$ inches thick. Its chamber has 9 inches 7 lines of diameter at its greatest width: the higher part thereof has 6 inches of diameter, and 4 inches in height; and its lower part $2\frac{3}{4}$ inches. The thickness of the metal round the chamber is of 26 inches 9 lines. The tourillons have, from one end to the other, 8 inches of diameter. The mortar has in height 3 feet 5 inches 4 lines. It throws a bomb of 11 inches 8 lines diameter, which is 1 inch 4 lines thick every where, except at its cullot, which has 1 inch 8 lines. The aperture of its touch hole is 16 lines inside and outside. The bomb contains 15 pounds of powder, and weighs 130 pounds, or thereabout.

The bore or chase of the concave mortar, whose chamber contains 12 pounds of powder, has 12 inches 6 lines of diameter, and 17 inches 6 lines in length. Its thickness between the bourelet and its reinforced ring, is of $2\frac{1}{2}$ inches. Its reinforced ring is 3 inches thick. Its chamber has of diameter, at its greatest width, 9 inches 6 lines. The portion of that chamber a-top has 5 inches 4 lines of diameter, and 2 inches at bottom. The thick-

nefs of the metal round the chamber is 6 inches. The tourillons are, from one end to the other, 30 inches long, and 7 inches of diameter; and the mortar is in all 3 foot 2 inches high.

It throws a bomb 11 inches 8 lines of diameter, which is 1 inch 4 lines thick every where, except at its cullot, which has 1 inch 8 lines.

The aperture of its touch-hole outfide and infide, is 16 lines.

The bomb contains 15 pounds of powder, and weighs 130.

The mortar, which has a concave chamber containing 8 pounds of powder, muft throw a bomb of 11 inches 8 lines. Its diameter is of $12\frac{1}{2}$ inches; its bore 18 inches long; its thicknefs at the chafe $2\frac{1}{4}$ inches; its reinforced ring 6 inches long, and 3 inches thick; its concave chamber 8 inches 8 lines long, and 7 inches in diameter; the thicknefs of the metal round it 5 inches; its tourillons 3 inches long from one end to the other, and 7 inches in diameter. The concave chamber contains 8 pounds of powder, and throws a bomb as above.

The ordinary mortar, which throws a bomb of 11 inches 8 lines, has a bore of 12 inches diameter, and 18 long; its thicknefs at the neck 2 inches; at its reinforced ring $2\frac{1}{2}$ inches; its chamber $9\frac{1}{2}$ inches in length, its diameter of $5\frac{1}{4}$ inches, the thicknefs of the metal round the chamber 7 inches, which chamber contains 6 pounds of powder; the tourillons have in length, from one end to the other, 28 inches, and 8 inches of diameter.

The mortar, which throws a bomb of 8 inches, has the bore 12 inches long, and 8 inches 4 lines in diameter; its thicknefs 1 inch 4 lines at the chafe; its reinforced rings 4 inches 8 lines long, and 1 inch 8 lines thick; its chamber 6 inches long, and 2 inches 8 lines of diameter; its tourillons 18 inches 8 lines in length, and 4 inches 8 lines of diameter. The bomb of 8 inches of diameter is 10 lines thick every where, except at the cullot, which is 13, and its touch-hole 1 inch of diameter infide and outfide. The chamber contains 4 pounds of powder, and the bomb weighs 40 pounds.

The bore of the mortar, which is to throw a bomb of 6 inches, is of $6\frac{1}{4}$ inches of diameter, and 9 inches long; its thicknefs at the chafe 1 inch; its reinforced ring $1\frac{1}{4}$ inch thick, and $3\frac{1}{2}$ inches long; its chamber $4\frac{1}{2}$ inches long, and 2 inches of diameter; the thicknefs of the metal 2 inches, and from the bottom of the chamber to behind the recoil of the mortar 4 inches thick.

Common mortars are very good for the bombardment of a place, when they can be carried near the place; throwing the bomb to 45 degrees of elevation, and to 700 fathoms diftance: the chamber is charged with 5 or 6 pounds of powder, which is the greateft charge, and carries farther: the nearer a place a mortar is mounted, the lefs powder is wanted for its charge. The mortars, with a concave chamber of the fame diameter, *i. e.* of 12 and $12\frac{1}{2}$ inches, pointed at 45 degrees, are proper to bombard places afar off; they carry their bombs from 1200 to 1800 fathoms. Thofe whofe chamber contains 8 pounds of powder, throw the bomb to 1200 fathoms, and weigh 2000 lb. Thofe of 12 pounds of powder will carry their bombs to 1400 fathoms, and weigh 2500 lb. Thofe of 18 pounds of powder will carry to 1800 fathoms, and weigh 5000 lb.

The carriage for a mortar of 12 inches of diameter muft be 6 foot long, the flafks 12 inches long and 10 thick. The trunnions are placed in the middle of the carriage.

The carriage of 18 muft be 4 foot long; and the flafks 11 inches high, and 6 thick.

To mount the mortars of new invention, they ufe carriages of caft iron.

In Germany, to mount mortars from 8 to 9 inches, and carry them into the field, and execute them horizontally as a piece of cannon, they make ufe of a piece of wood 8 feet 2 inches long, with a hole in the middle to lodge the body of the mortar and its trunnions as far as their half diameter, and mounted on two wheels four feet high, to which they join a vantrain proportioned to it, and made like thofe which ferve to the carriages of cannons.

Having mounted the mortar on its carriage, the next thing is to caliber the bomb, by means of a great caliber, the two branches whereof embrace the whole circumference of the bomb: thefe two branches are brought on a rule where the different calibers are marked, among which that of the bomb is found.

A bomb is a hollow iron ball, or fhell, filled with gunpowder, and furnifhed with a vent for a fufee or wooden tube filled with combuftible matter to be thrown out from a mortar. The method of preparing a bomb is as follows: A hollow iron globe is caft pretty thick, having a round aperture by which it may be filled and lighted; and circular anfæ for the commodioufly putting it into the mortar. To prove whether it be ftaunch, after heating it red hot on the coals, it is expofed to the air fo as it may cool gently; for, fince fire dilates iron, if there be any hidden chinks or perforations, they will thus be opened and enlarged, and the rather becaufe of the fpring of the included air continually acting from within. This done, the cavity of the globe is filled with hot water, and the aperture well ftopped, and the outer furface wafhed with cold water and foap; fo that if there be the fmalleft leak, the air, rarified by the heat, will now perfpire and form bubbles on the furface.

If no defect be found in the bomb, its cavity is filled, by means of a funnel, with whole gun-powder; a little fpace or liberty is left, that when a fufee or wooden tube, of the figure of a truncated cone, is driven through the aperture, (with a wooden mallet, not an iron one, for fear of accident), and faftened with a cement made of quick-lime, afhes, brick-duft, and fteel-filings worked together in a glutinous water, or of four parts of pitch, two of colophony, one of turpentine, and one of wax; the powder may not be bruifed. This tube is filled with a combuftible matter, made of two ounces of nitre, one of fulphur, and three of gun-powder-duft well rammed.

This fufee fet on fire, burns flowly till it reaches the gun-powder, which goes off at once, burfting the fhell to pieces with incredible violence. Special care, however, muft be taken, that the fufee be fo proportioned, as that

that the gun-powder do not take fire ere the ſhell arrives at the deſtined place; to prevent which, the fuſee is frequently wound round with a wet clammy thread.

The mortar mounted on its carriage, and the bomb ready, let us place our piece in battery, which battery muſt conſiſt,—1. Of an epaulment to ſhelter the mortars from the fire of the enemy. 2. Of platforms on which the mortars are placed. 3. Of ſmall magazines of powder. 4. Of a boyau which leads to the great magazine. 5. Of ways which lead from the battery to the magazine of bombs. 6. Of a great ditch before the epaulment. 7. Of a berm or retraite.

The platforms for mortars of 12 inches muſt have 9 feet in length, and 6 in breadth.—The lambourds for common mortars muſt be four inches thick; thoſe of a concave chamber of 8 lb. of powder, 5 inches; thoſe of 12 lb. 6 inches; thoſe of 18 lb. 7 inches, or thereabouts. Their length is at diſcretion, provided there be enough to make the platforms 9 feet long.—The fore-part of the platform will be ſituated at two foot diſtance from the epaulment of the battery.—The bombardiers, to ſhelter themſelves in their battery, and not be ſeen from the town beſieged, raiſed an epaulment of 7 foot or more high, which epaulment has no embraſures.

To ſerve expeditiouſly a mortar in battery are required, —five ſtrong handſpikes; a dame or rammer, of the caliber of the conic chamber, to ram the wad and the earth; a wooden knife a foot long, to place the earth round the bomb; an iron ſcraper two foot long, one end whereof muſt be 4 inches broad and roundwiſe, to clean the bore and the chamber of the mortar, and the other end made in form of a ſpoon to clean the little chamber; a kind of brancard to carry the bomb, a ſhovel, and pick-ax.

The officer who is to mind the ſervice of the mortar muſt have a quadrant to give the degrees of elevation.

Five bombardiers, or others, are employed in that ſervice; the firſt muſt take care to fetch the powder to charge the chamber of the mortar, putting his priming-iron in the touch-hole before he charges the chamber; and never going to fetch the powder before he has aſked his officer at what quantity of powder he deſigns to charge, becauſe more or leſs powder is wanted, according to the diſtance where it is fired; the ſame will take care to ram the wad and earth, which another ſoldier ſhall put in the chamber.

That on the right will put again two ſhovels full of earth in the bottom of the bore, which ſhould be likewiſe very well rammed down.

This done, the rammer or dame is returned into its place, againſt the epaulment on the right of the mortar: he takes an handſpike in the ſame place to poſt himſelf behind the carriage of the mortar, in order to help to puſh it into battery: having laid down his handſpike, he takes out his priming-iron, and primes the touch-hole with fine powder.

The ſecond ſoldier on the right and left, will have by that time brought the bomb ready loaded, to be placed in the mortar, which muſt be received in the mortar by the firſt ſoldier, and placed very ſtrait in the bore or chaſe of the mortar.

The firſt, on the right, ſhall furniſh him with earth to put round the bomb, which he muſt take care to ram cloſe with the knife given him by the ſecond on the left.

This done, each ſhall take a handſpike, which the two firſt, on the right and left, ſhall put under the pegs of retreat of the fore part, and the two behind under thoſe of the hind-part; and they together ſhall puſh the mortar in battery.

Afterwards the officer ſhall point or direct the mortar.

During that time the firſt ſoldier ſhall take care to prime the touch hole of the mortar, without ramming the powder; and the laſt on the right, ſhall have the match ready to ſet fire on the fuſee of the bomb on the right, while the firſt ſhall be ready with his on the left, to ſet fire to the touch-hole of the mortar; which he ought not to do till he ſees the fuſee well lighted.

The foremoſt ſoldiers will have their handſpikes ready to raiſe the mortar upright, as ſoon as it has diſcharged; while the hindmoſt on the left ſhall, with the ſcraper, clean the bore and chamber of the mortar.

The magazine of powder for the ſervice of the battery, ſhall be ſituated 15 or 20 paces behind, and covered with boards, and earth over it.—The loaded bombs are on the ſide of the ſaid magazine, at five or ſix paces diſtance.

The officer who commands the ſervice of the mortar, muſt take care to diſcover, as much as poſſible, with the eye, the diſtance of the place where he intends to throw his bomb, giving the mortar the degrees of elevation, according to the judgment he has formed of the diſtance. Having thrown the firſt bomb, he muſt diminiſh or increaſe the degrees of elevation, according to the place upon which it ſhall fall. Several make uſe of tables to diſcover the different diſtances according to the differences of the elevations of the mortar, eſpecially the degrees of the quadrant from 1 to 45.

M. Blondel has wrote a large treatiſe on that ſubject, where he pretends to give a demonſtration to throw bombs with great exactneſs.

They ſay then, (ſays M. Blondel, ſpeaking of bombardiers), that the mortar chaſes more or leſs, according as it is more or leſs charged with powder; and that a mortar, for example, of 12 inches caliber, charged in its chamber with 2 lb. of powder, gives every degree 48 feet difference in the random, and for the greateſt extent under the elevation of 45 degrees, 2160 feet.

The ſame mortar will give every degree 50 foot difference, if it be charged with $2\frac{1}{2}$ of the ſame goodneſs, and 2700 foot for the greateſt random.

Laſtly, it will give 72 foot difference every degree, if the charge be of 3 lb. of the ſame powder; and at the elevation of 45 degrees, which, they ſay, is the greateſt random, it will throw the bomb at the diſtance of 3240 feet.

On this foundation they have made the following tables.

TABLES.

TABLES *for* Mortars *of* 12 *inches of* Caliber.

Firſt Table at *two pounds* of *powder.*

Degrees	*Randoms*	*Degrees*	*Randoms*
5	240 *Feet*	28	1344 *Feet*
10	480	29	1392
11	528	30	1440
12	576	31	1488
13	624	32	1536
14	672	33	1584
15	720	34	1632
16	768	35	1680
17	816	36	1728
18	864	37	1776
19	912	38	1824
20	960	39	1872
21	1008	40	1920
22	1056	41	1968
23	1104	42	2016
24	1152	43	2064
25	1200	44	2112
26	1248	45	2160
27	1296		

Note, That the difference is of 48 feet every degree.

Second Table at *two pounds* and *half* of *powder.*

Degrees	*Randoms*	*Degrees*	*Randoms*
36	2160 *Feet*	41	2460 *Feet*
37	2200	42	2520
38	2280	43	2580
39	2340	44	2640
40	2400	45	2700

Note, That the difference is of 60.

Third Table at *three pounds* of *powder.*

Degrees	*Randoms*	*Degrees*	*Randoms*
37	2664 *Feet*	42	3024 *Feet*
38	2736	43	3096
39	2808	44	3168
40	2880	45	3240
41	2952		

The difference is of 72.

TABLES *for* Mortars *of* 8 *inches* Caliber.

Firſt Table at *half pound* of *powder.*

Degrees	*Randoms*	*Degrees*	*Randoms*
5	210 *Feet*	28	1176 *Feet*
10	420	29	1218
11	460	30	1260
12	504	31	1302
13	546	32	1344
14	588	33	1386
15	630	34	1428
16	672	35	1470
17	714	36	1512
18	756	37	1554
19	798	38	1596
20	840	39	1638
21	882	40	1680
22	924	41	1722
23	966	42	1764
24	1008	43	1806
25	1050	44	1848
26	1092	45	1890
27	1134		

The difference is of 42 feet every degree.

Second Table at *three quarters* of a *pound* of *powder.*

Degrees	*Randoms*	*Degrees*	*Randoms*
31	1922 *Feet*	39	2418 *Feet*
32	1984	40	2480
33	2046	41	2542
34	2108	42	2604
35	2170	43	2666
36	2232	44	2728
37	2294	45	2790
38	2356		

The difference is of 62.

Third Table at *one pound* of *powder.*

Degrees	*Randoms*	*Degrees*	*Randoms*
35	2870 *Feet*	41	3362 *Feet*
36	2952	42	3444
37	3034	43	3526
38	3116	44	3608
39	3198	45	3690
40	3280		

Granadoes are charged like the bombs, and are very much like them, except that they have no *anſæ*.

A granado is a hollow ball, or ſhell of iron, braſs, or even glaſs, or potters earth, filled with gun powder, and fitted with a fuſee to give it fire. (*ibid.*)

Of theſe there are two kinds; the one large for ditches, or foſſees, called ſometimes bombs, whoſe caliber is the ſame with that of the bullets of 33 lb. and which weigh 16 lb. of 24, and which weigh 12 lb. of 16, which weigh 8 lb.

Theſe granadoes are rolled from the ramparts, or other works, into the ditch, or on a breach, and do much execution.

The other are hand-granadoes, of the bigneſs or caliber of a bullet of 4 lb. and weigh only 2 lb. containing 4 or 5 ounces of powder, or thereabout.

Theſe ſerve to throw with the hand into the trenches, or retrenchments, in the middle of a troop or company, and they infallibly lame or kill.

Care is taken, as much as poſſible, that they be well emptied, ſhaved, and of brittle iron. Their aperture or orifice muſt have ſix lines, or thereabout.

Small lanterns or ladles of copper, and ſmall rammers, are uſed to charge the granadoes.

As to the proportions of granadoes, thoſe of the caliber of

of a bullet of 33, have 6 inches of diameter, and ſomething more; they are 8 lines thick, and weigh 16 lb.

Thoſe of the caliber of 24 have 5 inches 5 lines diameter, are 6 lines thick, and weigh 12 lb.

Thoſe of the caliber of 16 have 4 inches 9 lines of diameter, are 5 lines thick, and weigh 8 lb.

Thoſe which weigh 6 lb. have 3 inches 5 lines diameter, and 5 lines in thickneſs.

Thoſe of 5 lb. weight have 3 inches $2\frac{1}{4}$ lines diameter, and 5 lines in thickneſs.

Thoſe which weigh 3 lb. have 2 inches 8 lines diameter, and are $4\frac{1}{2}$ lines thick.

Thoſe of 2 lb. weight, have 2 inches 4 lines diameter, and 4 lines in thickneſs.

Thoſe of 1 lb. weight have 1 inch 10 lines diameter, and are 3 lines thick.

Thoſe of $\frac{3}{4}$ have 1 inch 8 lines diameter, and are 3 lines thick.

Thoſe of $\frac{1}{2}$ have 1 inch 6 lines diameter, and are 3 lines thick.

Thoſe of a $\frac{1}{4}$ have 1 inch 2 lines diameter, and are $2\frac{1}{2}$ lines thick.

All theſe granadoes muſt be thicker at bottom than any where elſe.

Theſe different ſorts of granadoes have alſo different ſorts of fuſees.

Thoſe of the caliber of	33	24	16	12	8	4
are at the biggeſt end, of	12 *lin.*	11	$10\frac{1}{2}$	10	$9\frac{1}{2}$	$8\frac{1}{2}$
The diameter of the orifices,	4	4	3	3	3	2
The fuſees are in length, in all, of	$5\frac{1}{2}$ *inch.*	5	4	4	$3\frac{1}{2}$	$2\frac{1}{2}$

And as the large granadoes, which are made to throw into the foſſes, or ditches, or with ſmall mortars, they muſt have fuſees of different lengths; theſe are for ſmall mortars; thoſe for ditches muſt be ſhorter.

The Germans cover over the fuſee with paper or parchment, tied with a thread round the fuſee.

In France they uſe a compoſition of black pitch, mixed with a little tallow, with which they rub over the fuſee, when fixed to the granado.

The fuſee muſt burn ſo long, and no longer, as is the time of the motion of the bomb or granado, from the mouth of the mortar, *&c.* to the place where it is to fall, which time is about 27 ſeconds; ſo that the fuſee muſt be contrived, either from the nature of the compoſition, or the length of the pipe which contains it, to burn juſt that time.

At Paris they charge the fuſees for the bombs and granadoes with a compoſition made with powder-duſt and charcoal, very well pounded, and ſifted very fine, putting two ounces of charcoal on each pound of powder, and make ſeveral proofs, to know if the compoſition be not too quick.

There are ſeveral other compoſitions to charge the fuſees for bombs or granadoes.

The firſt is of 4 lb. of powder, 2 lb. of ſaltpetre, and 1 lb. of ſulphur.

The ſecond is of 5 lb. of powder, 2 lb. of ſaltpetre, and 1 pound of ſulphur.

The third, which is the beſt, is of 3 lb. of powder, 2 lb. of ſaltpetre, and 1 lb. of ſulphur.

The fourth is of 3 lb. of powder, 2 lb. of ſaltpetre, and $\frac{1}{2}$ lb. of ſulphur.

The fuſees muſt be charged even, *i. e.* they muſt burn without ſpitting.

The fuſee of the hand-granado, which is of the caliber of 4, muſt be 2 inches 2 lines long, 9 lines of diameter, and 6 lines at the ſmall end: the orifice of the fuſee $2\frac{1}{2}$ lines.

As ſoon as the fuſee is placed to the granado, the head thereof muſt be ſauced in melted pitch, and afterwards dipped in water, which hinders the compoſition from ſpoiling, and the wood from rotting.

The PETARD, *(ibid.)* is the next piece of artillery which deſerves our attention, and is a kind of engine of metal, ſomewhat in ſhape of a high-crowned hat, ſerving to break down gates, barricades, draw-bridges, or the like works; which are intended to be ſurprized. It is very ſhort, narrow at the breach, and wide at the muzzle, made of copper mixed with a little braſs, or of lead with tin.

The petards are not always of the ſame height and bigneſs: they are commonly 10 inches high, 7 inches of diameter a-top, and 10 inches at bottom. They weigh commonly 40, 45, and 50 pounds.

The madrier, on which the petard is placed, and where it is tied with iron circles, is of two feet for its greateſt width, and of 18 inches on the ſides, and no thicker than a common madrier. Under the madrier are two iron bars paſſed croſs-ways, with a hook, which ſerves to fix the petard.

To charge a petard 15 inches high, and 6 or 7 inches of caliber or diameter at the bore, the inſide muſt be firſt very well cleaned and heated, ſo that the hand may bear the heat; then take the beſt powder that may be found, throw over it ſome ſpirit of wine, and expoſe it to the ſun, or put it in a frying-pan; and when it is well dried, 5 or 6 lb. of this powder is put into the petard, which reaches within three fingers of the mouth: the vacancies are filled with tow, and ſtopped with a wooden tampion; the mouth being ſtrongly bound up with cloth tied very tight with ropes; then it is fixed on the madrier, that has a cavity cut in it to receive the mouth of the petard, and faſtened down with ropes.

Some, inſtead of gun powder for the charge, uſe one of the following compoſitions, *viz.* gun-powder ſeven pounds, mercury ſublimate one ounce, camphor eight ounces; or gun-powder ſix pounds, mercury ſublimate three ounces, and ſulphur three; or gun-powder ſix, beaten glaſs $\frac{1}{2}$ an ounce, and camphor $\frac{3}{4}$.

Before any of theſe pieces are appropriated for ſervice, it is neceſſary to have each undergo a particular trial of its ſoundneſs, which is called a proof, to be made by or before one authoriſed for the purpoſe, called the *proof-maſter*.

To make a proof of the piece, a proper place is choſen, which is to be terminated by a mount of earth very thick to receive the bullets fired againſt it, that none of them may run through it. The piece is laid on the ground,

ſupported only in the middle by a block of wood. It is fired three times: the firſt with powder of the weight of the bullet, and the two others with $\frac{1}{4}$ of the weight; after which a little more powder is put in to ſinge the piece; and after this water, which is impreſſed with a ſpunge, putting the finger on the touch-hole, to diſcover if there be any cracks; which done, they are examined with the cat, which is a piece of iron with three graſps, diſpoſed in the form of a triangle, and of the caliber of the piece; then it is viſited with a wax candle, but it is of very little ſervice in the ſmall pieces, becauſe if they be a little long, the ſmoke extinguiſhes it immediately.

The proof of mortars is made in this manner: Where there are carriages of caſt iron, the mortar is placed on one of thoſe carriages. Under that carriage is made a platform of madriers 5 or 6 inches thick; the mortar is charged with the beſt powder, and with as much of it as its chamber can contain, obſerving to leave no vacuity at the neck of the mortar, but what is neceſſary to put a little wad over the powder, and which is rammed with the end of an handſpike, to keep the powder together as much as poſſible. A large green turf, with earth two fingers deep, is put over the wad, which muſt have width enough to fill up the bottom of the mortar. This turf and earth are very well rammed down, then the bomb is placed over it as upright as poſſible, leaving a ſmall place round it, which is to be filled with clay as tight as poſſible, preſſing it between the mortar and the bomb with a pointed ſtick; and as it is not neceſſary to ſpend much powder in theſe ſort of proofs, the bomb muſt be filled with as much earth as it would contain powder.

For want of carriages of caſt iron, holes are dug in the earth where the mortars are buried as far as the touch-hole; and in order that the mortars thus buried may find more reſiſtance, and make a greater effort, large pieces of wood in form of joiſts are put under the mortar, chuſing always the hardeſt ground, to reſiſt better the recoil of the mortar.

A fuſee for granadoes is put on the touch-hole of each mortar, that the gunner may have time to retire, in caſe the mortar was to burſt in the proof; which is alſo practiſed in the proof of the pieces.

This proof is made three times, without increaſing or diminiſhing any thing.

Beſides the large pieces mentioned throughout this treatiſe, invented for the deſtruction of mankind, there are others called ſmall guns, *viz.* muſkets of ramparts, common muſkets, fuſils, carabines, muſketoons, and piſtols.

A muſket, or muſquet, is a fire-arm borne on the ſhoulder, and uſed in war, formerly fired by the application of a lighted match, but at preſent with a flint and lock.

The common muſkets are of the caliber of 20 leaden balls to the pound, and receive balls from 22 to 24: its length is fixed to 3 feet 8 inches from the muzzle to the touch-pan.

A fuſil, or fire-lock, has the ſame length and caliber; and ſerves at preſent inſtead of a muſket.

A carabine is a ſmall ſort of fire-arm, ſhorter than a fuſil, and carrying a ball of 24 in the pound, borne by the light-horſe, hanging at a belt over the left ſhoulder.

The carabine is a kind of medium between the piſtol and the muſket; and bears a near affinity to the arquebuſs, only that its bore is ſmaller. It was formerly made with a match-lock, but of late only with a flint-lock.

The muſquetoon is of the ſame length of the carabine, the barrel poliſhed, and clean within.

The muſquetoon carries five ounces of iron, or ſeven and a half of lead, with an equal quantity of powder.

The barrel of a piſtol is generally 14 inches long.

As to the invention of cannon and gun powder, we are certain that they are diſcoveries of a modern date: but there is no depending upon the various accounts given of them by authors. All that can be ſaid with certainty is, that there is mention made of gun-powder in the regiſter of the chamber of accounts in France, in the year of Chriſt 1338; that Alphonſus XI. king of Caſtile, beſieged the Moors with iron mortars, in the year of Chriſt 1343; and that our King Edward, in 1346, firſt carried thoſe thundering machines of war and death into France, where he availed himſelf of five or ſix pieces of cannon at the battle of Creſſy.

Before the invention of theſe inſtruments of war, the ancients made uſe of the aries, or battering-ram, the catapultæ, the balliſta, ſcorpion, and teſtudo. See Ram, *&c.*

For the mathematical principles of Gunnery, ſee Projectiles.

GUN-POWDER, a compoſition of ſaltpetre, ſulphur, and charcoal, mixed together, and uſually granulated; which eaſily takes fire, and, when fired, rarifies, or expands, with great vehemence, by means of its elaſtic force.

It is to this powder we owe all the action and effect of guns, ordnance, *&c.* ſo that the modern military art, fortification, *&c.* in a great meaſure depend thereon.

Method of making Gun powder. Dr Shaw's recipe for this purpoſe is as follows. Take four ounces of refined ſaltpetre, an ounce of brimſtone, and ſix drams of ſmall coal: reduce theſe to a fine powder, and continue beating them for ſome time in a ſtone mortar, with a wooden peſtle, wetting the mixture between whiles with water, ſo as to form the whole into an uniform paſte, which is reduced to grains, by paſſing it through a wire ſieve fit for the purpoſe; and in this form being carefully dried, it becomes the common gun-powder.

For greater quantities, mills are uſually provided, by means of which more work may be performed in one day, than a man can do in a hundred.

The nitre or ſaltpetre is refined thus: diſſolve four pounds of rough nitre as it comes to us from the Indies, by boiling it in as much water as will commodiouſly ſuffice for that purpoſe: then let it ſhoot for two or three days in a covered veſſel of earth, with ſticks laid acroſs for the cryſtals to adhere to. Theſe cryſtals being taken out, are drained and dried in the open air.

In order to reduce this ſalt to powder, they diſſolve

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a large quantity of it in as ſmall a proportion of water as poſſible; then keep it conſtantly ſtirring over the fire, till the water exhales, and a white dry powder is left behind.

In order to purify the brimſtone employed, they diſſolve it with a very gentle heat; then ſcum and paſs it through a double ſtrainer. If the brimſtone ſhould happen to take fire in the melting, they have an iron cover that fits on cloſe to the melting veſſel, and damps the flame. The brimſtone is judged to be ſufficiently refined if it melts, without yielding any fetid odour, between two hot iron plates, into a kind of red ſubſtance.

The coal for the making of gun-powder is either that of willow, or hazel, well charred in the uſual manner, and reduced to powder. And thus the ingredients are prepared for making this commodity: but as theſe ingredients require to be intimately mixed, and as there would be danger of their firing if beat in a dry form, the method is to keep them continually moiſt, either with water, urine, or a ſolution of ſal ammoniac: they continue thus ſtamping them together for twenty-four hours, after which the maſs is fit for corning and drying in the ſun, or otherwiſe, ſo as ſeduloully to prevent its firing.

Rationale of GUN-POWDER. The exploſive force of gun-powder is now a thing commonly known, but the phyſical reaſon thereof may not perhaps be hitherto ſufficiently underſtood. In order to explain it, Dr Shaw propoſes the following obſervations: 1. That ſaltpetre of itſelf is not inflammable; and though it melts in the fire, and grows red hot, yet does not explode, unleſs it comes in contact with the coals. 2. That brimſtone eaſily melts at the fire, and eaſily catches flame. 3. That powdered charcoal readily takes fire, even from the ſparks yielded by a flint and ſteel. 4. That if nitre be mixed with powdered charcoal, and brought in contact with the fire, it burns and flames. 5. That if ſulphur be mixed with powdered charcoal, and applied to the fire, part of the ſulphur burns ſlowly away, but not much of the charcoal; and, 6. That if a lighted coal be applied to a mixture of nitre and ſulphur, the ſulphur preſently takes fire with ſome degree of exploſion; leaving part of the nitre behind, as we ſee in making the ſal prunellæ, and ſal polychreſtum.

Theſe experiments duly conſidered, adds the doctor, may give us the chemical cauſe of the ſtrange exploſive force of gun-powder. For each grain of this powder conſiſting of a certain proportion of ſulphur, nitre, and coal, the coal preſently takes fire, upon contact of the ſmalleſt ſpark: at which time both the ſulphur and the nitre immediately melt, and by means of the coal interpoſed between them, burſt into flame; which, ſpreading from grain to grain, propagates the ſame effect almoſt inſtantaneouſly: whence the whole maſs of powder comes to be fired: and as nitre contains both a large proportion of air and water, which are now violently rarified by the heat, a kind of fiery exploſive blaſt is thus produced, wherein the nitre ſeems, by its aqueous and aerial parts, to act as bellows to the other inflammable bodies, ſulphur and coal, to blow them into a flame, and carry off their whole ſubſtance in ſmoke and vapour.

Different kinds of GUN-POWDER. The three ingredients of gun-powder are mixed in various proportions according as the powder is intended for muſkets, great guns, or mortars; though theſe proportions ſeem not to be perfectly adjuſted or ſettled by competent experience.

Semienowitz, for mortars, directs an hundred pounds of ſaltpetre, twenty-five of ſulphur, and as many of charcoal; for great guns, an hundred pounds of ſaltpetre, fifteen pound of ſulphur, and eighteen pound of charcoal; for muſkets and piſtols, an hundred pound of ſaltpetre, eight pound of ſulphur, and ten pound of charcoal. Miethius extols the proportion of one pound of ſaltpetre to three ounces of charcoal, and two, or two and a quarter of ſulphur; than which, he affirms, no gun-powder can poſſibly be ſtronger. He adds, that the uſual practice of making the gun-powder weaker for mortars than guns, is without any foundation, and renders the expence needleſly much greater: for whereas to load a large mortar, twenty-four pound of common powder is required, and conſequently, to load it ten times, two hundred and forty pound, he ſhews, by calculation, that the ſame effect would be had by one hundred and fifty pound of the ſtrong powder.

To increaſe the ſtrength of powder, Dr Shaw thinks it proper to make the grains conſiderably large, and to have it well ſifted from the ſmall duſt. We ſee that gun-powder, reduced to duſt, has little exploſive force; but when the grains are large, the flame of one grain has a ready paſſage to another, ſo that the whole parcel may thus take fire nearly at the ſame time, otherwiſe much force may be loſt, or many of the grains go away as ſhot unfired.

It ſhould alſo ſeem that there are other ways of increaſing the ſtrength of powder, particularly by the mixture of ſalt of tartar; but perhaps, adds the laſt-mentioned author, it were improper to divulge any thing of this kind, as gun-powder ſeems already ſufficiently deſtructive.

Method of trying and examining GUN POWDER. There are two general methods of examining gun-powder; one with regard to its purity, the other with regard to its ſtrength. Its purity is known by laying two or three little heaps near each other upon white paper, and firing one of them: for if this takes fire readily, and the ſmoke riſes upright, without leaving any droſs or feculent matter behind, and without burning the paper, or firing the other heaps, it is eſteemed a ſign that the ſulphur and nitre were well purified, that the coal was good, and that the three ingredients were thoroughly incorporated together: but if the other heaps alſo take fire at the ſame time, it is preſumed, that either common ſalt was mixed with the nitre, or that the coal was not well ground, or the whole maſs not well beat, and mixed together; and if either the nitre or ſulphur be not well purified, the paper will be black or ſpotted.

In order to try the ſtrength of gun-powder, there are two kinds of inſtruments in uſe; but neither of them

them appear more exact than the common method of trying to what distance a certain weight of powder will throw a ball from a musket.

There has been much talk of a white powder, which, if it answered the character given it, might be a dangerous composition; for they pretend that this white powder will throw a ball as far as the black, yet without making a report; but none of the white powder we have seen, says Dr Shaw, answers to this character; being, as we apprehend, commonly made either with touchwood or camphor, instead of coal.

Observations on the force of GUN-POWDER. Gun-powder, fired either in vacuum, or in air, produces, by its explosion, a permanent elastic fluid. For if a red-hot iron be included in a receiver, after being exhausted, and gun powder be let fall on the iron, the powder will take fire, and the mercurial gage will suddenly descend upon the explosion; and though it immediately ascends again, yet it will never rise to the height it first stood at, but will continue depressed by a space proportioned to the quantity of gun powder which was let fall on the iron.

The same production likewise takes place, when gun powder is fired in the air: for if a small quantity of powder be placed in the upper part of a glass tube, and the lower part of the tube be immerged in water, and the water be made to rise so near the top, that only a small portion of air is left in that part where the gun-powder is placed; if in this situation the communication of the upper part of the tube with the external air be closed, and the powder be fired, which will easily be done by a burning-glass, the water will in this experiment descend upon the explosion as the quicksilver did in the last; and will always continue depressed below the place at which it stood before the explosion; and the quantity of this depression will be greater, if the quantity of powder be increased, or the diameter of the tube be diminished. From whence it is proved, that as well in air as in a vacuum, the explosion of fired powder produces a permanent elastic fluid. It also appears from experiment, that the elasticity or pressure of the fluid produced by the firing of gun powder, is *cæteris paribus*, directly as its density. This follows from hence, that if in the same receiver a double quantity of powder be let fall, the mercury will subside twice as much as in the firing of a single quantity.

To determine the elasticity and quantity of this elastic fluid, produced from the explosion of a given quantity of gun-powder, Mr Robins premises, that the elasticity of this fluid increases by heat, and diminishes by cold, in the same manner as that of the air; and that the density of this fluid, and consequently its weight, is the same with the weight of an equal bulk of air having the same elasticity, and the same temperature.

From these principles, and from his experiments, (for a detail of which we must refer the reader to his New Principles of Gunnery, in Scholium to prop. II.) he concludes, that the fluid produced by the firing of gun-powder will be $\frac{3}{10}$ of the weight of the gun-powder, and the ratio of the respective bulks of the powder, and the fluid produced from it, will be in round numbers 1 to 244.

Hence we are certain that any quantity of powder fired in any confined space, which it adequately fills, exerts, at the instant of its explosion, against the sides of the vessels containing it, and the bodies it impels before it, a force at least 244 times greater than the elasticity of common air; or, which is the same thing, than the pressure of the atmosphere; and this without considering the great addition which this force will receive from the violent degree of heat with which it is endued at that time, the quantity of which augmentation is the next head of Mr Robin's enquiry. He determines that the elasticity of the air is augmented when heated to the extremest heat of red hot iron, in the proportion of 796 to $194\frac{1}{3}$; and supposing that the flame of fired gun-powder is not less hot than red hot iron, and the elasticity of the air, and consequently of the fluid, generated by the explosion, being augmented by the extremity of this heat in the ratio of 796 to $194\frac{1}{3}$, it follows, that if 244 be augmented in this ratio, the resulting number, which is $999\frac{1}{3}$, will determine how many times the elasticity of the flame of fired powder exceeds the elasticity of common air, supposing it to be confined in the same space which the powder filled before it was fired.

Hence then, the absolute quantity of the pressure exerted by gun-powder at the moment of its explosion may be assigned: for since the fluid then generated has an elasticity of $999\frac{1}{3}$, or, in round numbers, 1000 times greater than common air; and since common air, by its elasticity, exerts a pressure on any given surface equal to the weight of the incumbent atmosphere with which it is in *equilibrio*, the pressure exerted by fired powder, before it has dilated itself, is 1000 times greater than the pressure of the atmosphere; and consequently the quantity of this force on a surface of an inch square amounts to above six tun weight, which force however diminishes as the fluid dilates itself. The variations of the density of the atmosphere does not any way alter the action of powder by any experiment that can be made. But the moisture of the air has a very great influence on the force of it: for that quantity which in a dry season would communicate to a bullet a velocity of 1700 feet in one second, will not in damp weather communicate a velocity of more than 12 or 1300 feet in a second, or even less, if the powder be bad and negligently kept.

The velocity of expansion of the flame of gunpowder, when fired in a piece of artillery, without either bullet, or any other body before it, is prodigious. By the experiments of Mr Robins, it seems this velocity cannot be much less than 7000 feet in a second. This, however, must be understood of the most active part of the flame. For, as was observed before, the elastic fluid, in which the activity of gunpowder consists, is only $\frac{3}{10}$ of the substance of the powder, the remaining $\frac{7}{10}$ will in the explosion be mixed with the elastic part, and will by its weight retard

tard the activity of the explosion; and yet they will be so completely united, as to move with uncommon motion; but the unelastic part will be less accelerated than the rest, and some of it will not even be carried out of the barrel, as appears by the considerable quantity of unctuous matter, which adheres to the inside of all fire-arms, after they have been used. These inequalities in the expansive motion of the flame render it impracticable to determine its velocity, otherwise than from experiments.

To recover damaged GUN POWDER. The method of the powder-merchants is, to put part of the powder on a sail-cloth, to which they add an equal weight of what is really good; and with a shovel mingle it well together, dry it in the sun, and barrel it up, keeping it in a dry and proper place. Others again, if it be very bad, restore it by moistening it with vinegar, water, urine, or brandy: then they beat it fine, searce it, and to every pound of powder add an ounce, an ounce and a half, or two ounces, according as it is decayed, of melted salt petre. Afterwards, these ingredients are to be moistened and mixed well, so that nothing can be discerned in the composition, which may be known by cutting the mass; and then they granulate it as aforesaid. In case the powder be in a manner quite spoiled, the only way is to extract the salt-petre with water, according to the usual manner, by boiling, filtrating, evaporating, and crystallizing; and then with fresh sulphur and charcoal to make it up a-new again. In regard to the medical virtues of gun-powder, Boerhaave informs us, that the flame of it affords a very healthy fume in the height of the plague: because the explosive acid vapour of nitre and sulphur corrects the air; and that the same vapour, if received in a small close pent up place, kills insects.

It is enacted by 5 and 11 of Geo I. and 5 Geo. II. *c.* 20. that gun-powder be carried to any place in a covered carriage; the barrels being close jointed; or in cases and bags of leather, *&c.* And persons keeping more than 200 pounds weight of gun-powder at one time, within the cities of London and Westminster, or the suburbs, *&c.* are liable to forfeitures if it be not removed; and justices of peace may issue warrants to search for, seize, and remove the same.

The invention of gun-powder is ascribed by Polydore Virgil to a chemist, who having accidentally put some of the ingredients in this composition in a mortar, and covered it over with a stone, it happened to take fire, and blew up the stone. Thevet says, the person here spoken of was a monk of Friburg, named Constantine Anelzen; but Belleforet and others hold it to be Bartholdus Schwartz, or the black; at least it is affirmed, that he first taught the use of it to the Venetians, in the year 1380, during the war with the Genoese. But what contradicts this account, and shews gun-powder to be of an older date, is, that Peter Mexia, in his Variæ Lectiones, relates, that Alphonsus XI. king of Castile, used mortars against the Moors in a siege in 1343. Ducange adds, that there is mention made of this powder in the registers of the chambers of accounts in France, as early as the year 1338; and frier Bacon, our countryman, mentions the composition in express terms, in his treatise De nullitate magiæ, published at Oxford, in the year 1216.

GUN-SHOT-WOUNDS. See SURGERY.

GUNTSBERG, a town of Germany in the circle of Swabia, situated on the east side of the Danube: E. long. 10° 15′, N. lat. 48° 35′.

GUNTER's LINE, a logarithmic line, usually graduated upon scales, sectors, *&c.*

It is also called the line of lines, and line of numbers; being only the logarithms graduated upon a ruler, which therefore serves to solve problems instrumentally in the same manner as logarithms do arithmetically. It is usually divided into an hundred parts, every tenth whereof is numbered, beginning with 1, and ending with 10; so that, if the first great division, marked 1, stand for one tenth of any integer, the next division, marked 2, will stand for two tenths; 3, three tenths, and so on; and the intermediate divisions will, in like manner, represent 100dth parts of the same integer. If each of the great divisions represent 10 integers, then will the lesser divisions stand for integers; and if the greater divisions be supposed each 100, the subdivisions will be each 10.

Use of GUNTER's LINE. 1. *To find the product of two numbers.* From 1 extend the compasses to the multiplier; and the same extent, applied the same way from the multiplicand, will reach to the product. Thus if the product of 4 and 8 be required, extend the compasses from 1 to 4, and that extent laid from 8 the same way, will reach to 32, their product. 2. *To divide one number by another.* The extent from the divisor to unity, will reach from the dividend to the quotient: thus, to divide 36 by 4, extend the compasses from 4 to 1, and the same extent will reach from 36 to 9, the quotient sought. 3. *To three given numbers, to find a fourth proportional.* Suppose the numbers 6, 8, 9; extend the compasses from 6 to 8, and this extent, laid from 9 the same way, will reach to 12, the fourth proportional required. 4. *To find a mean proportional between any two given numbers.* Suppose 8 and 32; extend the compasses from 8, in the left hand part of the line, to 32 in the right; then bissecting this distance, its half will reach from 8 forward, or from 32 backward, to 16, the mean proportional sought. 5. *To extract the square root of any number.* Suppose 25; bissect the distance between 1 on the scale and the point representing 25; then the half of this distance, set off from 1, will give the point representing the root 5. In the same manner, the cube root, or that of any higher power, may be found by dividing the distance on the line, between 1 and the given number, into as many equal parts as the index of the power expresses; then one of those parts, set from 1, will find the point representing the root required.

GUNTER's QUADRANT, one made of wood, brass, *&c.* containing a kind of stereographic projection of the sphere, on the plane of the equinoctial; the eye being supposed placed in one of the poles.

GUNTER'S SCALE, called by navigators fimply the gunter, is a large plain fcale, generally two foot long, and about an inch and a half broad, with artificial lines delineated on it, of great ufe in folving queftions in trigonometry, navigation, *&c.*

GUN-WALE, or GUNNEL, is the uppermoft wale of a fhip, or that piece of timber which reaches on either fide from the quarter-deck to the forecaftle, being the uppermoft bend which finifhes the upper works of the hull, in that part in which are put the ftanchions which fupport the wafte-trees.

GURIEL, a fubdivifion of Georgia in Afia, fituated on the eaftern coaft of the Euxine fea.

GURK, a city of Carinthia, in Germany: E. long. 14°, N. lat. 47° 20′.

GURNARD, in ichthyology. See TRIGLA.

GUSSET, in heraldry, is formed by a line drawn from the dexter or finifter chief points, and falling down perpendicularly to the extreme bafe. See Plate XCVII. fig. 8.

The guffet is an abatement of honour, denoting an effeminate perfon.

GUSTROW, a town of Germany, in the dutchy of Mecklenburg: E. long. 12° 15′, N. lat. 54°.

GUTS. See ANATOMY, p. 257.

GUTSKROW, a city of Germany in the circle of Upper Saxony, and province of Swedifh Pomerania: E. long. 13° 40′, N. lat. 54°.

GUTTÆ, in architecture, are ornaments in the form of little cones, ufed in the plafond of the Doric corniche, or on the architrave underneath the triglyphs, reprefenting a fort of drops or bells. See ARCHITECTURE.

GUTTA SERENA, a difeafe in which the patient, without any apparent fault in the eye, is entirely deprived of fight. See MEDICINE.

GUTTERS, in architecture, a kind of canals in the roofs of houfes, ferving to receive and carry off the rain.

GUTTURAL, a term applied to letters or founds pronounced or formed as it were in the throat.

GUTTY, in heraldry, a term ufed when any thing is charged or fprinkled with drops. In blazoning, the colour of the drops is to be named; as, gutty of fable, of gules, *&c.*

GUY, in a fhip, is any rope ufed for keeping off things from bearing or falling againft the fhip's fide when they are hoifting in.

That rope which at one end is made faft to the foremaft, and feized to a fingle block at the pendant of the garnet, is called the guy of the garnet.

GUZES, in heraldry, roundles of a fanguine or murry colour. Thefe, from their bloody hue, are by fome fuppofed to reprefent wounds.

GYMNASIARCH, in antiquity, the director of the gymnafium. He had two deputies under him; the one called xyftarch, who prefided over the athletæ, and had the overfight of the wreftling; the other gymnaftes, who had the direction of all the other exercifes.

GYMNASIUM, in Grecian antiquity, a place fitted for performing exercifes.

Gymnafia, according to Potter, were firft ufed at Lacedæmon, but were afterwards very common in all the parts of Greece, and imitated, very much augmented, and improved at Rome. They were not fingle edifices, but a knot of buildings united, being fo capacious as to hold many thoufands of people at once; and having room enough for philofophers, rhetoricians, and the profeffors of all other fciences, to read their lectures; and wreftlers, dancers, and all others who would, to exercife at the fame time without the leaft difturbance or interruption. They confifted of a great many parts, the chief of which were, the porticos, elæothefium, palæftra, conifterium, *&c.*

Athens had feveral gymnafia, of which the lyceum, academia, and cynofurges, were thofe of moft note.

The lyceum was fituated on the banks of the river Iliffus, and received its name from Apollo, to whom it was dedicated.

The lyceum was the place where Ariftotle taught philofophy, walking there every day till the hour of anointing; whence he and his followers got the name of peripatetics.

The academy was part of the ceramicus without the city, where Plato lectured. See ACADEMY.

GYMNASTICS, the art of performing the feveral bodily exercifes, as wreftling, running, fencing, dancing, *&c.*

GYMNOPYRUS, in natural hiftory, a name given by Dr Hill to the pyritæ of a fimple internal ftructure, and not covered with a cruft.

Of thefe there are only two fpecies: 1. A green varioufly fhaped kind. 2. A botryoide kind.

The firft fpecies is the moft common of all the pyritæ, and appears under a great diverfity of fhapes. It is very hard and heavy, very readily gives fire with fteel, but will not at all ferment with aquafortis. The fecond fpecies is very elegant and beautiful, and its ufual colour is a very agreeable pale green; but what moft diftinguifhes it from all other pyritæ is, that its furface is always beatifully elevated into tubercles of various fizes, refembling a clufter of grapes.

GYMNOSOPHISTS, a fect of philofophers who clothed themfelves no farther than modefty required. There was fome of thefe fages in Africa; but the moft celebrated clan of them was in India. The African gymnofophifts dwelt upon a mountain in Ethiopia, near the Nile, without the accommodation either of houfe or cell. They did not form themfelves into focieties like thofe of India, but each had his private retirement, where he ftudied and performed his devotions by himfelf. If any perfon had killed another by chance, he applied to thefe fages for abfolution, and fubmitted to whatever penances they enjoined. They obferved an extraordinary frugality, and lived only upon the fruits of the earth. Lucan afcribes to thefe gymnofophifts feveral new difcoveries in aftronomy.

As to the Indian gymnofophifts, they dwelt in the woods, where they lived upon the wild products of the earth, and never drank wine, nor married. Some of them practifed phyfic, and travelled from one place to another: thefe were particularly famous for their remedies

remedies againſt barrenneſs. Some of them, likewiſe, pretended to practiſe magic, and to foretell future events.

In general, the gymnoſophiſts were wiſe and learned men: their maxims and diſcourſes, recorded by hiſtorians, do not in the leaſt ſavour of a barbarous education, but are plainly the reſult of great ſenſe and deep thought. They keep up the dignity of their character to ſo high a degree, that it was never their cuſtom to wait upon any body, not even upon princes themſelves; for which reaſon Alexander, who would not condeſcend to viſit them in perſon, ſent ſome of his courtiers to them in order to ſatisfy his curioſity. Their way of educating their diſciples is very remarkable: every day, at dinner, they examined them how they had ſpent the morning; and every one was obliged to ſhew, that he had diſcharged ſome good office, practiſed ſome virtue, or improved in ſome part of learning: if nothing of this appeared, he was ſent back without his dinner. They held a tranſmigration of ſouls; and it is probable that Pythagoras borrowed his doctrine from them.

GYMNOSPERMIA, in botany. See Botany, p. 636.

GYMNOTUS, in ichthyology, a genus of fiſhes belonging to the order of apodes. They have two tentacula at the upper lip; the eyes are covered with the common ſkin; there are five rays in the membrane of the gills; the body is compreſſed, and carinated on the belly with a fin. There are five ſpecies.

GYNÆCEUM, among the ancients, the apartment of the women, a ſeparate room in the inner part of the houſe, where they employed themſelves in ſpinning, weaving, and needle-work.

GYNÆCOCRACY, denotes the government of women, or a ſtate where women are capable of the ſupreme command. Such are Britain and Spain.

GYNANDRIA, in botany. See Botany, p. 635.

GYPSIES. See Egyptians.

GYPSUM, or Plaster-stone, in natural hiſtory, a genus of foſſils, naturally and eſſentially ſimple, not inflammable nor ſoluble in water, and compoſed of flat ſmall particles, which form bright, gloſſy, and in ſome degree tranſparent maſſes, not flexible or elaſtic, not giving fire with ſteel, nor fermenting with, or being ſoluble in, acid menſtrua, and very eaſily calcined in the fire.

Of theſe gypſums, ſome are harder, others ſofter, and are of ſeveral colours; as, white, grey, red, green, *&c.* ſometimes diſtinct, and ſometimes variouſly blended together.

The texture of all the gypſums being ultimately the ſame, it may be ſufficient to obſerve, that their origin is plainly from particles of a determinate nature and ſubſtance, and of a certain and invariable figure, an oblong, flat, and irregularly angular one. Theſe we ſometimes ſee, as indeed is moſt natural to them, diſpoſed without order or regularity, into looſe, complex, friable maſſes; at others, they are getting out of their native order, and emulating the ſtructure of other claſſes of bodies, of which they are indeed properly the baſis, and appearing ſomewhat in the figure of the fibrariæ; and at other times, of the foliaceous compoſite flakes of the ſelenitæ: the ſpecies which have theſe ſtructures, are truly varying from the gypſums into thoſe bodies they emulate; for the fibrariæ are only a peculiar arrangement of theſe very particles, and the ſelenitæ only more broad flakes of the ſame, like thoſe of the foliaceous talcs.

The gypſums are much uſed in plaſter, for ſtuccoing rooms, and caſting buſts and ſtatues.

GYRFALCON. See Falco.

GYSHORN, a town of germany, in the dutchy of Lunenburg, ſituated on the river Aller, forty-five miles north-eaſt of Hanover: E. long. 10° 45′, and N. lat. 52° 50′.

H

HABAT, the north-weſt province of the empire of Morocco, ſituated on the ſtreights of Gibraltar.

HABAKKUK, or the prophecy of Habakkuk, a canonical book of the Old Teſtament.

There is no mention made in ſcripture, either of the time when this prophet lived, or of the parents from whom he was deſcended; but according to the authors of the lives of the prophets, he was of the tribe of Simeon, and a native of Bethzacar.

HABEAS CORPUS, in law, is a writ of two kinds; the one being the great writ of the Engliſh liberty, which lies where a perſon is indicted for any crime or treſpaſs before juſtices of the peace, or in a court of any franchiſe, and on being impriſoned has offered ſufficient bale, which has been refuſed, though the caſe be bailable; in which caſe he may have this writ out of the king's bench, in order to remove himſelf thither, to anſwer the cauſe at the bar of that court.

The practice in this caſe is, firſt to procure a certiorari out of the court of chancery, directed to all the juſtices for removing the indictment into the king's bench; and upon that to obtain this writ, directed to the ſheriff, for cauſing the body of the party to be brought at a certain day.

The other kind of habeas corpus is uſed for bringing the body of a perſon into court, who is committed to any goal or priſon, either in civil or criminal cauſes; which writ will remove the perſon and cauſe from one court and priſon to another.

No habeas corpus, or other writ, to remove a cauſe

from

from out of an inferior court, can be allowed, if the ſame be not delivered to the judge of the court, before the jury who are to try the cauſe have appeared, and before any of them are ſworn, 43 Eliz. c. 5.

The habeas corpus act, 31 Car. II. c. 2. has ordained, that a perſon may have a habeas corpus from any judge, on complaint made and view of the warrant of commitment, (except ſuch perſon is committed for treaſon or felony expreſſed in the warrant, or ſome other offence that is not bailable) which habeas corpus muſt be made returnable immediately; and on producing a certificate of the cauſe of commitment, the priſoner is to be diſcharged on bail given to appear in the court of king's bench the next term, or next aſſizes, *&c.* Perſons committed, for either treaſon or felony, expreſsly mentioned in the warrant, upon a motion made in open court, in the firſt week of the term, or day of ſeſſions, *&c.* after commitment, are to be brought to trial; and if they are not indicted the next term or ſeſſions after commitment, on a motion made the laſt day of that term, they ſhall be let out upon bail, except it appear on oath, that the king's witneſſes are not ready; and in caſe they are not indicted or tried the ſecond term after commitment, they ſhall be diſcharged.

Judges denying a habeas corpus, ſhall forfeit 500 l. and if an officer refuſe to obey it, or to deliver a true copy of the commitment-warrant, he forfeits 100 l. for the firſt offence.

HABIT, in philoſophy, an aptitude or diſpoſition either of mind or body, acquired by a frequent repetition of the ſame act.

HABIT, in medicine, denotes the ſettled conſtitution of the body, or the habitude of any thing elſe, as the ſtructure or compoſition of a body, or the parts thereof.

HABIT is alſo uſed for a dreſs or garb, or the compoſition of garments, wherewith a perſon is covered; in which ſenſe we ſay, the habit of an eccleſiaſtic, of a religious, *&c.* a military habit, *&c.*

HABITE AND REPUTE, in Scots law, the common opinion of the people, among whom a perſon lives, with reſpect to any circumſtance relating to him.

HABITUAL, ſomething grown to a habit by long uſe. See HABIT.

HABITUDE, among ſchoolmen, the reſpect or relation one thing bears to another. See RELATION.

HACHA, a town of terra firma, in South America, ſituated on the north ſea, at the mouth of the river Hacha, in W. long. 72°, N lat. 11° 0′.

HACKNEY, a village on the north-eaſt ſide of London, with a handſome church, three meeting-houſes, and ſeventeen alms-houſes.

HADDINGTON, a parliament-town in Scotland, about eighteen miles eaſt of Edinburgh.

HADDOCK, the Engliſh name of a well known fiſh of the gadus kind. See GADUS.

HADRAMUT, a city of Arabia Felix, the capital of the province of Hadramut, ſituated in E. long. 50° 30′, N. lat. 16°, three hundred and ſixty miles north-eaſt of Mocho.

HÆMAGOGOS, among phyſicians, a compound medicine conſiſting of fetid and aromatic ſimples, mixed with black hellebore; and preſcribed in order to promote the menſtrual and hæmorrhoidal fluxes, as alſo to bring away the lochia.

HÆMANTHUS, in botany, a genus of the hexandria monogynia claſs. The involucrum is large, and conſiſts of ſix leaves; the corolla is above the fruit, and divided into ſix parts; and the berry has three cells. There are four ſpecies, none of them natives of Britain.

HÆMATITES, or BLOOD-STONE, in natural hiſtory, an extremely rich and fine iron.

It is very ponderous, and is either of a pale red, a deeper red, or a bluiſh colour; uſually of a very gloſſy ſurface; and when broken, of a fine and regularly ſtriated texture; the ſtriæ converging toward the centre of the body; and the maſſes thereof naturally breaking into fragments of a broad baſe and pointed end; appearing ſomething pyramidal. The hæmatites is various in its degrees of purity and hardneſs, as well as in its figure: the fineſt and moſt pure is of a botryoide ſurface; the whole ſuperficies riſing into larger or ſmaller roundiſh tubercles: ſometimes the hæmatites is of a coarſe texture, and a laxer ſtructure, in which ſtate it is known to many by the name ſchiſtus.

HÆMATOPUS, the SEA-PYE, in ornithology, a genus belonging to the order of grallæ. The beak is compreſſed with an equal wedge-ſhaped point; the noſtrils are linear; and the feet have three toes without nails. There is but one ſpecies, *viz.* the aſtralegus, a native of Europe and America. It feeds upon ſhell-fiſh near the ſea ſhores.

HÆMATOXYLUM, CAMPECHE-WOOD, in botany, a genus of the decandria monogynia claſs. The calix is divided into five parts; the petals are five; the capſule is lanceolated, and contains one cell with two boat-ſhaped valves. There is but one ſpecies, *viz.* the campechianum, campechy or logwood, a native of America, near Carthagena. It is uſually brought home in large logs, very hard, of a red colour, and an aſtringent ſweet taſte. It has been long uſed by the dyers, but not till very late as a medicine: an extracted decoction of it are ſaid to be ſerviceable in diarrhœas.

HÆMOPTOSIS, HÆMAPTYSIS, or HÆMOPTOE, in medicine, a ſpitting of blood. See MEDICINE.

HÆMORRHAGE, in medicine, a flux of blood from any part of the body. See MEDICINE.

HÆMORRHOIDAL, an appellation given by anatomiſts to the arteries and veins going to the inteſtinum rectum. See ANATOMY, Part III. and IV.

HÆMORRHOIDS, or PILES, in medicine, an hæmorrhage, or flux of blood from the hæmorrhoidal veſſels. See MEDICINE.

HAERLEM, a populous city of the United Provinces, in the province of Holland, ſituated near the lake which from this town is called Haerlem-Meer; four miles eaſt of the ocean, and twelve weſt of Amſterdam: E. long. 4° 20′. N. lat. 52° 30′.

HAGAI, a canonical book of the Old Teſtament, ſo called

called from the prophet of that name, who, in all probability was born at Babylon, from whence he returned with Zerubbabel.

HAGENAU, a fortified town of Germany, in the Landgraviate of Alſace: E. long. 7° 40′, N. lat. 48° 45′.

HAGUE, a town of the United Provinces, in the province of Holland, ſituated two miles eaſt of the ſea, and fourteen north-weſt of Rotterdam. This is one of the fineſt towns in Europe; but though it enjoys all the privileges of a city of Holland, except that of ſending repreſentatives to the ſtate, yet, as it has no walls, it is only eſteemed a village. Here every city of the United provinces has a houſe for their reſpective deputies, and here the ſtates of the province of Holland aſſemble, and all public affairs are tranſacted.

HAIL, in phyſiology, an aqueous concretion, in form of white or pellucid ſpherules, deſcending out of the atmoſphere.

Hail is evidently no other than drops of rain congealed into ice. This happens when in their paſſage thro' the inferior air, they meet with nitrous particles, which are known to contribute greatly to freezing. Their magnitude is owing to a freſh acceſſion of matter as they paſs along. Hence we ſee the reaſon why hail is ſo frequent in ſummer, becauſe at that time greater quantities of nitre are exhaled from the earth, and float up and down the air. See Rain and Frost.

HAIMSUCKEN, in Scots law, the aſſaulting or beating a man in his own houſe. See Scots Law, title 33.

HAIR, ſlender, oblong, and flexible filaments, growing out of the pores of animals, and ſerving moſt of them as a covering. See Anatomy, p. 256.

HAKE, in ichthyology. See Gadus.

HALBERSTAT, a city of Germany, in the circle of Upper Saxony, the capital of the duchy of the ſame name; ſubject to the king of Pruſſia, E. long. 11° 6′, N. lat. 51° 55′.

HALCRYPTIUM, a name given by Dr Hill to the ſalt ſuſpended in a fluid form, and in very ſmall quantities in mineral waters, ſcarce diſcernable by the taſte, and with much difficulty ſeparable from them.

HALCYON, in ornithology, a name given by the ancients to the alcedo, or kings-fiſher. See Alcedo.

Halcyon days, in antiquity, a name given to ſeven days before and as many after the winter ſolſtice; by reaſon the halycon, invited by the calmneſs of the weather, laid its eggs in neſts build in the rocks, cloſe by the brink of the ſea, at this ſeaſon.

HALE, in the ſea-language, ſignifies pull; as, to hale up, is to pull up; to hale in or out, is to pull in or out. To over-hale a rope, is to hale it too ſtiff, or to hale it the contrary way.

Keel-Hale. See Ducking.

HALEM, a town of the Auſtrian Netherlands, in the province of Brabant, twenty-five miles weſt of Maeſtricht: E long. 5° 5′, N. lat. 51° 5′.

HALESWORTH, a market town of Suffolk, thirty-five miles eaſt of Bury: E. long. 1° 40′, N. lat. 52° 30′.

HALF-BLOOD, in law, is where a man marries a ſecond wife, the firſt being dead, and by the firſt venter has a ſon, and by his ſecond venter has likewiſe a ſon, the two brothers, in this caſe, are but of half blood.

HALF merk, a noble, or 6 s. 8 d.

HALF moon, in fortification, an outwork compoſed of two faces, forming a ſaliant angle, whoſe gorge is in form of a creſcent, or half moon; whence the name. See Fortification.

HALIÆTUS, in ornithology. See Falco.

HALIOTIS, the ear-shell, a genus of inſects belonging to the order of Vermes teſtacea. This is an animal of the ſnail-kind, with an open ſhell reſembling an ear. There are ſeven ſpecies, diſtinguiſhed by the figure of their ſhells.

HALL, in geography, a town of Germany, in the circle of Auſtria, and county of Tyrol, ſituated ſix miles north eaſt of Inſpruck: E. long. 11° 28′, N. lat. 47° 15′.

Hall is alſo a town of the Auſtrian Netherlands in the province of Brabant, ſeven miles ſouth of Bruſſels: E. long. 4° 10′, N. lat. 50° 50′.

Hall is alſo a city of Germany, in the circle of Upper Saxony, in the capity of a duchy ſituated on the river Sala, ſubject to the king of Pruſſia: E. long. 12° 5′, N. lat. 51° 35′.

Hall is alſo a town of Germany, in the circle of Swabia, twenty miles eaſt of Hailbron; being an imperial city, or ſovereign ſtate: E. long. 9° 45′, N. lat. 49° 20′.

HALLAGE, a fee or toll paid for cloth brought to be ſold in Blackwell-hall, London.

HALLAMASS. See All-Saints.

HALLELUJA, a word ſignifying, praiſe the Lord.

The ſinging halleluja was a ſort of invitatory, or call to each other, to praiſe the Lord.

St Auſtin ſays, that in ſome churches, it was ſung only on Eaſter-day, and the fifty days of Pentecoſt; but that even in thoſe churches where it was moſt in uſe, it was never uſed in the time of lent.

HALLEN, a town of the Auſtrian Netherlands, in the province of Brabant: E. long. 5°, N. lat. 50° 55′.

HALLEIN, a town of Germany, in the archbiſhopric of Saltzburg: E. long. 13° 6′, N. lat. 47° 36′.

HALLER, a town in the Netherlands, in the province of Brabant: E. long. 5°, N. lat. 50° 40′.

HALLERIA, in botany a genus of the didynamia angioſpermia claſs. The calix has three ſegments, and the corolla four, the filaments are longer than the corolla; and the berry has two cells. There is but one ſpecies, a native of Æthiopia.

HALLIFAX, a large market town in the weſt riding of of Yorkſhire, thirty-four miles ſouth-weſt of York: W. long. 1° 40′, N. lat. 53° 45′.

HALMSTAT, a port town of Gothland in Sweden, eighty miles ſouth of Gottenberg: E. long. 13° 5′, N. lat. 56° 45′.

HALO, a meteor in the form of a luminous ring or circle, of various colours, appearing round the bodies of the ſun, moon, or ſtars.

Concerning the production of halos, Sir Iſaac Newton intimates, that they are formed by the light which

which comes through the drops of rain, by two refractions, without any reflection; but how this may be, is not eafy to conceive.

HALTWESEL, a market-town of Northumberland, thirty-two miles weft of Newcaftle: W. long. 2°, N. lat. 55°.

HAM, in anatomy, the part behind the knee.

HAM, in geography, a city in Germany, in the circle of Weftphalia, and the capital of the county of Mark, fubject to Pruffia: E. long. 7° 15, N. lat. 51° 35′.

HAMA, or APAMEA. See APAMEA.

HAMADAN, a city of Perfia, in the province of Eyrac Agem, 200 miles north-weft of Ifpahan; E. long. 47° 35′, N. lat 35°.

HAMADRYADS, in heathen theology, certain rural deities; being nymphs of the woods, whofe fate depended upon certain trees, together with which they were fuppofed both to be born and to die.

HAMAMELIS, in botany, a genus of the tetrandria digynia clafs. The involucrum confifts of three leaves, and the proper calix of four; the petals are four; and the nut has two cells. There is but one fpecies, a native of Virginia.

HAMAXOBIANS, *hamaxobii*, an ancient people of Europian Sarmatia, fo called from their living together in chariots or waggons, for the conveniency of fhifting the place of their abode at pleafure.

HAMBURGH, a large city and well fortified port town of Germany, in the circle of Lower Saxony, and duchy of Holftein, fituated on the north fide of the river Elb, partly on iflands, and partly on the continent. It is an imperial city, or fovereign ftate, governed by its own magiftrates, and fubject only to the general laws of the empire. Merchants from all parts of Europe refort to it, from whence their goods are fent into the heart of the empire: E. long. 9° 40′, N. lat. 54°.

HAMCHEU, the capital of the province of Chekiam, in China, fituated on the river Cienton, 160 miles fouth-eaft of Nanking: E. long. 120°, N. lat. 30°.

HAMELIN, a town of Germany, in the circle of lower Saxony, and duchy of Brunfwic, fubject to the elector of Hanover: E. long. 9° 12′, N. lat. 52° 15′.

HAMILTON, a town of Scotland, in the county of Clydefdale, fituated on the river Clyde, eleven miles fouth-eaft of Glafgow: W. long. 3° 50′, N. lat. 55° 40′.

HAMLE, the name of the eleventh month of the Ethiopian year, beginning on the 25th of June, old ftyle.

HAMMONT, a town of Germany, in the circle of Weftphalia, and bifhopric of Liege, fituated near the confines of Brabant: E. long. 5° 32′, N. lat. 51° 20′.

HAMPSHIRE, an Englifh country, bounded by Berkfhire, on the north; by Surry and Suffex, on the eaft; by the Englifh channel, on the fouth; and by Wiltfhire and Dorfetfhire, on the weft. It comprehends the ifle of Wight. Its chief towns are Winchefter, Southampton, and Portfmouth.

New HAMPSHIRE, a province of New England, in North America, bounded by Nova Scotia, on the north; by the Atlantic ocean, on the eaft; by the province of Maffachufets bay, on the fouth; and by New York, on the weft: fubject to Great Britain.

HAMPSTEAD, a pleafant village in Middlefex, four miles north of London.

HAMPTON, a market-town of Gloucefterfhire, twelve miles fouth of Gloucefter: W. long. 2° 15. N. lat. 51° 38′.

HAMPTON-COURT, a town in Middlefex, fituated on the north fide of the Thames, twelve miles weft of London, and two weft of Kingfton; in which is the fineft palace belonging to the king of Britain.

HANAU, the capital of a county of the fame name in Germany, is pleafantly fituated on the river Kunts, thirteen miles eaft of Frankfort, and twelve north-weft of Afchaffenburgh: E. long. 8° 45′. N. lat. 50° 12′.

HAND, in anatomy. See ANATOMY, Part I. II. *&c.*

HAND, in the manege, a meafure of four inches, or of a clinched fift, by which the height of a horfe is computed.

HAND-BREADTH, a meafure of three inches.

HANDS, in heraldry, are borne in coat armour dexter and finifter, that is, right and left, expanded or open. Thefe are the moft neceffary parts of the human body, as they ferve to exprefs all forts of actions, and even our very thoughts and defigns; thus, joining of hands is an univerfal token of friendfhip, and clapping of hands a general mark of applaufe.

HANOVER, a city of Germany, in the circle of Lower Saxony, and dukedom of Brunfwic, fituated on the river Leina, thirty-fix miles weft of Brunfwic: it is the capital of his Britannic majefty's German dominions, fituated in E. long. 9° 45′. N. lat. 52° 32′.

HANSE, or HANS, a company of merchants united for the promotion and advantage of trade.

HANSE-TOWNS, port-towns of Germany of which Lubec and Hamburgh were the chief. They were formerly all of them imperial cities, confederated for their mutual defence, and the protection of their trade.

HAPPINESS, among philofophers, confifts in the profecution or enjoyment of fome good.

HARBINGER, an officer of the king's houfhold, having four yeomen under him, who ride a day's journey before the court, when it travels, to provide lodgings, *&c.*

HARBOROUGH, a town of Leicefter fhire, thirteen miles fouth-eaft of Leicefter: W. long. 1°. N. lat. 52°. 26′.

HARBOUR, a place where fhips may ride fafe at anchor, chiefly ufed in fpeaking of thofe fecured by a boom and chain, and furnifhed with a mole.

HARBURGH, a port town of Germany, in the circle of Lower Saxony, and duchy of Lunenburg, fituated on the river Elbe, oppofite to Hamburgh: E. long. 9° 30′. N. lat. 53° 57′.

HARCOURT, a town of France, in the province of Normandy, twenty-three miles fouth-weft of Rouen.

HARDENING, the giving a greater degree of hardnefs to bodies than they had before.

There are feveral ways of hardening iron and fteel, as by hammering them, quenching them when hot in cold water, *&c.* CHEMISTRY, p. 134.

HARDERWICK,

HARDERWICK, a town of Guelderland, in the United Netherlands, twenty-three miles north-west of Zutphen: E. long. 5° 30′. N. lat. 52° 35′.

HARDNESS, in physiology, that quality in bodies whereby their parts cohere firmly together, so as not to give way to any external impulse, nor yield inwards, without breaking.

In this sense hardness coincides with what on other occasions we call firmness, in opposition to softness and fluidity.

HARE, in zoology. See LEPUS.

HARE-LIP, in surgery. See SURGERY.

HARENGUS. See CEUPEA.

HARFLEUR, a port-town of France, in the province of Normandy, situated near the mouth of the Seyne, four miles west of Havre de Grace: E. long. 15° N. lat. 49° 30′.

HARIOT, or HERIOT, in law, a due belonging to a lord at the death of his tenant, consisting of the best beast, either horse, ox, or cow, which he had at the time of his death; and in some manors, the best goods, piece of plate, *&c.* are called hariots.

HARLEBECK, a town of the Austrian Netherlands, in the province of Flanders, situated on the river Lys, six miles north-east of Courtray: E. long. 3° 15′, N. lat. 50° 50′.

HARLEQUIN, a buffoon or merry andrew; but is now used for a person of extraordinary agility, dressed in party-coloured cloaths, the principal character in a pantomime entertainment. See PANTOMIME.

HARLESTON, a market-town of Norfolk, situated on the river Waveney, fourteen miles south of Norwich: E. long. 1° 25′, N. lat. 52° 35′.

HARLINGEN, a port-town of the United Netherlands, in the province of West Friesland, situated on the German sea: E. long 5° 20′, N. lat. 53° 15′.

HARLOW, a market-town of Essex, situated fifteen miles west of Chelmsford: E. long. 6′, N. lat. 51° 45′.

HARMONICAL, something belong to harmony. See HARMONY

HARMONICAL COMPOSITION, in a general sense, includes both harmony and melody, *i. e.* of music or songs, both in a single part, and in several parts.

HARMONICAL SERIES, a series of many numbers in continual harmonical proportion. Thus, if there are four or more numbers, of which every three immediate terms are harmonical, the whole will make an harmonical series: such is 30 : 20 : 15 : 12 : 10. Or, if every four terms immediately next each other are harmonical, it is also a continual harmonical series, but of another species, as 3, 4, 6, 9, 18, 36, *&c.*

HARMONICAL SOUNDS, an appellation given, by Mr Sauveur, to such sounds as always make a determinate number of vibrations, in the time that one of the fundamentals, to which they are referred, makes one vibration.

Harmonical sounds are produced by the parts of chords, *&c.* which vibrate a certain number of times, while the whole chord vibrates once.

The relations of sounds had only been considered in the series of numbers, 1 : 2, 2 : 3, 3 : 4, 4 : 5, *&c.* which produced the intervals called octave, fifth, fourth, third, *&c.* Mr Sauveur first considered them in the natural series, 1, 2, 3, 4, 5, *&c.* and examined the relations of sounds arising therefrom. The result is, that the first interval, 1 : 2, is an octave; the second, 1 : 3, a twelfth; the third, 1 : 4, a fifteenth, or double octave; the fourth, 1 : 5, a seventeenth; the fifth, 1 : 6, a nineteenth, *&c.*

This new consideration of the relations of sounds is more natural than the old one; and is, in effect, all the music that nature makes without the assistance of art.

HARMONICS, that part of music which considered the differences and proportions of sounds, with respect to acute and grave; in contradistinction to rythmica and metrica.

HARMONY, in music, the agreeable result or union of several musical sounds heard at one and the same time; or the mixture of divers sounds, which together have an effect agreeable to the ear.

HARMONY *of the spheres*, or *Celestial* HARMONY, a sort of music much talked of by many of the ancient philosophers and fathers, supposed to be produced by the sweetly tuned motions of the stars and planets. This harmony they attributed to the various proportionate impressions of the heavenly globes upon one another, acting at proper intervals. It is impossible, according to them, that such prodigious large bodies, moving with so much rapidity, should be silent; on the contrary, the atmosphere continually impelled by them, must yield a set of sounds proportionate to the impression it receives; consequently, as they do not all run the same circuit, nor with one and the same velocity, the different tones arising from the diversity of motions, directed by the hand of the Almighty, must form an admirable symphony, or concert.

They therefore supposed, that the moon, as being the lowest of the planets, corresponded to *mi*; mercury, to *fa*; venus, to *sol*; the sun, to *la*; mars, to *si*; jupiter, to *ut*; saturn, to *re*; and the orb of the fixed stars, as being the highest of all, to *mi*, or the octave.

HARP, a musical instrument of the string-kind, of a triangular figure, held upright between the legs of the person who plays upon it.

HARPIES, among the ancient poets, fabulous impure monsters, said to be the daughters of Neptune and Earth. Virgil mentions three of them, Aello, Ocypete, and Celœno; they are described to be fowls, with the face of a virgin, bears ears, their bodies like vultures, and hands like their crooked talons.

HARPINEER, or HARPONEER, the person who manages the harping-iron.

HARPSICHORD, the most harmonious of all the musical instruments of the string-kind. It is played on after the manner of the organ, and is furnished with a set, and sometimes with two sets of keys; the touching or striking of these keys moves a kind of little jacks, which

which alſo move a double row of chords or ſtrings, of braſs or iron, ſtretched over four bridges on the table of the inſtrument.

HARQUEBUSS, a piece of fire-arms, of the length of a muſket, uſually cocked with a wheel. It carried a ball that weighed one ounce ſeven eighths.

There was alſo a larger ſort, called the great harquebuſs, uſed for the defence of ſtrong places, which carried a ball of about three ounces and a half: but they are now but little uſed, except in ſome old caſtles, and by the French in ſome of their garriſons.

HARRIER, a kind of hound, endowed with an admirable gift of ſmelling, and very bold in the purſuit of his game.

HARROW, in agriculture. See AGRICULTURE, p. 58.

HART, a ſtag, or male deer, in the ſixth year. See CERVUS.

HART's HORNS, in pharmacy, the whole horns of the common male deer, as ſeparated from the head, without farther preparation.

The chemical analyſis of hart's-horn is ſufficiently known: it yields a water highly impregnated with a volatile ſalt, which is called ſpirit of hart's-horn, with a fetid oil, and a volatile ſalt by the common diſtillation in a retort.

The ſalt of hart's horn is a great ſudorific, and is given in fevers of many kinds with great ſucceſs; the ſpirit has the ſame, and all the other virtues of volatile alkalis, and is uſed to bring people out of faintings by its pungency, on holding it under their noſe, and at the ſame time pouring ſome drops of it in water down the perſon's throat.

HART-WORT, in botany. See TORDYLLIUM.

HARTFORD, the capital of Hartfordſhire, ſituated twenty-one miles north of London: W. long. 7′, and N. lat. 51° 45′.

HARTFORD is alſo a town of New England, in the province of Connecticut, ſituated 50 miles weſt of Boſton: W. long. 71° 15′, and N. lat. 42°.

HARTLAND, a market-town of Devon, ſituated near the Briſtol channel; it gives name to a cape, called Hartland-point, at the entrance of the Briſtol channel: W. long. 4° 45′, and N. lat. 51° 9′.

HARTLEPOOL, a port-town of the county of Durham, ſituated on the German ocean, fourteen miles ſouth-eaſt of Durham: W. long. 55′, and N. lat. 54° 40′.

HARVEST, the time or ſeaſon that the corn is ripe, and fit to be reaped and taken into barns.

HARWICH, a borough and port-town of Eſſex, ſixty-two miles north-eaſt of London: E. long. 1° 25′, N. lat. 52° 5′. It ſends two members to parliament.

HASLEM, an iſland of Denmark, in the Categate-ſea, north of the iſland of Zealand.

HASLEMERE, a borough-town of Surry, thirty eight miles ſouth-weſt of London, and ten miles ſouth-weſt of Guildford. It ſends two members to parliament.

HASSELT, a town of Weſtphalia, in Germany, fifteen miles north-weſt of Maeſtricht.

HASSIDEANS, or ASSIDEANS, an appellation given to thoſe Jews who reſorted to Mattathias, to fight for the law of God, and the liberties of their country.

HASSOCK, a baſs made of ruſhes, to kneel or reſt the feet upon in churches.

HASP and STAPLE, in Scots law, the ſymbol commonly uſed in burgage tenements for entering and infefting an heir, by delivering into his hands the haſp and ſtaple of the door. See SCOTS LAW, title 27.

HASTA, among medalliſts, a kind of javelin, not ſhod or headed with iron; or rather an ancient ſort of ſceptre, longer than ordinary, occaſionally given to all the gods.

HASTATED LEAF. See BOTANY, p. 639.

HASTINGS, a borough-town of Suſſex, ſituated on the coaſt of the Engliſh channel, fifty miles ſouth-eaſt of London: E. long. 36′, and N. lat. 50° 50′.

HAT, a covering for the head, worn by the men in moſt parts of Europe. Thoſe moſt in eſteem are made of the pure hair of the caſtor or beaver; for they are alſo made of the hair or wool of divers other animals, and that by much the ſame proceſs.

Method of making HATS. To make the beaver-hats, they tear off the long and ſhort hair from the ſkin, with knives ſuitable to the occaſion: after which they proportion the quantity of the ſeveral ſorts of beaver-hair, by mixing one third of the dry caſtor to two thirds of old-coat, which is a term for a ſkin that has been worn ſome time by the Indians of America, who catch and ſell them to the Europeans. The hair, ſo mixed, is carded and weighed out into parcels, according to the ſize and thickneſs of the hat intended. The ſtuff is now laid on the hurdle, with an inſtrument called a bow, reſembling that of a violin, but larger; whoſe ſtring being worked with a ſmall bow-ſtick, and made to play on the furs, they fly, and mix themſelves together, the duſt and filth at the ſame time paſſing through the chinks. Inſtead of a bow, ſome hat-makers uſe a ſearce of hair, through which they paſs the ſtuff. Thus hats are formed of an oval figure, ending with an acute angle at the top: with what ſtuff remains, they ſtrengthen them where ſlendereſt, yet deſignedly make them thicker in the brim near the crown, than towards the circumference, or in the crown itſelf. They next harden the ſtuff, ſo managed, into more compact flakes, by preſſing down a hardened leather upon it. This done, they are carried to the baſon, upon which laying one of the hardened hats, they ſprinkle it over with water, and mould it; and the heat of the fire, with the water and preſſing, imbody the ſtuff into a ſlight hairy ſort of felt; after which, turning up the edges all round over the mould, they lay it by, and proceed with another; which being in like manner reduced to the ſame conſiſtence and form, they are both joined together, ſo as to make them meet in an angle at top, making only one conical cap. The next proceſs is to remove the hat to a trough, reſembling a mill-hopper, which is a copper kettle filled with water and grounds, kept hot for the purpoſe; and, after being dipped in the kettle, the hat is laid on the ſloping ſide, called the plank. Here they proceed to work it, by rolling and unrolling it

again and again, one part after another, firft with the hand, and afterwards with a fmall wooden roller, taking care to dip it from time to time, till at length, by thus fulling and thickening it four or five hours, it is brought to the dimenfions intended. In this violent labour, the workmen ufually guard their hands with thick leather, which they call gloves. The hat thus wrought into the form of a conical cap, is reduced into proper fhape on a block of the fize of the intended crown, by tying it round with a ftring, called a commander; after which, with a bent iron, called a ftamper, they gradually beat down the commander all round, till it has reached the bottom of the block, and what remains at the bottom below the ftring forms the brim. In this ftation it is fet to dry, and afterwards finged, by holding it over the blaze of a fire, made of ftraw, or fhavings: it is then rubbed with pumice-ftone, to take off the coarfer nap; then rubbed over with feal fkin, to lay the nap ftill finer; and, laftly, carded with a fine card, to raife the fine cotton, with which the hat is to appear when finifhed: then fitting it to the block, they tie it, cut round the edges, and deliver it to the dyers. (See DYING.) The dye being completed, the hat is dried by being hung in the roof of a ftove heated with a charcoal-fire; and, when dry, it is ftiffened with melted glue, or rather gum-fenega, which is fmeared over the hat with a brufh, and rubbed in with the hand. Then, having fpread a cloth over the fteaming bafon, which is a little fire-place raifed about three feet high, with an iron plate laid over it, exactly covering the fire, the hat is laid uoon the cloth, with the brim downwards, the cloth being firft fprinkled with water, to raife a ftrong fteam, to force in the ftiffening. When it is moderately hot, the workman ftrikes gently on the brim, with the flat of his hand, to make the joinings incorporate and bind fo as not to appear, turning it from time to time, and at laft fetting it on the crown. And when it has been fufficiently fteamed and dried, it is put again on the block, brufhed, ironed, well fmoothed, and fitted for lining.

Hats make a confiderable article in commerce: England fupplies Spain, Portugal, Italy, and Germany, with extraordinary quantities of them; and as our manufacturers have the reputation of making the beft hats in Europe, their importation is prohibited.

HATS are alfo made for womens wear, of chips, ftraw, or cane, by platting, and fewing the plats together; beginning with the centre of the crown, and working round till the whole is finifhed. Hats for the fame purpofe are alfo wove and made of horfe-hair, filk, *&c.*

HATCHEL, or HITCHEL, a tool with which flax and hemp are combed into fine hairs. It confifts of long iron pins, or teeth, regularly fet in a piece of board.

HATCHES, in a fhip, a kind of trap-doors between the main-maft and fore-maft, through which all goods of bulk are let down into the hold.

HATCH-WAY, the place where the hatches are. Thus, to lay a thing in the hatch way, is to put it fo, that the hatches cannot be come at, or opened.

HATCHING, the maturating fecundated eggs, whether by the incubation and warmth of the parent-bird, or by artificial heat, fo as to produce young chickens alive.

The art of hatching chickens by means of ovens has long been practifed in Egypt; but it is there only known to the inhabitants of a fingle village named Berme, and to thofe that live at a fmall diftance from it. Towards the beginning of autumn they fcatter themfelves all over the country, where each perfon among them is ready to undertake the management of an oven, each of which is of a different fize, but in general they are capable of containing from forty to fourfcore thoufand eggs. The number of thefe ovens placed up and down the country is about three hundred and eighty fix, and they ufually keep them working for about fix months: as therefore each brood takes up in an oven, as under a hen, only twenty-one days, it is eafy in every one of them to hatch eight different broods of chickens. Every Bermean is under the obligation of delivering to the perfon who intrufts him with an oven, only two thirds of as many chickens as there have been eggs put under his care; and he is a gainer by this bargain, as more than two thirds of the eggs ufually produce chickens. In order to make a calculation of the number of chickens yearly fo hatched in Egypt, it has been fuppofed, that only two thirds of the eggs are hatched, and that each brood confifts of at leaft thirty thoufand chickens; and thus it would appear, that the ovens of Egypt give life yearly to at leaft ninety-two millions fix hundred and forty thoufand of thefe animals.

This ufeful and advantageous method of hatching eggs has been lately difcovered in France, by the ingenious Mr Reaumur, who, by a number of experiments, has reduced the art to certain principles. He found by experience that the heat neceffary for this purpofe is nearly the fame with that marked 32 on his thermometer, or that marked 96 on Farenheit's. This degree of heat is nearly that of the fkin of the hen, and, what is remarkable, of the fkin of all other domeftic fowls, and probably of all other kinds of birds. The degree of heat which brings about the developement of the cygnet, the gofling, and the turkey-pout, is the fame as that which fits for hatching the canary-fongfter, and, in all probability, the fmalleft humming bird: the difference is only in the time during which this heat ought to be communicated to the eggs of different birds: it will bring the canary bird to perfection in eleven or twelve days, while the turkey-pout will require twenty feven or twenty-eight.

After many experiments, Mr Reaumur found that ftoves heated by means of a baker's oven, fucceeded better than thofe made hot by layers of dung: and the furnaces of glafs-houfes, and thofe of the melters of metals, by means of pipes, to convey heat into a room, might, no doubt, be made to anfwer the fame purpofe. As to the form of the ftoves, no great nicety is required; a chamber over an oven will do very well; nothing more will be neceffary but to afcertain the degree of heat, which may be done by melting a lump of butter, of the fize of a walnut, with half as much tal-

low, and putting it into a phial; this will ferve to indicate the heat with fufficient exactnefs, for when it is too great, this mixture will become as liquid as oil, and when the heat is too fmall, it will remain fixed in a lump; but it will flow like a thick fyrup, upon inclining the bottle, if the ftove be of a right temper: great attention therefore fhould be given to keep the heat always at this degree, by letting in frefh air, if it be too great, or fhutting the ftove more clofe, if it be too fmall; and that all the eggs in the ftove may equally fhare the irregularities of the heat, it will be neceffary to fhift them from the fides to the centre; thereby imitating the hens, who are frequently feen to make ufe of their bills, to pufh to the outer parts thofe eggs that were neareft to the middle of their nefts, and to bring into the middle fuch as lay neareft the fides.

Mr Reaumur has invented a fort of low boxes, without bottoms, and lined with furs. Thefe, which he calls artificial parents, not only fhelter the chickens from the injuries of the air, but afford a kindly warmth, fo that they prefently take the benefit of their fhelter as readily as they would have done under the wings of a hen. After hatching, it will be neceffary to keep the chickens, for fome time, in a room artfully heated and furnifhed with thefe boxes; but afterwards they may be fafely expofed to the air in the court yard, in which it may not be amifs to place one of thefe artificial parents to fhelter them if there fhould be occafion for it.

As to the manner of feeding the young brood, they are generally a whole day after being hatched, before they take any food at all; and then a few crumbs of bread may be given them for a day or two, after which they will begin to pick up infects and grafs for themfelves.

But to fave the trouble of attending them, capons may be taught to watch them in the fame manner as hens do. Mr Reaumur affures us, that he has feen above two hundred chickens at once, all led about and defended only by three or four fuch capons. Nay, cocks may be taught to perform the fame office, which they, as well as the capons, will continue to do all their lives after.

HATFIELD, a market-town of Hartfordfhire, fituated twenty miles north weft of London.

HATHERLY, a market-town of Devonfhire, twenty miles north weft of Exeter.

HATTEM, a town of Gelderland, one of the United Provinces: E. long 6°, N. lat. 52° 30′.

HATTOCK, a fhock of corn containing twelve fheaves: others make it only three fheaves laid together.

HATUAN, a town of Upper Hungary, fifteen miles north eaft of Buda: E. long. 19° 35′, and N. lat. 47° 48′.

HAVANNA, a port-town of the ifland of Cuba, in America, fituated at the entrance of the gulph of Mexico; fubject to Spain: W. long. 84°, and N. lat. 23°.

HAVANT, a market town of Hampfhire, fix miles north-eaft of Portfmouth.

HAVEL, a river of Brandenburg, in Germany, which receives the river Spree, near Berlin, and difcharges itfelf into the Elbe, a little below Havelburg.

HAVELBURG, a town of Germany, in the circle of Upper Saxony, and marquifate of Brandenburg, fubject to the king of Pruffia: E. long. 12° 44′, and N. lat. 53°.

HAVEN, a fea-port or harbour. See HARBOUR.

HAVERFORD WEST, a borough-town of Pembrokefhire, in fouth Wales, fituated twelve miles fouth eaft of St David's. It fends only one member to parliament.

HAUNCH, or HANCH, the hip, or that part of the body between the laft ribs and the thigh

HAVRE DE GRACE, is a port-town of France, in the province of Normandy, fituated on the Englifh channel, at the mouth of the river Seyne: E. long. 10′, and N. lat. 49° 30′.

HAUTBOY, a mufical inftrument of the wind-kind, fhaped much like the flute, only that it fpreads and widens towards the bottom, and is founded through a reed. The treble is two feet long; the tenor goes a fifth lower, when blown open: it has only eight holes; but the bafs, which is five feet long, has eleven.

HAW, a fort of berry, the fruit of feveral fpecies of mefpilus, thence denominated haw-thorns. See MESPILUS.

HAW, among farriers, an excrefcence refembling a griftle, growing under the nether eye-lid and eye of a horfe, which, if not timely removed, will put it quite out. See FARRIERY.

HAWK. See FALCO.

HAWKING, the exercife of taking wild-fowl by means of hawks.

HAWSER, in the fea-language, a large rope, or a kind of fmall cable, ferving for various ufes a-board a fhip, as to faften the main and fore fhrouds, to warp a fhip as fhe lies at anchor, and wind her up to it by a capftan, *&c.* The hawfer of a man of war may ferve for a cable to the fheet-anchor of a fmall fhip.

HAWSES, in a fhip, are two large holes under the bow, through which the cables run when fhe lies at anchor.

HAY, any kind of grafs, cut and dried, for the food of cattle.

The time of mowing grafs for hay, muft be regulated according to its growth and ripenefs; nothing being more prejudicial to the crop than mowing it too foon, becaufe the fap is not then fully come out of the root, and when made into hay, it fhrinks away to nothing. It muft not, however, be let ftand too long, till it have fhed its feeds. When the tops of the grafs look brown, and begin to bend down, and the red honey-fuckle flowers begin to wither, you may conclude it ripe for mowing.

St Foin HAY. See AGRICULTURE, p. 65.

HAY, in geography, a market-town in Brecknockfhire, fouth Wales, thirteen miles north-eaft of Brecknock.

HAYNAULT, a province of the Netherlands, bounded by Brabant and Flanders, on the north; by Namur and

and Liege, on the eaſt; by the Cambreſis, Picardy, and Champaign, on the ſouth; and by Artois, and another part of Flanders, on the weſt: the north part is ſubject to the houſe of Auſtria, and the ſouth part to France. Its capital is Mons.

HAYWARD, the perſon who keeps the common herd or cattle of a town.

HAZARD, a game on dice, without tables, is very properly ſo called; ſince it ſpeedily makes a man, or undoes him.

It is played with only two dice; and as many may play at it as can ſtand round the largeſt round table.

Two things are chiefly to be obſerved, *viz.* main and chance; the latter belonging to the caſter, and the former, or main, to the other gameſters. There can be no main thrown above nine, nor under five; ſo that five, ſix, ſeven, eight, and nine, are the only mains flung at hazard. Chances and nicks are from four to ten: thus four is a chance to nine, five to eight, ſix to ſeven, ſeven to ſix, eight to five; and nine and ten a chance to five, ſix, ſeven, and eight: in ſhort, four, five, ſix, ſeven, eight, nine, and ten, are chances to any main, if any of theſe nick it not. Now nicks are either when the chance is the ſame with the main, as five and five, or the like; or ſix and twelve, ſeven and eleven, eight and twelve. Here obſerve, that twelve is out to nine, ſeven, and five; eleven is out to nine, eight, ſix, and five; and ames-ace and duce-ace, are out to all mains whatever.

HAZLE, in botany. See CORYLUS.

HAZLE-EARTH, or HAZLEY EARTH, a kind of red loam, which is ſaid to be an excellent mixture with other ſorts of earth; uniting what is too looſe, cooling what is too hot, and gently entertaining the moiſture.

HEAD, in anatomy. See ANATOMY, Part I. II. *&c.*

HEAD-ACH, a moſt troubleſome ſenſation in the head, produced by various cauſes, and attended with different ſymptoms, according to its different degrees, and the place where it is ſeated. See MEDICINE.

Dragon's HEAD, in aſtronomy, *&c.* is the aſcending node of the moon, or other planet.

HEADFORD, a town of Galway, in Ireland, twelve miles north of the city of Galway.

HEALTH is a right diſpoſition of the body, and of all its parts; conſiſting in a due temperature, a right conformation, juſt connection, and ready and free exerciſe of the ſeveral vital functions.

HEAM, in beaſts, is the ſame with the ſecundines, or after-birth in women.

HEARING, the ſenſe whereby we perceive ſounds.

The organ of hearing is the ear, and particularly the auditory nerve and membrane. See ANATOMY, p. 295.

This membrane, in the various degrees of tenſion and relaxation, adapts itſelf to the ſeveral natures and ſtates of ſonorous bodies; becoming tenſe for the reception of acute ſounds, and relaxed for the admiſſion of grave ſounds. In ſhort, it is rendered tenſe and relaxed in a thouſand different degrees, according to the various degrees of acuteneſs or gravity in ſounds.

Sound, then, is in effect nothing but a certain modulation of the air, which being collected by the external ear, paſſes through the meatus auditorius, and beats upon the membrane of the tympanum, which moves the bones in the tympanum: theſe move the internal air, which finally communicates the motion to the auditory nerve, in the labyrinth and cochlea; and according as the vibrations are quick or ſlow, the ſound is either acute or grave.

It deſerves obſervation, that though the air be the uſual matter of ſounds; ſo that if a bell be hung in vacuo, it will not be heard at all; yet moſt other bodies, properly diſpoſed, will do its office, only ſome more faintly than others. Thus a ſound may be heard through water, or even through earth, of which there are various inſtances.

As the ſight is aſſiſted by ſpectacles, or other glaſſes; ſo the hearing is enlivened and rendered quick, by means of acouſtic inſtruments; which are of various figures, but for the moſt part bear ſome reſemblance to a trumpet, diverging and growing wider towards the external mouth.

HEARSE, among ſportſmen, a hind of the ſecond year of her age.

HEART, in anatomy. See ANATOMY, p. 278.

Force of the HEART. Several ingenious perſons have, from time to time, attempted to make eſtimates of the force of the blood in the heart and arteries; who have as widely differed from each other, as they have from the truth, for want of a ſufficient number of data to argue upon. This ſet the truly ingenious Dr Hales upon making proper experiments, in order to aſcertain the force of the blood in the veins and arteries of ſeveral animals.

If, according to Dr Keil's eſtimate, the left ventricle of a man's heart throw out in each ſyſtole an ounce or 1.638 cubic inches of blood, and the area of the orifice of the aorta be =0.4187; then dividing the former by this, the quotient 3.9 is the length of the cylinder of blood, which is formed in paſſing through the aorta in each ſyſtole of the ventricle; and in the ſeventy-five pulſes of a minute, a cylinder of 292.5 inches in length will paſs: this is at the rate of 1462 feet in an hour. But the ſyſtole of the heart being performed in one third of this time, the velocity of the blood in that inſtant will be thrice as much, *viz.* at the rate of 4386 feet in an hour, or 73 feet in a minute. And if the ventricle throws out one ounce in a pulſe, then in the ſeventy-five pulſes of a minute, the quantity of blood will be equal to 4.4 ℔ 11 oz. and, in thirty-four minutes, a quantity equal to a middle-ſized man, *viz.* 158 ℔. will paſs through the heart. But if, with Dr Harvey and Dr Lower, we ſuppoſe two ounces of blood, that is, 3.276 cubic inches, to be thrown out at each ſyſtole of the ventricle, then the velocity of the blood in entering the orifice of the aorta, will be double the former, *viz.* at the rate of 146 feet in a minute, and a quantity of blood equal to the weight of a man's body will paſs in half the time, *viz.* 17 minutes.

If we ſuppoſe, what is probable, that the blood will riſe $7+\frac{1}{2}$ feet high in a tube fixed to the carotide artery

tery of a man, and that the inward area of the left ventricle of his heart is equal to fifteen ſquare inches; theſe multiplied into $7+\frac{1}{2}$ feet, give 1350 cubic inches of blood, which preſſes on that ventricle, when it firſt begins to contract, a weight equal to 15.5 pounds.

What the doctor thus calculates, from ſuppoſition, with regard to mankind, he actually experimented upon horſes, dogs, fallow-does, *&c.* by fixing tubes, in orifices opened in their veins and arteries; by obſerving the ſeveral heights, to which the blood roſe in theſe tubes, as they lay on the ground; and by meaſuring the capacities of the ventricles of the heart, and orifices of the arteries. And, that the reader may the more readily compare the ſaid eſtimates together, he has given a table of them, ranged in the following order.

The ſeveral animals.	Weight of each.	Height of the blood in the tube from the jugular vein.	Height of the blood in tubes fixed to arteries.	Capacity of the left ventricle of the heart.	Area of the orifice of the aorta.	Velocity of the blood in the aorta.	Quantities of blood equal to the weight of the animal, in what time.	How much in a minute	Weight of the blood ſuſtained by the left ventricle contracting.	N° of pulſes in a minute.	Area of tranſverſe ſection of deſcending aorta.	Area of the tranſverſe ſection of aſcending aorta.
	Pounds. Ounces.	Inches.	Feet Inches.	Cubic inches.	Square inches.	Feet and inches in a minute.	Minutes.	Pounds.	Pounds.		Square inches.	Square inches.
Man	160	On	7 6	1.659	0.4187	56.55	34.18	4.38	51.5	75		
		ſtrain-		3.318		113.3	17.5	9.36				
Horſe 1ſt.		ing.	8 3									
2d.			9 8									
3d.	825	12 52	9 6	10	1.036	86.85	60	13.75	113.22	86	0.677	0.369
Ox	1600			12.5	1.539	76.95	88	18.14		38	0.912	0.84
												right. left.
Sheep	91	5½ 9	6 5½	1.85	0.172	174.5	20	4.593	36.56	65	0.094	0.07 0.012
Doe			4 2	9	0.476						0.383	0.246
												right. left.
Dogs 1ſt.	52	0 6	6 8	1.172	0.196	144.77	11.9	4 34	33.61	97	0.106	0.041 0.034
2d.	24	5 7	2 8	1	0.185	130.9	6.48	3.7			0.102	0.031 0.009
3d.	18	5	4 8	0.633	0.118	130	7.8	2.3	19.8		0.07	0.022 0.009
4th.	12 8	4	3 3	0 5	0.101	120	6.7	1 85	11.1		0.061	0.015 0.007

HEAT, in phyſiology, one of the ſecondary qualities of bodies, produced by fire, and oppoſed to cold.

Under the article fire, we conſidered the ſun as the principal ſource of heat upon the earth's ſurface, and the confines of the earth and atmoſphere: without this, all the bodies upon our globe would doubtleſs grow rigid, lifeleſs, and fixed. It is this that ſtirs within them, as the main ſpring of their actions. Hence vegetation and animalization are evidently promoted; and hence the ocean and the atmoſphere continue in a fluid ſtate.

Heat in us is properly a ſenſation, excited by the action of fire; or it is the effect of fire on our organs of feeling. Hence it follows, that what we call heat is a particular idea or modification of our own mind, and not any thing exiſting in that form in the body that occaſions it. Heat, ſays Mr Locke, is no more in the fire that burns the finger, than pain is in the needle that pricks it. In effect, heat in the body that gives it, is only motion; and in the mind, only a particular idea.

Heat in the hot body, according to 'S Graveſande, is an agitation of the parts of the body, made by means of the fire contained in it: by ſuch an agitation a motion is produced in our bodies, which excites the idea of heat in our mind; ſo that heat in reſpect of us is nothing but that idea, and in the hot body nothing but motion. If ſuch motion expel the fire in right lines, it gives us the idea of light; if in a various and irregular motion, only heat.

Heat, with reſpect to our ſenſations, or the effect produced on us by a hot body, is eſtimated by its relation to the organ of feeling; no object appearing to be hot, unleſs its heat exceed that of our body. Whence the ſame thing to different perſons, or at different times to the ſame perſon, ſhall appear both hot and cold. The degree of heat is meaſured by the expanſion of the air, or ſpirit in the thermometer.

It

It has been juftly obferved, by fome of our modern philofophers, that actual or abfolute heat, is to fenfible or relative heat, the fame as motion is to velocity: for abfolute heat is nothing but the whole motion of all the parts of the ignited body; and fenfible or relative heat, refpects only the comparative velocity of the parts. Thus, equal bulks of mercury and water fet in a fand-heat, where the heat of the fire may be uniformly communicated to both, will acquire in equal times equal degrees of abfolute heat: but the relative heat of the water, or that which is fenfible to the finger, will be near 14 times as great as that of the mercury, becaufe the water, having 14 times a lefs quantity of matter, will admit of velocity fo much in proportion greater.

Again, if mercury and water have the fame relative or fenfible heat, that is, if both are heated in fuch a manner as to caufe an equal afcent in the thermometer, then a quantity of mercury will heat 14 times as much water as the fame quantity of water will do; or it will make the fame quantity of cold water 14 times hotter than the fame quantity of hot water can. All which is eafy to be fhewn by experiment, and abundantly proves, that heat and fire are wholly owing to the velocity of the parts of the heated or ardent body: on which theory the various phenomena of heat, cold, fire, burning, *&c.* are rationally accounted for. For, firft, we are to confider, that cold and heat are only comparative terms, or that the fame thing may either be too hot, or too cold, according to the relative idea or ftandard-degree. Thus, ice or fnow is faid to be cold with refpect to the finger, but ice or fnow is warm if compared to a freezing mixture; fo that if (as we commonly do) we make the hand or any part of the body the ftandard of heat or cold, or the term of comparifon; then it is evident, 1. If the parts of any body, applied to the hand, have the fame velocity as the parts of the hand, fuch a body we naturally pronounce is neither hot nor cold. 2. If the particles of the body have a greater velocity than thofe of the hand, we pronounce it warm, if the excefs be fmall; but hot, if it be great. 3. If the velocity of the parts of the body applied be lefs than that in the hand, the fenfation then is what we call cold, which alfo may be in various degrees. 4. Hence it is plain, there can be no fuch thing as abfolute cold, but where the particles of matter are abfolutely quiefcent or at reft. 5. Hence alfo, there can be no fuch thing as abfolute heat, becaufe no degree of velocity can be affigned but a greater is ftill affignable, till we come to infinity, where we are quite loft, as having no idea of infinite velocity or heat.

From this theory of heat and cold we may conclude, that there is no body in nature whofe parts are not in motion, in fome degree, fince we have yet been able to difcover no ultimate degree or limit of cold; and if any fuch thing were to be found in nature, it is likely that it would be as impoffible to bear or endure the teft, as any extreme degree of heat; both heat and cold naturally tending to deftroy the animated part, or teft, in the extreme degrees: cold, by deftroying the vital motion, and fixing the part rigid and inflexible; but heat, by putting the parts into too great an agitation, caufing a greater velocity of the fluids, and diffipation and a force of tenfion in the folids beyond what the natural ftate of the body can bear; and therefore it will inevitably deftroy it.

Heat, in the animal œconomy, known by the feveral names of natural heat, vital heat, innate heat, and animal heat, is commonly fuppofed to be that generated by the attrition of the parts of the blood, occafioned by its circulatory motion, efpecially in the arteries.

To what organs, or operations, the heat of the human body, and other animal bodies, is owing, is hitherto extremely doubtful. The opinions that at prefent prevail are, 1. That the heat of animal-bodies is owing to the attrition betwixt the arteries and the blood. 2. That the lungs are the fountain of this heat. 3. That the attrition of the parts of the folids on one another produce it. 4. That it is owing to the mechanical attrition of the particles of our fluids. To which opinions Dr Stevenfon of Edinburgh added a 5th, *viz.* That whole procefs by which our aliment and juices are conftantly undergoing fome alteration.

The reafonings in favour of thefe feveral opinions may be feen at large, as laid down by the above-mentioned author in an effay on the caufe of animal-heat, in the Medical Effays, vol. vi. The chief arguments in favour of the firft opinion, are, that if an artery is tied, or cut, the part to which it goes turns cold; and on the ceafing of the pulfation of the arteries, cold and death follow. An increafe of heat attends a brifk circulation, and a languid circulation is accompanied with a fmall heat. One who burns in a fever, or is hot with exercife, has a full and frequent pulfe. In cold faintings, chlorofis, *&c.* the pulfe is fmall and flow. To thefe they add, that the thermometer fhews the arterial blood to be a little hotter than that of the veins.

This is accounted for from the conical figure of the arteries, from their fluxes and branches into exquifitely fmall capillaries; whence the refiftance, and confequently the attrition, muft be great, from the number, ftrength, and elafticity of their coats, from the propelling power of the heart, and their ftrong refiftance. From all thefe it is inferred, that the particles of blood perpetually getting new motions, directions, and rotations, are attenuated, condenfed, have their angles grinded off, and are made homogeneous: hence, it is faid, follows the fluidity, red colour, and heat of the mafs, which is here perfected.

The fecond opinion is, that the lungs are the fountain of heat in the human body. All that has been faid for the blood's being heated in the arteries is advanced to prove this hypothefis, with confiderable additions, *viz.* that in the lungs the blood-veffels every where attend, divide, and fubdivide, along with the ramifications of the wind-pipe; and as thefe are perpetually changing their fituation and form, becoming longer or fhorter, making more acute or more obtufe angles,

angles, fo muft the concomitant blood-veffels every moment make new angles, and give the blood new directions; that at laft it enters into an exquifitely fine net-work, fpreads every where on the vaftly thin air-veficles, where thefe air-bladders are perpetually changing their angles, points of contact, their form, volume, interftices, and fo forth. From thefe and the elafticity of the air, and weight of the atmofphere, the blood is faid to be churned, preffed backward and forward, broken and kneaded together, diffolved and condenfed, made red and hot in refpiration.

The third opinion is, that the caufe of the animal heat is owing to the action of the folid parts upon one another. The reafon in fupport of this opinion, is, that the heart and arteries move moft; thence that it is natural to think, that the heat fhould be owing to this motion.

The fourth opinion is, the mechanical attrition of the particles of the fluids upon one another. Dr Stevenfon obferves, that thofe who fupport this hypothefis, muft not only fuppofe that mechanical attrition begets heat, but begets itfelf without diminution; that they muft not only fhew what fets this attrition agoing, but what maintains it, becaufe all mechanical force perpetually decreafes in a refifting medium; in fhort, that they muft fhew the poffibility of a perpetuum mobile, the impoffibility of which they themfelves demonftrate.

The fifth opinion is, what Dr Stevenfon calls the animal procefs, or that procefs by which our aliment and fluids are perpetually undergoing fome alteration. This procefs, according to that writer, may be one *fui generis*, fomewhat of a middle nature betwixt fermentation and putrefaction; and he thinks it comes fo near to the latter, that he chufes to call it by that name. In putrefaction, which is a moft powerful diffolvent of bodies, the inteftine action of their minute particles creates, collects, or fome way or other is the caufe or means of heat. The doctor thinks it probable that this procefs is conftantly carried on in all our juices, efpecially where there is blood; and this is chiefly in the veins, fo that the blood is both the fountain of heat and the firft fpring and motion.

The late Dr Mortimer, in the Philof. Tranf. n° 476. gives it as his opinion, that the heat of animals is explicable from the phofphorus and air they contain. Phofphorus exifts, at leaft in a dormant ftate, in animal fluids; and it is alfo known, that they all contain air: it is therefore only neceffary to bring the phofphoreal and aerial particles into contact, and heat muft of confequence be generated.

HEATH, in botany. See ERICA,

Berry-bearing HEATH. See EMPETRUM.

HEATHENS, in matters of religion. See PAGANS.

HEAVEN, literally fignifies the expanfe of the firmament, furrounding our earth, and extended every way to an immenfe diftance.

The Hebrews acknowledged three heavens: the firft the aerial heaven, in which the birds fly, the winds blow, and the fhowers are formed; the fecond, the firmament in which the ftars are placed; the third, the heaven of heavens, the refidence of the Almighty, and the abode of faints and angels.

Heaven is confidered by Chriftian divines and philophers, as a place in fome remote part of infinite fpace, in which the omniprefent Deity is faid to afford a nearer and more immediate view of himfelf, and a more fenfible manifeftation of his glory, than in the other parts of the univerfe. This is often called the empyrean, from that fplendor with which it is fuppofed to be invefted; and of this place the infpired writers give us the moft noble and magnificent defcriptions.

The pagans confidered heaven as the refidence only of the celeftial gods, into which no mortals were admitted after death, unlefs they were deified. As for the fouls of good men, they were configned to the elyfian fields. See ELYSIAN FIELDS.

HEBDOMARY, a folemnity of the ancient Greeks, in honour of Apollo, in which the Athenians fung hymns in honour of that god, and carried in their hands branches of laurel. The word fignifies the feventh day, this folemnity being obferved on the feventh day of every lunar month.

HEBENSTRETIA, in botany, a genus of the didynamia angiofpermia clafs. The calix is bilabiated; the corolla has but one labium, confifting of four fegments; and the capfule contains two feeds. There are two fpecies, both natives of Ethiopia.

HEBRAISM, an idiom or manner of fpeaking peculiar to the Hebrew language. See the next article.

HEBREW, or HEBREW LANGUAGE, that fpoken by the ancient Jews, and wherein the Old Teftament is wrote.

This appears to be the moft ancient of all the languages in the world, at leaft we know of none older: and fome learned men are of opinion, that this is the language in which God fpoke to Adam in Paradife.

The books of the Old Teftament are the only pieces to be found, in all antiquity, written in pure Hebrew; and the language of many of thefe is extremely fublime; it appears perfectly regular, and particularly fo in its conjugations; indeed, properly fpeaking, it has but one conjugation, but this is varied in each feven or eight different ways, which has the effect of fo many different conjugations, and affords a great variety of expreffions to reprefent by a fingle word the different modifications of a verb, and many ideas which in the modern and in many of the ancient and learned languages cannot be expreffed without a periphrafis.

The primitive words, which are called roots, have feldom more than three letters or two fyllables.

In this language there are twenty-two letters, only five of which are ufually reckoned vowels, which are the fame with ours, *viz. a, e, i, o, u;* but then each vowel is divided into two, a long and a fhort, the found of the former being fomewhat grave and long, and that of the latter fhort and acute: it muft however be remarked, that the two laft vowels have founds that differ in other refpects befides quantity, and a greater or lefs elevation. To thefe ten or twelve vowels may be added others called femi-vowels, which ferve to connect the confonants, and to make the eafier tranfitions from

from one another. The number of accents to this language are, indeed, prodigious: of theſe there are near forty, the uſe of ſome of which, notwithſtanding all the inquiries of the learned, are not yet perfectly known. We know, in general, that they ſerve to diſtinguiſh the ſentences like the points called commas, ſemicolons, *&c.* in our language; to determine the quantity of the ſyllables, and to mark the tone with which they are to be ſpoken or ſung. It is no wonder then, that there are more accents in the Hebrew than in other languages, ſince they perform the office of three different things, which in other languages are called by different names.

HEBREWS, or *Epiſtle to the* HEBREWS, a canonical book of the New Teſtament.

Though St Paul did not prefix his name to this epiſtle, the concurrent teſtimony of the beſt authors ancient and modern afford ſuch evidence of his being the author of it, that the objections to the contrary are of little or no weight.

The Hebrews, to whom this epiſtle was wrote, were the believing Jews of Paleſtine; and its deſign was to convince them, and by their means all the Jewiſh converts whereſoever diſperſed, of the inſufficiency and aboliſhment of the ceremonial and ritual law.

HEBRIDES, iſlands on the weſt of Scotland, of which Sky, Mull, Iſla, and Arran are ſome of the largeſt.

HECATOMB, among the ancient pagans, was the ſacrifice of an hundred bulls or oxen; or, in a leſs confined ſenſe, an hundred animals of any ſort.

HECATOMBÆON, in ancient chronology, the firſt month of the Athenian year, conſiſting of thirty days, and anſwering to the latter part of our June.

HECK, an engine to take fiſh. A ſalmon heck is a grate for catching that ſort of fiſh.

HECTIC FEVER. See MEDICINE.

HEDERA, in botany, a genus of the pentandria monogynia claſs. The corolla conſiſts of five oblong petals, and the berry contains five ſeeds. There are two ſpecies; one of them, *viz.* the helix, is a native of Britain.

HEDERA TERRESTRIS. See GLECHOMA.

HEDGES, in agriculture, are either planted to make fences round incloſures, or to divide the ſeveral parts of a garden. When they are deſigned as outward fences, they are planted either with haw thorn, crabs, or blackthorn; but thoſe hedges which are planted in gardens, either to ſurround wilderneſs-quarters, or to ſcreen the other parts of a garden from ſight, are planted according to the fancy of the owner, ſome preferring ever-greens, in which caſe the holly is beſt; next the yew, then the laurel, lauruſtinus, phillyria, *&c.* others prefer the beech, the hornbeam, and the elm.

HEDMORA, a city of Sweden, in the province of Weſtmania, ſituated on the river Dalecarlia, fifty miles north-weſt of Upſal: E. long. 15° 55′, and N. lat. 60° 16′.

HEDYOTIS, in botany, a genus of the tetrandria monogynia claſs. The calix conſiſts of one funnel ſhaped petal; and the capſule has two cells, and many ſeeds. There are three ſpecies, all natives of Ceylon.

HEDYSARUM, in botany, a genus of the diadelphia decandria claſs. The corolla is tranſverſely carinated; and the pod is jointed, each joint containing one ſeed. There are 46 ſpecies, only one of which is a native of Britain, *viz.* the St Foin, or cocks-head.

HEEL, in anatomy. See ANATOMY, p. 185.

HEEL, in the ſea language. If a ſhip leans on one ſide, whether ſhe be a-ground or a-float, then it is ſaid ſhe heels a ſtarboard, or a-port; or that ſhe heels offwards, or to the ſhore; that is, inclines more to one ſide than to another.

HEELER, or *Bloody* HEEL-*cock*, a fighting cock that ſtrikes or wounds much with his ſpurs.

The maſters know ſuch a cock, even while a chicken, by the ſtriking of his two heels together in his going.

HEGIRA, in chronology, a celebrated epocha among the Mahometans.

The event which gave riſe to this epocha was the flight of Mahomet from Mecca, with his new proſelytes, to avoid the perſecution of the Coraiſchites; who, being then moſt powerful in the city, could not bear that Mahomet ſhould aboliſh idolatry, and eſtabliſh his new religion. This flight happened in the fourteenth year after Mahomet had commenced prophet: he retired to Medina, which he made the place of his reſidence.

HEIDELBURG, a city of Germany, in the circle of the lower Rhine, the capital of the Palatinate, ſituated on the river Neckar: E. long. 8° 40′, and N. lat. 49° 20′.

HEILA, a port-town of regal Pruſſia, in the kingdom of Poland, ſituated on the point of a peninſula in the Baltic ſea, twelve miles north of Dantzick: E. long. 19°, N. lat. 54° 30′.

HEINUSE, among hunters, a roe-buck of the fourth year.

HEIR, in Scots law, a generic term applicable to thoſe who are intitled by law to take the poſſeſſion of any ſubject which belonged to a perſon deceaſed.—For the different kinds of heirs, *&c.* ſee LAW, tit. 27. & 28.

HEIRSHIP *moveables*, in Scots law, the beſt of certain kinds of moveables, which the heir of line is intitled to take, beſides the heretable eſtate. See LAW, tit. 27.

HEIR-APPARENT, is a perſon ſo called in the lifetime of his anceſtor, at whoſe death he is heir at law.

HEIRESS, a female heir to one who has an eſtate in lands, *&c.* Stealing an heireſs, and marrying her againſt her will, was declared felony by 3 Hen. VII.

HELENA, or *St* HELENA, an iſland in the Atlantic ocean, ſituated 1200 miles weſt of the coaſt of Africa, and 1800 eaſt of the coaſt of ſouth America: W. long. 6° 30′, S. lat. 16°.

HELENIUM, in botany, a genus of the ſyngeneſia polygamia ſuperflua claſs. The receptacle is naked; the calix is ſimple, and conſiſts of many leaves; and the corollulæ of the radius are ſemitrifid. There is but one ſpecies, a native of Auſtria.

HELIÆA, in Grecian antiquity, was the greateſt and moſt frequented court in Athens for the trial of civil affairs. The judges who ſat in it were at leaſt fifty, but the more uſual number was either two or five hundred. When cauſes of great moment were to be tried, it was cuſtomary to call in the judges of the other courts: ſometimes a thouſand were called in, and then two courts are ſaid to have been joined; ſometimes fifteen hundred or two thouſand were called in, and then three or four courts met together.

They had cognizance of civil affairs of the greateſt weight and importance, and were not permitted to give judgment till they had taken a ſolemn oath to do it with impartiality, and to give ſentence according to the laws, *&c.*

HELIACAL, in aſtronomy, a term applied to the riſing or ſetting of the ſtars; or, more ſtrictly ſpeaking, to their emerſion out of, and immerſion into, the rays and ſuperior ſplendor of the ſun.

A ſtar is ſaid to riſe heliacally, when after having been in conjunction with the ſun, and on that account inviſible, it comes to be at ſuch a diſtance from him, as to be ſeen in the morning before ſun-riſing; the ſun, by his apparent motion, receding from the ſtar towards the eaſt: on the contrary, the heliacal ſetting is when the ſun approaches ſo near a ſtar, as to hide it with his beams, which prevent the fainter light of the ſtar from being perceived; ſo that the terms apparition and occultation would be more proper than riſing and ſetting.

HELIANTHEMUM, in botany, ſee the article CISTUS.

HELIANTHUS, *the Great* SUN-FLOWER, in botany, a genus of the ſyngeneſia polygamia fruſtranea claſs. The receptacle is paleaceous and plane; the pappus conſiſts of two leaves; and the calix is imbricated and ſquarrous. There are twelve ſpecies, none of them natives of Britain.

HELIASTES, in antiquity, one of the judges of the court heliæa. See HELIÆA.

HELICTERES, the SREW-TREE, in botany, a genus of the gynandria decandria claſs. It has five ſtyli; the calix conſiſts of one oblique leaf; the petals are five; the nectarium conſiſts of five ſmall leaves; and it has five twiſted capſules. There are four ſpecies, none of them natives of Britain.

HELIOCARPUS, in botany, a genus of the dodecandria digynia claſs. The calix conſiſts of four leaves; the petals are four; the ſtyli are ſimple; and the capſule conſiſts of two compreſſed cells, radiated on each ſide. There is but one ſpecies, a native of America.

HELIOCENTRIC *latitude of a planet*, the inclination of a line drawn between the centre of the ſun and the center of a planet, to the plane of the ecliptic.

HELIOCENTRIC *place of a planet*, in aſtronomy, the place of the ecliptic wherein the planet would appear to a ſpectator placed at the centre of the ſun.

HELIOCOMETES, a phænomenon ſometimes obſerved about ſun ſetting; being a large luminous tail, or column of light, proceeding from the body of the ſun, and dragging after it, not unlike the tail of a comet; whence the name.

HELIOSCOPE, in optics, a ſort of teleſcope, peculiarly fitted for viewing the ſun without hurting the eyes.

HELIOSTATA, in optics, an inſtrument invented by the late learned Dr S Graveſande; who gave it this name, from its fixing, as it were, the rays of the ſun in an horizontal direction acroſs the dark chamber all the while it is in uſe.

HELIX, in anatomy. See ANATOMY, p. 298.

HELIX, in zoology, a genus belonging to the order of vermes teſtacea. It is an animal of the ſnail-kind; the ſhell conſiſts of one ſpiral, brittle, and almoſt diaphanous valve; and the aperture is narrow. There are 60 ſpecies, principally diſtinguiſhed by the figure of their ſhells.

HELL, the place of divine puniſhment after death.

As all religions have ſuppoſed a future ſtate of exiſtence after this life; ſo all have their hell or place of torment, in which the wicked are ſuppoſed to be puniſhed. The hell of the ancient heathens was divided into two manſions; the one called elyſium, on the right hand, pleaſant and delightful, appointed for the ſouls of good men; the other called tartara, on the left, a region of miſery and torment, appointed for the wicked. The latter only was hell, in the preſent reſtrained ſenſe of the word. See ELYSIUM.

The philoſophers were of opinion, that the infernal regions were at an equal diſtance from all the parts of the earth; nevertheleſs it was the opinion of ſome, that there were certain paſſages which led thither, as the river Lethe near the Syrtes, and the Acheruſian cave in Epirus. At Hermione it was thought, that there was a very ſhort way to hell; for which reaſon the people of that country never put the fare into the mouths of the dead to pay their paſſage.

The Jews placed hell in the centre of the earth, and believed it to be ſituated under waters and mountains. According to them, there are three paſſages leading to it: the firſt is in the wilderneſs, and by that Korah, Dathan and Abiram deſcended into hell; the ſecond is in the ſea, becauſe Jonah, who was thrown into the ſea, cried to God out of the belly of hell; the third is in Jeruſalem, becauſe it is ſaid the fire of the Lord is in Zion, and his furnace is in Jeruſalem. They likewiſe acknowledged ſeven degrees of pain in hell, becauſe they find this place called by ſeven different names in ſcripture. Though they believed that infidels, and perſons eminently wicked, will continue for ever in hell; yet they maintained, that every Jew who is not infected with ſome hereſy, and has not acted contrary to the points mentioned by the rabbins, will not be puniſhed therein for any other crimes above a year at moſt.

The Mahometans believe the eternity of rewards and puniſhments in another life. In the Koran it is ſaid, that hell has ſeven gates, the firſt for the Muſſulmans, the ſecond for the Chriſtians, the third for the Jews, the fourth for the Sabians, the fifth for the Magians, the

the fixth for the pagans, and the feventh for the hypocrites of all religions.

Among Chriftians, there are two controverted queftions in regard to hell; the one concerns locality, the other the duration of its torments. The locality of hell, and the reality of its fire, began firft to be controverted by Origen. That father, interpreting the fcripture account metaphorically, makes hell to confift not in external punifhments, but in a confcioufnefs or fenfe of guilt, and a remembrance of paft pleafures. Among the moderns, Mr Whifton advanced a new hypothefis. According to him, the comets are fo many hells appointed in their orbits alternately to carry the damned into the confines of the fun, there to be fcorched by its violent heat, and then to return with them beyond the orb of Saturn, there to ftarve them in thefe cold and difmal regions. Another modern author, not fatisfied with any hypothefis hitherto advanced, affigns the fun to be the local hell. As to the fecond queftion, *viz.* the duration of hell-torments, we have Origen again at the head of thofe who deny that they are eternal; it being that father's opinion, that not only men, but devils, after a due courfe of punifhment fuitable to their refpective crimes, fhall be pardoned and reftored to heaven. The chief principle upon which Origen built his opinion, was the nature of punifhment, which he took to be emendatory, applied only as phyfic for the recovery of the patient's health. The chief objection to the eternity of hell torments among modern writers, is the difproportion between temporary crimes and eternal punifhments. Thofe who maintain the affirmative, ground their opinions on fcripture accounts, which reprefent the pains of hell under the figure of a worm which never dies, and a fire which is not quenched; as alfo upon the words, "Thefe fhall go away into everlafting punifhment, but "the righteous into life eternal.

HELLEBORUS, HELLEBORE, in botany, a genus of the polyandria polygynia clafs. It has no calix; the petals are five or more; the nectarium is tubular and bilabiated; and the capfule contains many feeds. There are five fpecies, two of them natives of Britain, *viz.* the fætidus, or great baftard black hellebore; and the viridis, or wild black hellebore. The hellebore, when taken in large quantities, is poifonous; but the root, in fmall dofes, is fuppofed to attenuate the humours, and to promote urinary and uterine difcharges.

HELLENISM, in matters of language, a phrafe in the idiom, genius, or conftruction of the Greek tongue.

This word is only ufed when fpeaking of the authors who, writing in a different language, exprefs themfelves in a phrafeology peculiar to the Greek.

HELLENISTIC, or HELENISTIC LANGUAGE, that ufed by the Grecian Jews who lived in Egypt and other parts where the Greek tongue prevailed. In this language it is faid the Septuagint was written, and alfo the books of the New Teftament; and that it was thus denominated to fhew that it was Greek filled with Hebraifms and Syriacifms.

HELLESPONT, the entrance of the ftreights which divides Afia from Europe, and paffes from the Archipelago to Conftantinople. It is now called the Dardanelles, and is about two miles wide.

HELM *of a fhip*, is a piece of timber faftened into the rudder, which comes forward into the fteerage, or place where the perfon at the helm fteers the fhip, by holding the whipftaff in his hand, which is joined to the helm. They begin however to be left off, fteering-wheels being ufed in their room.

There are feveral terms in the fea-language relating to the helm; as, *bear up the helm*: that is, let the fhip go more large before the wind. *Helm a mid-fhip*, or *right the helm*; that is, keep it even with the middle of the fhip. *Port the helm*, put it over the the left fide of the fhip. *Starboard the helm*, put it on the right fide of the fhip.

HELMET, an ancient defenfive armour worn by horfemen both in war and in tournaments. It covered both the head and face, only leaving an aperture in the front fecured by bars, which was called the vifor.

HELMINTHOLITHUS, in natural hiftory, a name given by Linnæus to petrified bodies refembling worms.

Of thefe he reckons four genera. 1. Petrified lithophyta, found in the mountains of Sweden. 2. Petrified fhells. 3. Petrified zoophytes. 4. Petrified reptiles.

HELMONT, a town of the Netherlands, in the province of Dutch Brabant, fituated on the river Aa: E. long. 5° 40′, N. lat. 51° 30′.

HELMSTAT, a town of Germany, in the circle of Lower Saxony, and dukedom of Brunfwic: E. long. 11° 15′, N. lat. 52° 20′.

HELOTS, in Grecian antiquity, the inhabitants of Helos, a town of Laconia, conquered by the Spartans; who made them all prifoners of war, and reduced them into the condition of flaves.

The freemen of Sparta were forbidden the exercife of any mean or mechanical employment, and therefore the whole care of fupplying the city with neceffaries devolved upon the Helots.

HELSINGFORD a port-town of Sweden, fituated on the gulph of Finland, in 24° 6′ E. long. and 60° 8′ N. lat.

HELSINGIA, a province of Sweden, bounded by the Bothnic gulph on the eaft, and by Dalecarlia on the weft.

HELSINGIC CHARACTER, a peculiar kind of character, found infcribed on ftones in the province of Helfingia: the Runic and Helfingic characters may be eafily tranformed into each other.

HELSTON, a borough of Cornwall, nine miles fouthweft of Falmouth: it fends two members to parliament.

HELVOETSLUYS, a port-town of the united Netherlands, fituated in the ifland of Voorn, in the province of Holland, five miles fouth of the Briel: it is one of the beft harbours in Holland, and that to which the Englifh packet alway goes.

HEMEROBIUS, in zoology, a genus of infects of the neuroptera order, the characters of which are thefe: The mouth is furnifhed with two teeth; the palpi are four; the wings are deflected, but not plaited; and the

the antennæ are briſtly and longer than the breaſt. There are 15 ſpecies, principally diſtinguiſhed by their colours.

HEMEROCALLIS, DAY-LILLY, in botany, a genus of the hexandria-monogynia claſs. The corolla is bell-ſhaped, with a cylindrical tube; and the ſtamina are declinated. There are two ſpecies, none of them natives of Britain.

HEMI, a word uſed in the compoſition of divers terms, ſignifying the ſame with ſemi, or demi, *viz.* one half.

HEMINA, in Roman antiquity, a liquid meaſure which, according to Arbuthnot, was equal to half a wine-pint engliſh meaſure; its contents being 2,818 ſolid inches.

HEMIONITIS, in botany, a genus of the cryptogamia filices claſs. The parts of fructification lie in decuſſating lines. There are three ſpecies, none of them natives of Britain.

HEMIPLEGIA, or HEMIPLEXIA, among phyſicians, a palſy of one half of the body.

HEMISPHERE, in geometry, the half of a globe or ſphere, when it is ſuppoſed to be cut through its centre in the plane of one of its great circles.

HEMISPHERE is alſo uſed to denote a projection of half the terreſtrial globe, or half the celeſtial ſphere, on a plane, and frequently called planiſphere.

HEMISTICH, in poetry, denotes half a verſe, or a verſe not completed.

HEMITRITÆUS, among phyſicians, a kind of intermitting fever, being a ſemitertian. See MEDICINE.

HEMLOCK, in botany. See CICUTA.

HEMP, in botany. See CANNABIS.

The raiſing and dreſſing of hemp ſcarcely differs from the raiſing and dreſſing of flax, but in the following particulars.

Hemp requires a light, free, dry, duſty, and even a ſandy warm ſoil; which if not naturally rich, muſt be made ſo by manure. New broke up ground does not anſwer for hemp, producing it thin and poor upon the ſtalk. Hemp does well to follow beans. The ground ſhould be ploughed and harrowed three or four times, a fortnight or three weeks intervening between each time. In ſome parts of Lincoln and Holland the ſoil is naturally ſo free and rich, that it will produce hemp conſtantly year after year without manure. The leaves which fall off the ſtalk help to manure the ground. It is frequently ſown with a view to clear the ground of weeds; which it does moſt affectually, growing faſt, and ſoon checking every weed but mugwort, which is picked out with a fork.

It is ſown about the firſt of May; ſo thin, that about four pecks are ſufficient for an Engliſh acre; and the ground muſt then be covered as much as poſſible to preſerve the ſeed from the birds, who are very fond of it.

The *taper-topped* ſtalk which does not bear the pods, is called the *female*, though in fact it is the *male*, ſcattering from its bloom a ſmall duſt, which impregnates the pods of the *buſhy-topped*; which laſt is commonly, though improperly, called the male or carle hemp.

When hemp is the object of the farmer more than a crop of ſeed, the whole ſhould be pulled when the ſtalk begins to grow yellow, and the earth remaining about the roots ſhould be beat off to prevent more growth: but if the ſeed is wanted in its greateſt perfection, the ſtalks bearing the pods muſt be pulled before the upmoſt pod begins to open; the earth ſhould not be beat off from the roots; it ſhould be ſtooked in ſheaves upon the field, to dry and win as corn; and the top of theſe ſtooks ſhould be covered with undergrowth, or the like, to preſerve the ſeed from the birds.

Hemp is ſooner watered than flax, and the canals muſt be deeper.

In keeping the ſeed, care muſt be taken to preſerve it from rats, mice, and ſuch like vermin, who are all fond of it.

It is dreſſed as coarſe flax, but is ſooner dreſſed; and its greater length requires more care, and renders it more troubleſome in the handling, eſpecially in the ſkutching of it by the water lint-mills with horizontal ſkutchers, when it muſt be folded double. What is too coarſe and ſtrong in the ſtalk for the hand or foot machines, may be broke and peeled by the hand. See FLAX.

HEMPSTEAD, a market-town of Hartfordſhire, twenty-four miles north-weſt of London.

HEN, in ornithology. See PHASIANUS.

HEN-BANE. See HYOSCIAMUS.

HENDECAGON, in geometry, a figure that hath eleven ſides and as many angles.

HENLEY, a market-town of Oxfordſhire, ſituated on the river Thames, twenty miles ſouth-eaſt of Oxford, and thirty-two weſt of London.

HENNEBURG, a town of Germany, in the circle of Franconia, and the capital of the county of Henneburgh: E. long 10° 27′, and N. lat. 50° 40′.

HENOTICON, in church-hiſtory, a decree or edict of the emperor Zeno, made at Conſtantinople, in the year 482, by which he pretended to reconcile all parties under one faith. It is generally agreed that Peter, patriarch of Alexandria, and Acacius, patriarch of Conſtantinople, were the authors of this decree, and that their deſign was to compliment the emperor with a right of preſcribing regulations in matters of faith. The emperor, by this decree, arrogated to himſelf the right of being head of the church. Pope Simplicius, however, in the year 483, condemned the henoticon, and cited Acacius, the chief promoter of it, to appear before him at Rome; but it was not entirely ſuppreſſed till the year 518.

HENRICO, a county of the colony of Virginia, in North America.

HENRY, or CAPE-HENRY, the ſouth cape of Virginia, at the entrance of Cheſepeak-bay: W. long. 74° 50′, N. lat. 37°.

HEPAR SULPHURIS, or LIVER OF SULPHUR. See CHEMISTRY.

HEPATIC, in medicine and anatomy, any thing belonging to the liver.

HEPATICA, in botany. See ANEMONE.

HEPATITIS, in medicine. See MEDICINE.

HEPATUS, in ichthyology. See LABRUS.

HEPHÆSTIA, in Grecian antiquity, an Athenian feſtival, in honour of Vulcan, the chief ceremony of which was a race with torches.

HEPSETUS, in ichthyology. See ESOX.

HEPTACHORD, in the ancient poetry, ſignified verſes that were ſung or played on ſeven chords, that is, on ſeven different notes. In this ſenſe it was applied to the lyre, when it had but ſeven ſtrings.

HEPTAGON, in geometry, a figure conſiſting of ſeven ſides and as many angles.

HEPTANDRIA, in botany. See BOTANY, p. 635.

HEPTANGULAR, in geometry, an appellation given to figures which have ſeven angles.

HEPTARCHY, a government of ſeven perſons: alſo a a ſtate or country divided into ſeven kingdoms, and governed by ſeven independent princes; in which ſenſe it is particularly applied to the government of ſouth Britains when divided amongſt the Saxons.

HEPTATEUCH, the ſeven firſt books of the Old Teſtament, containing the pentateuch, or five books of Moſes, and the books of Joſhua and Judges.

HEPHTHEMIMERIS, in ancient poetry, a verſe conſiſting of three feet and an half, or ſeven half feet.

It likewiſe denotes a cæſura after the third foot of a verſe.

HERACLEA, a port-town of Romania, in European Turky, ſituated on the Propontis, ſixty miles ſouthweſt of Conſtantinople; it was once a great city: E. long. 28°, and N. lat. 41°.

HERACLEONITES, a ſect of chriſtians, the followers of Heracleon, who refined upon the gnoſtic divinity, and maintained that the world was not the immediate production of the Son of God, but that he was only the occaſional cauſe of its being created by the demiurgus. The Heracleonites denied the authority of the prophecies of the Old Teſtament, maintaining that they were mere random ſounds in the air; and that St. John the Baptiſt was the only true voice that directed to the Meſſiah.

HERACLEUM, in botany, a genus of the pentandria digynia claſs, the general flower of which is difform and radiated; the ſingle flowers of the diſc conſiſt each of five equal petals, but thoſe of the radius conſiſt of five unequal petals: the fruit is eliptic, compreſſed, and ſtriated on each ſide in the middle, and contains two oval compreſſed ſeeds. There are five ſpecies, one of which, *viz.* the ſphondylium, or cow-parſnip, is a native of Britain.

HERACLIDÆ, or *Return of the* HERACLIDÆ *into Peloponneſus*, in chronology, a famous epocha, that conſtitutes the beginning of profane hiſtory; all the time preceding that period being accounted fabulous.

This return happened in the year of the world 2862, an hundred years after they were expelled, and eighty after the deſtruction of Troy.

HERALD, an officer at arms, whoſe buſineſs it is to declare war, to proclaim peace, to marſhal all the ſolemnities at the coronation, chriſtening, marriage, and funeral of princes, to blazon and examine coats of arms, *&c.*

Heralds were formerly held in much greater eſteem than they are at preſent, and were created and chriſtened by the king, who pouring a gold-cup of wine on their head, gave them the herald-name; but this is now done by the earl-marſhal. They could not arrive at the dignity of herald without having been ſeven years purſuivant; nor could they quit the office of herald, but to be made king at arms.

HERALDRY, is the art of armory and blazoning; or, the knowledge of what relates to the bearing of arms, and the laws and regulations thereof.

Arms, or *Armories*, are marks of dignity and honour, regularly compoſed of certain figures and colours, given or authorized by ſovereigns, and borne in banners, ſhields, coats, *&c.* for the diſtinction of perſons, families, and ſtates, and paſſing by deſcent to poſterity.

They are called *arms*, in regard they are borne principally on the buckler, cuiraſſe, banners, and other apparatus of war; and *coats of arms*, *coat-armour*, &c. becauſe anciently embroidered on a cloak or habit, worn by the ancient knights over their arms, both in war and at tournaments, and ſtill borne by the heralds at arms.

It was a kind of ſurcoat, reaching only as low as the navel, open at the ſides, with ſhort ſleeves; ſometimes furred with *ermine* and *vair*, wherein were applied the *armories* of the knight, embroidered with gold and ſilver, and enamelled with beaten tin, coloured *black*, *green*, *red*, and *blue*; whence the rule never to apply colour on colour, nor metal on metal.

The *coats of arms* were frequently open, and diverſified with bands and fillets of ſeveral colours, alternately placed, as we ſtill ſee cloths ſcarleted, watered, *&c.* Hence they were alſo called *devices* or *diviſes*; and being divided, or compoſed of ſeveral pieces ſewed together, whence the words *feſſe*, *pale*, *chevron*, *bend*, *croſs*, *ſalter*, *lozenge*, &c. See theſe articles.

The ſurcoat being embroidered with *gold* and *ſilver*, was the occaſion that thoſe two metals have been ſince placed in the coats of arms, under their *French* name of *or* and *argent*; and their being coloured *black*, *green*, *red*, and *blue*, that thoſe different colours have alſo been introduced in them: therefore,

There are two metals in *Heraldry*, viz, *or* and *argent*; and ſeven colours, which are, *gules*, *azure*, *ſable*, *vert*, *purpure*, *tenne*, and *ſanguine*. See theſe and all the other terms belonging to heraldry as they occur in the order of the alphabet.

HERAT, a city of Perſia, in the province of Choraſſan: E. long. 61°, and N. lat. 34° 30′.

HERB, in pharmacy, an appellation given to the ſtalks and leaves of plants, eſpecially ſuch as are fleſhy and ſucculent, and die away every year; but is alſo frequently uſed to denote the leaves alone.

HERBAL, a book that treats of the claſſes, genera, ſpecies, and virtues of plants. See BOTANY.

HERBIVOROUS ANIMALS, thoſe which feed only on vegetables.

HERBOURG, a town in the circle of the upper Rhine, and territory of Naſſau: E. lon. 8° 15′, and N. lat. 50° 36′.

HERCINIAN,

HERCINIAN FOREST, a foreſt which anciently extended the whole length of Germany and Bohemia, ſome remains of which are ſtill in being, *viz.* the Black Foreſt, Odenwald near Heidelburg, Stigewald in Wurtſburg, and Bamberg, and Hartſwald in Brunſwic.

HERCOLE, a port-town of Tuſcany, on the coaſt called Stato del Preſidii: E. lon. 12°, and N. lat. 42° 25′.

HERCULES, in aſtronomy. See ASTRONOMY. p. 486.

HERCULES-PILLARS, in antiquity, a name given to mount Calpe in Spain, near Gibraltar, on the European ſide of the ſtreights, and mount Avila on the African ſide.

HEREDITAMENTS, whatever immoveable things a perſon may have to himſelf and his heirs by way of inheritance; and which, if not otherwiſe bequeathed, deſcend to him who is next heir, and not to the executor, as chattels do.

HEREDITARY, an appellation given to whatever belongs to a family by right of ſucceſſion, from heir to heir.

HEREDITAS JACENS, in Scots law. An eſtate is ſaid to be *in hereditate jacente*, after the proprietor's death, till the heir's entry.

HEREFORD, the principal city of Herefordſhire, ſituated on the river Wye, twenty-four miles north-weſt of Gloceſter, and one hundred and twenty weſt of London: W. lon. 2° 42′, and N. lat. 52° 6′.

It ſends two members to parliament.

HERESY, the crime of obſtinately perſiſting in opinions that are contrary to the fundamentals of religion.

HERETABLE RIGHTS, in Scots law, all rights affecting lands, houſes, *&c.* or any immoveable ſubject. See LAW, tit. 9.

HERETAGE, in Scots law, lands, houſes, or any immoveable ſubject, in contradiſtinction to moveables or moveable ſubjects. See LAW, tit. 9. It alſo ſometimes ſignifies ſuch immoveable property as a perſon ſucceeds to as heir to another, in contradiſtinction to that which he himſelf purchaſes or acquires in any other manner, called *conqueſt*. See LAW, tit. 27.

HERETIC, a general name for all ſuch perſons, under any religion, but eſpecially the Chriſtian, as profeſs or teach religious opinions contrary to the eſtabliſhed faith, or to what is made the ſtandard of orthodoxy.

HERLING, a market-town of Norfolk, twenty miles ſouth-weſt of Norwich.

HERMÆ, among antiquarians, ſtatues of the god Mercury, made of marble, and ſometimes of braſs, without arms or feet, and ſet up by the Greeks and Romans in the croſs ways.

HERMÆA, in antiquity, ancient Greek feſtivals, in honour of the god Hermes or Mercury.

HERMANIA, in botany, a genus of the monadelphia pentandria claſs. It has but one ſtylus; the capſule has five cells; and the petals are ſemitubular at the baſe. There are nine ſpecies, none of them natives of Britain.

HERMANASTAT, the capital city of Tranſilvania, ſubject to the houſe of Auſtria: E. lon. 24°, N. lat. 46° 32′.

HERMAPHRODITE, a perſon of both ſexes, or who has the parts of generation both of male and female.

It is now generally allowed, that there is no ſuch thing as a true hermaphrodite; moſt, if not all thoſe who paſs for ſuch, being mere women, whoſe clitoris is grown to an enormous ſize, and the labia pudendi become unuſually tumid.

Among the inſect-claſs of animals, indeed, hermaphrodites are very frequent: ſuch as worms, ſnails, leeches, *&c.*

HERMAPHRODITE FLOWERS, among botaniſts. See BOTANY.

HERMATHENA, among antiquarians, a ſtatue repreſenting Mercury and Minerva both in one.

HERMES. See HERMÆ.

HERMETIC, or HERMETICAL, an appellation given to whatever belongs to chemiſtry, from Hermes Triſmegiſtus, who is ſuppoſed to have been its inventor.

HERMETICAL PHILOSOPHY, that which undertakes to ſolve the various phænomena of nature, from the chemical principles ſalt, ſulphur, and mercury.

HERMETICAL SEAL, among chemiſts, a method of ſtopping glaſs-veſſels, uſed in chemichal operations, ſo cloſely, that the moſt ſubtil ſpirit cannot eſcape through them.

It is commonly done by heating the neck of the veſſel in a flame, till ready to melt, and then twiſting it cloſely together with a pair of pincers. Or, veſſels may be hermetically ſealed, by ſtopping them with a glaſs plug, well luted; or, by covering the veſſel with another ovum philoſophicum.

HERMIT, a devout perſon retired into ſolitude to be more at leiſure for contemplation, and to diſencumber himſelf from the affairs of the world.

HERMON, a mountain on the eaſt of Syria and Paleſtine, in Aſia.

HERNANDIA, in botany, a genus of the monœcia triandria claſs. The calix of the male has three ſegments, and the corolla three petals. The calix of the female is entire and truncated; the corolla conſiſts of ſix petals; and the drupa is hollow, with an open mouth, and a looſe kernel. There are two ſpecies, both natives of the Indies.

HERNGRUNT, a town of Upper Hungary, ſituated north of Buda, near the Carpathian mountains: E. lon. 19° 20′ lat. 48° 47′.

HERNIA, in medicine. See MEDICINE and SURGERY.

HERNIARIA, RUPTURE-WORT, in botany, a genus of the pentandria digynia claſs. The calix conſiſts of five ſegments; it has no corolla; and the capſule contains one ſeed. There are four ſpecies, three of them natives of Britain, *viz.* the glabra, or ſmooth rupture-wort; the hirſuta, or rough rupture-wort; and the lenticulata, or ſea rupture-wort. The leaves may be uſed as a mild reſtringent; but have no title to their former reputation of curing ruptures.

HERO, in the ancient mythology, a great and illuſtrious perſon, of a mortal nature, though ſuppoſed by the populace

lace to partake of immortality; and, after his death, placed among the number of the gods.

HEROIC POEM, that which defcribes fome extraordinary enterprize; being the fame with epic poem. See COMPOSITION.

HEROIC VERSE, that wherein heroic poems are ufually compofed; or it is that proper for fuch poems. In the Greek and Latin, hexameter verfes are ufually denominated heroic verfes, as being alone ufed by Homer, Virgil, *&c*.

HERON. in ornithology. See ARDEA.

HERPES, in medicine, a bilious puftule, which breaking out in different manners upon the fkin, accordingly receives different denominations. See MEDICINE.

HERRING, in ichthyology. See CLUPEA.

HERSILLON, in the art of war, is a ftrong plank or beam, about ten or twelve feet long, ftuck full of fpikes on both fides, and ufed to incommode the march of the infantry or cavalry.

HESPER, an appellation given to the planet Venus, when fhe fets after the fun.

HESPERIDES, in antiquity, the daughters of Hefperus, brother of Atlas, who kept a garden full of golden apples, guarded by a dragon: but Hercules having laid the dragon afleep, ftole away the apples.

HESPERIS, DAME'S VIOLET, in botany, a genus of the tetradynamia filiquofa clafs. The petals are obliquely bent; there is a gland betwixt the fhort ftamina; and the ftigma is forked at the bafe, and connivent at top. There are feven fpecies, only one of which, *viz.* the martronalis, or unfavoury dame's violet, is a native of Britain.

HESSE-CASSEL landgraviate, including Wetteravia, is a circle of the Upper Rhine, bounded by Weftphalia and Brunfwic on the north, by Franconia and Saxony on the eaft, by the river Maine on the fouth, and by another part of Weftphalia and the electorate of Mentz and Triers on the weft: it is fubject to the king of Sweden.

HESSE-DARMSTAT, is bounded by the river Maine, which divides it from Heffe-Caffel, on the north, by the fame river on the eaft, and by the Palatinate on the fouth and weft.

HETEROCLITE, among grammarians, one of the three variations in irregular nouns, and defined by Mr Ruddiman, a noun that varies in declenfion; as, *hoc vas, vafis: hæc vafa, vaforum.*

HETERODOX, in polemical theology, any thing contrary to the faith and doctrines of a church.

HETERODOMUS VECTIS, in mechanics, a lever, wherein the fulcrum, or point of fufpenfion, is placed between the power and the weight. See MECHANICS.

HETEROGENEITY, in phyfiology, that quality or property of bodies which denominates a thing heterogeneous. See the next article.

HETEROGENOUS, or HETEROGENEAL, fomething that confifts of parts of diffimilar kinds, in oppofition to homogeneous.

HETEROSCII, in geography, a term of relation, denoting fuch inhabitants of the earth as have their fhadows falling but one way, as thofe who live between the tropics and polar circles, whofe fhadows at noon in north latitude are always to the northward, and in fouth latitude to the fouthward.

HEUCHERA, in botany, a genus of the pentandria digynia clafs. The petals are five; and the capfule has a double beak, and two cells. There is but one fpecies, a native of Virginia.

HEXACHORD, in ancient mufic, a concord called by the moderns a fixth.

HEXAGON, in geometry, a figure of fix fides and angles; and if thefe fides and angles be equal, it is called a regular hexagon. See GEOMETRY.

HEXAHEDRON, in geometry, one of the five Platonic bodies, or regular folids; being the fame with a cube.

HEXAMETER, *carmen hexametrum*, in ancient poetry, a kind of verfe confifting of fix feet; the firft four of which may be indifferently either fpondees or dactyls, the fifth is generally a dactyl, and the fixth always a fpondee. Such is the following verfe of Horace:

1 2 3 4 5 6
Aut pro|deffe vo|lunt, aut|dele|ctare po|etæ.

HEXANDRIA, in botany. See BOTANY, p. 635.

HEXASTYLE, in architecture, a building with fix columns in front.

HEXHAM, a market-town of Northumberland, fixteen miles weft of Newcaftle.

HEYDON, a borough town in Yorkfhire, thirty-feven miles fouth-eaft of York, and fix miles weft of Hull. It fends two members to parliament.

HEYTSBURY, a borough town of Wiltfhire, fourteen miles north-weft of Salifbury, fends two members to parliament.

HIATICULA, in ornithology. See CHARADRIUS.

HIATUS, properly fignifies an opening, chafm, or gap; but it is particularly applied to thofe verfes, where one word ends with a vowel, and the following word begins with one, and thereby occafions the mouth to be more open, and the found to be very harfh.

The term hiatus is alfo ufed in fpeaking of manufcripts, to denote their defects, of the parts that have been loft or effaced.

HIBISCUS, in botany, a genus of the monadelphia polyandria clafs. The calix is double; the exterior one confifts of many leaves; the capfule has five cells, and contains many feeds. There are twenty-five fpecies, none of them natives of Britain.

HICCUP, or HICCOUGH, in medicine, a fpafmodic affection of the ftomach and diaphragm, arifing from any thing that irritates and vellicates their nervous coats. See MEDICINE.

HIDE, the fkin of beafts, but particularly applied to thofe of large cattle, as bullocks, cows, horfes, *&c.*

Hides are either raw or green, juft as taken off the carcafe; falted or feafoned with falt, alum, and faltpetre, to prevent their fpoiling; or curried and tanned. See TANNING.

HIDE *of land*, was fuch a quantity of land as might be plowed with one plough within the compafs of a year, or fo much as would maintain a family; fome call

call it fixty, fome eighty, and fome an hundred acres.

HIDE-BOUND. See FARRIERY, p. 563.

HIERACHIUM, HAWKWEED, in botany, genus of the fyngenefia polygamia æqualis clafs. The receptacle is naked; the calix is oval and imbricated; and the pappus is fimple and feffile. There are 28 fpecies, 8 of them natives of Britain. The leaves of the pilofella, or common creeping moufe-ear, are recommended as aftringents.

HIERACITES, in church-hiftory, Chriftian heretics in the third century, fo called from their leader Hierax, a philofopher of Egypt; who taught that Melchifedek was the Holy Ghoft, denied the refurrection, and condemned marriage.

HIERARCHY, among divines, denotes the fubordination of angels.

Some of the rabbins reckon four, others ten, orders or ranks of angels; and give them different names, according to their different degrees of power and knowledge.

HIERARCHY likewife denotes the fubordination of the clergy, ecclefiaftical polity, or the conftitution and government of the Chriftian church confidered as a fociety.

HIEROGLYPHICS, in antiquity, myftical characters, or fymbols, in ufe among the Egyptians, and that as well in their writings as infcriptions; being the figures of various animals, the parts of human bodies, and mechanical inftruments.

But befides the hieroglyphics in common ufe among the people, the priefts had certain myftical characters, in which they wrapped up and concealed their doctrines from the vulgar. It is faid, that thefe fomething refembled the Chinefe characters, and that they were the invention of Hermes. Sir John Marfham conjectures, that the ufe of thefe hieroglyphical figures of animals introduced the ftrange worfhip paid them by that nation: for as thefe figures were made choice of, according to the refpective qualities of each animal, to exprefs the qualities and dignity of the perfons reprefented by them, who were generally their gods, princes and great men, and being placed in their temples, as the images of their deities; hence they came to pay a fuperftitious veneration to the animals themfelves.

The meaning of a few of thefe hieroglyphics, has been preferved by ancient writers. Thus we are told they reprefented the fupreme Deity by a ferpent with the head of a hawk. The hawk itfelf was the hieroglyphic of Ofiris; the river-horfe, of Typhon; the dog, of Mercury; the cat, of the moon, or Diana; the beetle, of a couragious warrior; a new-born child, of the rifing fun; and the like.

HIEROGRAMMATISTS, *i. e.* holy regifters, were an order of priefts among the ancient Egyptians, who prefided over learning and religion.

They had the care of the hieroglyphics, and were the expofitors of religious doctrines and opinions. They were looked upon as a kind of prophets, and it is pretended that one of them predicted to an Egyptian king, that an Ifraelite, (meaning Mofes) eminent for his qualifications and atchievements, would leffen and deprefs the Egyptian monarchy.

HIEROMANCY, in antiquity, that part of divination which predicted future events from obferving the various things offered in facrifice. See DIVINATION and SACRIFICE.

HEROMNEMON, the name of an officer in the Greek church, whofe principal function it was to ftand behind the patriarch at the facraments and other ceremonies of the church, and to fhew him the prayers, pfalms, *&c.* in the order in which they were to be rehearfed.

HIEROPHANTES, in Grecian antiquity, the name by which the Athenians called thofe priefts and prieftefles who were appointed by the ftate to have the fupervifal of things facred, and to take care of the facrifices.

HIEROPHYLAX, an officer in the Greek church, who was guardian or keeper of the holy utenfils, veftments, *&c.* anfwering to our facrifta or veftry-keeper.

HIGH WAY, a free paffage for the king's fubjects, on which account it is called the king's high-way, tho' the freehold of the foil belong to the owner of the land. Thofe ways that lead from one town to another, and fuch as are drift or cart-ways, and are for all travellers in great roads, or that communicate with them, are high-ways only; and as to their reparation, are under the care of furveyors.

HIGHAM-FERRERS, a borough town of Northamptonfhire, twelve miles north-eaft of Northampton: it fends two members to parliament.

HIGHNESS, at title given to princes. Before king James I. the kings of England had no other title but that of highnefs; which was alfo the cafe of the kings of Spain before Charles V.

At prefent all the fons of crowned heads are ftyled royal highnefs, as the electors of Germany are electoral highnefs.

HIGHWORTH, or HIGWORTH, a market-town of Wiltfhire, fituated thirty miles north of Salifbury.

HILARIA, an ancient Roman feftival, obferved on the eighth of the calends of April, or the twenty-fifth day of March, in honour of the goddefs Cybele. It was fo called from the various expreffions of joy and mirth on this occafion.

HILARODI, in the ancient mufic and poetry, a fort of poets among the Greeks, who went about finging little gay poems or fongs, fomewhat graver than the Ionic pieces, accompanied with fome inftrument. From the ftreets they were at length introduced into tragedy, as the magodi were into comedy. They appeared dreffed in white, and were crowned with gold. At firft they wore fhoes, but afterwards they affumed the crepida, being only a fole tied over with a ftrap.

HILARY-TERM. See TERM.

HILDESHEIM, the capital of a bifhopric, furrounded by the territories of Brunfwic, and fubject to its own bifhop: E. long. 10°, N. lat. 52° 17′.

HILUM, among botanifts, denotes the eye of a bean.

HIN, a hebrew meafure of capacity for things liquid, containing the fixth part of an ephah, or one gallon two pints, or 2.533 folid inches, Englifh meafure.

HIND,

HIND, a female ſtag in the third year of its age. See CERVUS.

HINDON, a borough town of Wiltſhire, ſituated fourteen miles weſt of Saliſbury: it ſends two members to parliament.

HINDOWN, or HENDOWN, the capital of the country of the Hindowns, in the hither India: E. long. 76° 30′, N. lat. 27°.

HINE, or HIND, a huſbandman's ſervant. Thus the perſon who overſees the reſt, is called the maſter hine.

HIPPOBOSCA, or HORSE-FLY, in zoology, a genus of inſects belonging to the order of diptera. The beak conſiſts of two valves, is cylindrical, obtuſe, and hanging; and the feet have ſeveral claws. There are four ſpecies, diſtinguiſhed by their wings, *&c.* The equina is extremely troubleſome to horſes.

HIPPOCAMPUS, in ichthyology. See SYNGNATHUS.

HIPPOCENTAUR, in antiquity, a fabulous animal, half man half horſe.

What gave riſe to the fable of Hippocentaurs, was this. The Theſſalians are ſaid to have been the firſt inventors of the art of breaking horſes; and being firſt ſeen on horſeback, they ſeemed to make but one body with the horſes; whence the origin of the fable.

HIPPOCREPIS, COMMON HORSE-SHOE VETCH, in botany, a genus of the diadelphia decandria claſs. The pod is compreſſed and crooked. There are three ſpecies, only one of which, *viz.* the comoſa, or tufted horſe-ſhoe vetch, is a native of Britain.

HIPPODROME, in antiquity, the courſe where horſe-races were performed.

HIPPOGLOSSUS, in ichthyology, See PLEURONECTES.

HIPPOMANES ſignifies the expreſſed juice of the tithymallus; as alſo a juice diſtilling from the genitals of a mare, in the time of her covering: ſome again take it for the ſecundines of a mare; and, laſtly, it ſignifies a fleſhy ſubſtance adhering to the forehead of a colt newly foaled, which ſome imagine to have a virtue of procuring love, and promoting the birth.

HIPPOPHAE, in botany, a genus of the diœcia tetrandria claſs. The calix of the male has two ſegments; and the corolla is wanting The calix of the female conſiſts of two ſegments; it has no corolla; but one ſtylus; and the berry contains many ſeeds. There are three ſpecies, only one of which, *viz.* the rhamnoides, ſallow-thorn, or ſea buck-thorn, is a native of Britain.

HIPPOPOTAMUS, the RIVER-HORSE, a genus of quadrupeds, belonging to the order of belluæ; the characters of which are theſe: It has 6 foreteth in the upper jaw, diſpoſed in pairs at a diſtance from each other; and four prominent foreteeth in the under jaw, the intermediate ones being longeſt: the dog-teeth are ſolitary and obliquely truncated; and the feet are hoofed on the edges.

There is but one ſpecies of hippopotamus, *viz.* the amphibius, or river-horſe. The hiſtory of this quadruped, though next to the elephant in magnitude, is far from being ſufficiently delineated. The beſt deſcription hitherto given of him is that of Frederic Zerenghi, an Italian ſurgeon, publiſhed in the year 1603. Zerenghi killed two of them (a male and a female) on the banks of the Nile, preſerved their ſkins, and brought them to Rome. Every ſkin took 400 pounds of ſalt in curing. He ſays, the ſkin of the hippopotamus is about an inch thick, extremely hard, impenetrable by a common muſket-ball; and there are only a few ſhort white hairs ſcattered very thin over it. The teeth are not protruded out of the mouth, as is commonly believed; for, when the mouth is ſhut, although the teeth be extremely large, they are entirely covered by the lips. The dimenſions of the female, of which Zerenghi gives a figure, are as follow: From the point of the muzzle to the origin of the tail, between 11 and 12 feet; the circumference of the body about 10 feet; the height of the body, 4½ feet; the circumference of the leg, near the ſhoulder, 2 feet 9 inches, lower down 1 foot 9½ inches; the height of the legs about 1½ foot; the length of the feet from the extremity of the claws, 4½ inches; the claws are nearly of an equal length and breadth, and are ſomewhat more than two inches; each toe is furniſhed with a claw, and each foot with four toes. The tail is about one foot long, more than a foot in circumference near the origin, and about 3 inches near the point. The tail is not round, but flattiſh. The head, from the extremity of the lips to the neck, is about 2 feet 4 inches, and the circumference 5 feet 8 inches The ears are about 3 inches long, and nearly as broad; they are a little pointed, and covered in the interior ſide with ſhort white hair. The mouth, when open is about 1½ foot wide, and furniſhed with 44 teeth of different figures. Their teeth are of ſuch a hard ſubſtance, that they give fire with ſteel. Theſe dimenſions are taken from a female hippopotamus; but the male is generally about one third larger.

With ſuch powerful arms, and ſuch a prodigious ſtrength of body, the hippopotamus might render himſelf formidable to every other animal. But he is naturally of a mild diſpoſition; and beſides, his body is ſo heavy, and his motions ſo ſlow, that he cannot overtake any other quadruped. He ſwims ſwifter than he runs, and preys upon fiſhes. He dives in the water, and can ſtay very long under. He has no membrane betwixt his toes, as the caſtor or the otter; and he only ſwims eaſily in conſequence of the great bulk of his belly, which makes him nearly of an equal ſpecific gravity with the water Moreover, he often keeps himſelf at the bottom, and walks upon the channel with the ſame freedom as upon dry land. Beſides preying upon fiſhes, crocodiles, *&c.* he frequently goes out of the water and feeds upon ſugar-canes, ruſhes, millet, rice, roots, *&c.* Theſe he devours in large quantities, and often does great damage in the cultivated field. But as he is more timid on land than in the water, he is eaſily drove away. His legs are ſo ſhort, that he cannot eſcape by flight when at a diſtance from the river. He generally flies when approached by people in boats; but, if they wound him, he returns with fury, attacks the boats with his teeth, and frequently overſets them.

This animal ſeems to be confined principally to the rivers

rivers of Africa. The male and female generally go together, and the female is ſaid to produce but one at a birth.

HIPPURIS, in botany, a genus of the monandria monogynia claſs. It has neither calix nor corolla; the ſtigma is ſimple; and there is but one ſeed. There is only one ſpecies, *viz.* the vulgaris, a native of Britain.

HIPPURIS, in ichthyology, See CORYPHÆNA.

HIRCANIA, in geography, the provinces of Perſia in Aſia, which lie on the ſouthern ſhore of the Caſpian ſea.

HIRCHFIELD, a city of Germany, in the circle of the upper Rhine, and landgraviate of Heſſe Caſſel, ſituated on the river Fuld, in E. long. 9° 32′, N. lat. 50° 47′.

HIRTELLA, in botany, a genus of the triandria monogynia claſs. The calix is divided into five parts; the petals are five, and equal; the filaments are ſpiral, and the ſtylus is lateral. There is but one ſpecies, a native of Brazil.

HIRUDO, the LEECH, in zoology, a genus belonging to the order of vermes inteſtina. The body is flat, jointed, and moves either forward or backward. There are nine ſpecies, principally diſtinguiſhed by that colour. This well known animal is uſed for bleeding children, *&c.* When they once fix, they ſeldom quit till they are glutted with blood. Salt makes them quit their hold, and throw up the blood.

HIRUNDO, in ornithology, a genus of birds, of the order of paſſeres. The bill is ſmall, crooked, ſubulated, bent a little inward, and depreſſed at the baſe. There are 12 ſpecies, principally diſtinguiſhed by their colour. This includes the common ſwallow, martin, *&c.*

HISPANIOLA, an iſland of America, in the Atlantic ocean, ſituated between 67° and 74° of W. long. and between 18° and 20° N lat. being about 420 miles long from eaſt to weſt, and 120 in breadth. It is frequently called St. Domingo, from the capital thereof.

HISTORIOGRAPHER, a profeſſed hiſtorian, or writer of hiſtory.

HISTORY, a deſcription or recital of things as they are, or have been, in a continued orderly narration of the principal facts and circumſtances thereof.

Hiſtory, with regard to its ſubject, is divided into the hiſtory of Nature, (See NAT. HIST.) and the hiſtory of Actions. The hiſtory of Actions is a continued relation of a ſeries of memorable events.

HISTRIO, in the ancient drama, ſignified an actor or comedian, but more eſpecially a pantomime, who exhibited his part by geſtures and dancing.

HITCHING, a market-town in Hartfordſhire, fourteen miles north-weſt of Hartford, and thirty-two north-weſt of London.

HITHE, one of the Cinque Ports in the county of Kent, ſituated on the Engliſh channel, ſix miles weſt of Dover.

HIVE, in country affairs, a convenient receptacle for bees. See APIS.

HIVING *of Bees*. See APIS.

HOACHE, in natural hiſtory, a kind of earth approaching to the nature of chalk, but harder, and feeling like ſoap; whence ſome think, that it is either the ſame with our ſoap rock of Cornwal, or very like it. The Chineſe diſſolve it in water, till the liquor is of the conſiſtence of cream, and then varniſh their china-ware with it.

HOAR-HOUND, in botany. See MARUBIUM.

HOARSENESS, in medicine, a diminution of the voice, commoly attended with a preternatural aſperity or roughneſs thereof

HOBBY, in ornithology. See FALCO.

HOE, in country-affairs, a tool made like a cooper's adz, to cut upwards in gardens, field, *&c.* This tool is commonly called the hand-hoe. See AGRICULTURE.

HOG, in zoology. See SUS.

HOGSHEAD, in commerce, a meaſure of capacity, containing ſixty-three gallons.

HOGUE, a town and cape on the north-weſt point of Normandy in France, near which admiral Rook burnt the French admiral's ſhip called the Riſing-ſun, with twelve more large men of war: W. lon. 2°, and N. lat. 49° 50′.

HOHIO, a river of North America; which riſing in the Apalachian mountains, near the confines of Carolina and Virginia, runs ſouth weſt, and falls into the river Miſſiſſipi.

HOKE-DAY, the Tueſday after eaſter-week; which was the day on which the Engliſh conquered and expelled the Danes: this was therefore kept as a day of rejoicing; and a duty, called hoke-tueſday-money, was paid to the landlord, for giving his tenants and bondmen leave to celebrate it.

HOLCUS, in botany, a genus of the polygamia monœcia claſs. The calix of the hermaphrodite is a double-flowered glume; the corolla is a glume with an awn; and there are three ſtamina, two ſtyli, and one ſeed. The calix of the male is a double valved glume; it has no corolla, but three ſtamina. There are ten ſpecies, only two of them natives of Britain, *viz.* the lanatus, or meadow ſoft-graſs; and the mollis, or creeping ſoft-graſs

HOLDERNESS, a peninſula in the eaſt riding of Yorkſhire, which has the German ocean on the eaſt, and the river Humber on the ſouth.

HOLDING, in Scots law, the tenor or terms upon which a proprietor of lands holds or enjoys them of his ſuperior.—See BLENCH, BURGAGE, FEU, WARD.

HOLLAND, one of the United Provinces. It is about one hundred miles long from north to ſouth, and ſcarce thirty miles broad; but enjoys the greateſt trade of any province in the world, and in point of ſtrength and riches is equal to the other ſix united provinces. It is ſituated one hundred miles eaſt of England, and is bounded on the north and weſt by the German ſea, on the eaſt by the Zuider ſea, and on the ſouth by the provinces of Zealand and Utrecht.

HOLLAND is alſo the name of the ſouth-eaſt diviſion of Lincolnſhire.

HOLLAND, in commerce, a fine and cloſe kind of linen,

linen, ſo called from its being firſt manufactured in Holland.

HOLLY, in botany. See ILEX.

Sea-HOLLY. See ERYNGIUM.

HOLOCAUST, a burnt-offering, or ſacrifice, wholly conſumed by fire: of this kind was the daily ſacrifice in the Jewiſh church. This was done by way of acknowledgment, that the perſon offering and all that belonged to him, were the effects of the divine bounty.

HOLOGRAPH, among civilians, a will wholly written by the hand of the teſtator.

HOLSTEIN, a dutchy of Germany, in the circle of lower Saxony, one hundred miles long, and fifty broad. It is bounded by Sleſwic or ſouth Jutland on the north, by the Baltic ſea and the duchy of Sax-Lawenburg on the eaſt, by the riven Elbe on the ſouth, and by the German ſea on the weſt.

HOLY-GHOST, one of the Perſons of the Holy Trinity.

Order of the HOLY GHOST, the principal military order in France, inſtituted by Henry III. in 1569. It conſiſts of an hundred knights, who are to make proof of their nobility for three deſcents. The king is the grand-maſter, or ſovereign; and as ſuch, takes an oath on his coronation-day, to maintain the dignity of the order.

HOLY-DAYS. See FESTIVAL.

HOLY-HEAD, a cape and town in the iſle of Angleſea, ſituated in the Iriſh channel: W. long. 4° 45′, and N. lat. 53° 26′.

HOLY-ISLAND, an iſland in the German ſea, ſix miles ſouth of Berwick upon Tweed: W. long. 1° 42′, and N. lat. 55° 45′.

HOLY-WELL, a town of north Wales, in Flintſhire, ten miles eaſt of St. Aſaph.

HOMAGE, in law, is the ſubmiſſion, loyalty, and ſervice which a tenant promiſed to his lord, when he was firſt admitted to the land which he held of the lord in fee: alſo that owing to a king, or to any ſuperior.

HOMBERG, a town of Germany, in the circle of the upper Rhine, and landgraviate of Heſſe, ſituated ten miles north of Francfort: E. long. 8° 24′, N. lat. 50° 20′.

HOMBERG is alſo a town of Germany, in the palatinate of the Rhine, and dukedom of Deuxponts: E. long. 7° 6′. and N. lat. 49° 20′.

HOMER. See OMER.

HOMICIDE, ſignifies in general the taking away of any perſon's life. See SCOTS LAW, tit. 33.

HOMILY, in eccleſiaſtical writers, a ſermon, or diſcourſe, upon ſome point of religion, delivered in a plain manner, ſo as to be eaſily underſtood by the common people.

HOMO, MAN, is ranked by Linnæus under the order of primates, and characteriſed by having four parallel foreteeth both in the upper and lower jaw, and two mammæ on the breaſt. The ſpecies, according to this author, are two, *viz.* the homo ſapiens, and the homo troglodytes. He ſubdivides the homo ſapiens into five varieties, *viz.* the American, the European, the Aſiatic, the African, and what he calls the monſtrous. The troglodytes, or orang outang, is a native of Athiopia, Java, and Amboina. His body is white; he walks erect; and is about one half the ordinary human ſize. He generally lives about 25 years. He conceals himſelf in caves during the day, and ſearches for his prey in the night. He is ſaid to be exceedingly ſagacious, but is not endowed with the faculty of ſpeech.

HOMOLOGOUS, in geometry, an appellation given to the correſponding ſides and angles of ſimilar figures, as being proportional to each other.

HONAN, a province of China, bounded by thoſe of Xanſi and Pekin on the north, by Xantong and Nankin on the eaſt, by Suchuen on the ſouth, and by Xenſi on the weſt; lying between 33° and 37° north latitude. Its capital is Caifum.

HONDURAS, a province of Mexico, in North America; which including the country of the Moſkito-Indians, is ſituated between 85° and 94° W. long. and between 12° and 16° N. lat.

HONE, a fine kind of whiteſtone, uſed for ſetting razors, pen-knives, and the like.

HONEY, is, in general, a thick, viſcous, and more or leſs fluid ſubſtance, of a whitiſh or yellowiſh colour, ſweet to the taſte, ſoluble in water, becoming vinous in fermentation, inflammable, liquable by a gentle heat, and of a fragrant ſmell. See APIS.

HONFLEUR, a port-town of France, in the province of Normandy, ſituated on the ſouth ſide of the river Seyne, near the Engliſh channel: E. long. 15′, and N. lat. 49° 24′.

HONITON, a borough-town of Devonſhire, twelve miles eaſt of Exeter. It ſends two members to parliament.

HONOUR, a teſtimony of eſteem or ſubmiſſion, expreſſed by words, actions, and an exterior behaviour, by which we make known the veneration and reſpect we entertain for any one on account of his dignity or merit. The word honour is alſo uſed in general for the eſteem due to virtue, glory, and reputation. It is alſo uſed for virtue and probity themſelves, and for an exactneſs in performing whatever we have promiſed; and in this laſt ſenſe we uſe the term, *a man of honour*. But honour is more particularly applied to two different kinds of virtue, bravery in men, and chaſtity in women.

Maids of HONOUR, are ſix young ladies in the houſehold of the queen and princeſs-royal; the ſalary of thoſe of a queen are 300 l. per ann. each, and thoſe of the princeſs dowager of Wales, 200 l.

HONOUR-POINT, in heraldry, is that next above the centre of the eſcutcheon, dividing the upper part into two equal portions.

HOOF, the horny ſubſtance that covers the feet of divers animals, as oxen, horſes, ſheep, *&c.*

HOOKS are a neceſſary ſort of utenſils, and uſed for various purpoſes.

HOOKER, in naval architecture, a veſſel much uſed by the Dutch, built like a pink, but rigged and maſted like a hoy.

Hookers will lie nearer a wind than veſſels with croſs ſails can do. They are from fifty to two hundred tons burden, and with a few hands will ſail to the Eaſt Indies.

HOP, in botany. See HUMULUS.

New land is found to fucceed better with hops than old; and on this principle they are very cautious in their plantations in Kent, and look forward for the after-produce. When they make a new hop-ground, they plant it with apple-trees at a large diftance afunder, and with cherry trees between; by this means, when the hops have grown ten years, which they judge as much as they will do well, they place their account in the cherry-trees, which bear large crops; thefe they gather for about thirty years, and then they cut them up, and depend upon their apple-trees only, which they find very large and ftrong by that time.

The dry ftalks of hops fhould be burnt on the ground in winter, covering them with a little frefh earth as they burn. This makes together an excellent compoft, to make the hills of. The land muft be dug or plowed well, and laid very even, and then the places for the hills marked out by a line, and a ftick put in every place where one is to be. A thoufand hills may be made in an acre of ground, and fix or feven plants fet on every hill. From fix to nine feet fhould be allowed between every hill, and the grounds in the hills fhould be better and richer than the common earth. Some plant hops in March and April, but the moft experienced people prefer the month of October, becaufe they will then ftrike firm roots, and be ftrong and vigorous againft fpring. The largeft plants are to be chofen; and it is beft to procure them from fome rich ground, where the hills have been laid high; they fhould be about eight or ten inches long, and have three or four joints or buds a-piece; the holes for planting them are to be dug eight or ten inches deep, and about a foot over; and in each of thefe holes four plants are to be fet, one in each corner: they may be covered an inch deep over the top, if planted in October; but in fpring, when they have fhot from the joints, then they muft not be buried: after this, the ground muft be carefully kept clear of weeds.

Dreffing of HOPS. This is preparing the ground in winter and fpring for the making a good fummer-crop. In doing this, the hills upon which the plants ftand muft be all pulled down, and undermined on every fide, till the fpade comes near the principal root; then fhake off or remove with the hand the loofe mould from the upper or loofe roots, that you may fee where the new roots grow out of the old fets. The old fets are to be carefully preferved, but the other roots may be cut away. Whatever time the hills are pulled down, the roots muft not be cut till March. When the young hops are dreffed for the firft time, all the roots are to be cut away that grew the year before, and the fets are to be cut off within one inch of the fame; and every year after, they muft be cut as clofe as may be to the old roots; but to a weak hop, fome of the fhoots are to be left at the dreffing. Thofe roots of the plant which grow downwards, are never to be injured, but only thofe which run horizontally are to be cut. The old roots and the young ones may be eafily diftinguifhed, in that the old ones are always red, and the young white. If there are by accident any wild hops got among the reft, the places where they grow are to be marked with fticks, or otherwife, at the time of their being gathered; and after this, at the time of dreffing the ground, that whole hill is to be deftroyed, and a new one made with new plants in the room of it. When the roots are cut and dreffed, the rich compoft is to be put to them; and the hills muft not be made too high at firft, left they hinder the young fhoots.

Gathering and drying of HOPS. Hops blow in the latter end of July, in the beginning of Auguft they bell; and they are fometimes ripe at the beginning of September, fometimes later. When they begin to change colour, are eafily pulled to pieces, and their feeds look brown within them, they are ripe; and they are then to be gathered as quick as poffible, for the leaft blaft of wind will hurt them at this time.

The manner of gathering hops, is to take down four hills ftanding together in the midft of the garden, and to cut the roots even with the ground, then lay the ground level; and when it is fwept clean, it makes a floor, on which the hops may be laid and picked. The hop-plants are firft unwound from the poles, and then the people fit round and pick off the hops into bafkets.

Care fhould be taken to dry the hops as faft as they are picked, for in lying undried they are apt to heat and change colour very quickly. If the quantity picked be fo large, that the kiln in which they are to be dried is over-ftocked, they muft be fpread thin upon a floor, and they will keep two or three days in that manner without any harm. Indeed, where the quantity is but fmall, there is no need to have recourfe to the kiln at all, for they will dry much better than any other way, by being laid thin upon a floor, and often turned. The drying of hops is the moft material part of their manufacture; for if they be ill dried, they lofe all their agreeable flavour; and great caution fhould be ufed, that they be all equally dried.

Bagging of HOPS, a term ufed by the farmers, who cultivate hops, for the laft thing they have to do with with them, in order to bring them to market; that is, the putting them up in large bags of coarfe cloth, for carriage. When the hops have been picked and dried in the ooft, or tin-floor, they are fo brittle that they would break to pieces and be fpoiled if they were immediately to be put up; they are therefore to lie together three weeks, or thereabouts, that they may become tough: if they are covered from the air by blankets in the heap, they may be bagged much fooner than if left open.

The manner of bagging them is this; a hole is made in an upper-floor, fo large that a man may eafily go up and down it; then a hoop is fitted to the mouth of the bag, and fo firmly fewed on, that it cannot be torn off; the bag is then let down through the hole, and the hoop remaining above, ftops it from being pulled quite through, being larger than the hole: a few hops are to be firft thrown into the bag, and a perfon below is to take up a parcel of thefe in each corner of the bag, tying it with a packthread; this makes a fort of taffel, by which the bags are afterwards the eafier managed and

and turned about. When this is done, one man muſt go down into the bag, and, while another caſts in the hops, he muſt tread them down equally every way with his feet; when the bag is in this manner filled, it is to be ripped from the hoop, and ſewed up, leaving two taſſels at the corners, as at the bottom. A bag of hops thus prepared, may be kept for ſeveral years in a dry place.

The tops of this plant, being of a cooling quality, are eaten, when boiled, as an emollient. A decoction of hop-flowers is alſo accounted an antidote againſt poiſon, and cures the itch, as well as the ſyrup thereof, and is eſteemed excellent in choleric and peſtilential fevers. The heads and tendrils are good in the ſcurvy and moſt cutaneous diſeaſes. Juleps and apozems are alſo prepared with hops for hypochondriacal and hyſterical affections, and to promote the menſes: but the chief uſe of this plant conſiſts in preſerving beer and other malt-liquors (in which the flower of this plant is a principal ingredient) from turning ſowr, and rendering it wholeſome and grateful to the taſte, *&c.*

HORD, in geography, is uſed for a company of wandering people, which have no ſettled habitation, but ſtroll about, dwelling in waggons, or under tents, to be ready to ſhift as ſoon as the herbage, fruit, and the preſent province is eaten bare: ſuch are ſeveral tribes of the Tartars, particularly thoſe who inhabit beyond the Wolga, in the kingdom of Aſtracan and Bulgaria.

HORDEUM, BARLEY, in botany, a genus of the triandria digynia claſs. The involucrum conſiſts of ſix leaves, and contains three flowers. There are eight ſpecies, only one of which, *viz.* the murinum, or wall-barley-graſs, is a native of Britain. The native place of the vulgare, or common barley cultivated in our fields, is not known. For the culture, *&c.* of common barley, ſee AGRICULTURE, p. 61.

HORDICALIA, or HORDICIDIA, in antiquity, a religious feaſt held among the Romans, wherein they ſacrificed cattle big with young. This feaſt fell on April 15. on which day they ſacrificed thirty cows with calf to the goddeſs Tellus or the Earth; part of them were ſacrificed in the temple of Jupiter. The calves taken out of their bellies were burnt to aſhes at firſt by the pontifices, afterwards by the eldeſt of the veſtal virgins.

HOREHOUND, BALLOTA, STACHYS, in botany. See MARUBIUM.

HORIZON, in aſtronomy and geography, that great circle which divides the heavens and the earth into two equal parts, or hemiſpheres, diſtinguiſhing the upper from the lower. See ASTRONOMY and GEOGRAPHY.

HORIZONTAL, ſomething relating to the horizon; or that is taken in, or on a level with the horizon: thus we ſay, an horizontal plane, *&c.*

HORMINUM, CLARY, in botany, a genus of the didynamia gymnoſpermia claſs. The calix is bell-ſhaped, with four nearly equal ſegments, and a fifth larger and emarginated; and the upper labium of the corolla is concave. There are two ſpecies, none of them natives of Britain.

HORN, a hard ſubſtance growing on the heads of divers animals, particularly the cloven-footed quadrupeds; and ſerving them both as weapons of offence and defence.

HORN-BEAM, in botany. See CARPINUS.

HORN-WORK, in fortification, an out-work compoſed of two demi-baſtions, joined by a curtin. See FORTIFICATION.

HORNET, in zoology. See APIS.

HORNING, in Scots law, a writing iſſuing from the ſignet, in his Majeſty's name, at the inſtance of a creditor againſt his debtor, commanding him to pay or perform within a certain time. See DENUNCIATION, —and LAW, tit. 12. §. 13. 14.

HORNSEY, a market-town of the eaſt riding of Yorkſhire, thirty-five miles eaſt of York.

HOROGRAPHY. See DIALLING.

HOROLOGIUM, a general name for inſtruments to meaſure the hours, as a watch, clock, dial, *&c.* See WATCH.

HOROSCOPE, in aſtrology, is the degree of the aſcendent, or the ſtar that riſes above the horizon at a certain moment, which is obſerved in order to predict ſome future event, as the ſucceſs of a deſign, the fortune of a perſon who was at that inſtant born, *&c.*

HORSE, in zoology. See EQUUS.

HORSEMANSHIP;

Or, The Art of Riding, and of Training and Managing HORSES.

The method of preparing horſes to be mounted.

THOUGH all horſes are generally bought at an age when they have already been backed, they ſhould be begun and prepared for the rider with the ſame care, gentleneſs and caution, as if they had never been handled or backed, in order to prevent accidents, which might elſe ariſe from ſkittiſhneſs or other cauſes: and as it is proper that they ſhould be taught the figure of the ground they are to go upon, when they are at firſt mounted, they ſhould be previouſly trotted in a *longe* on circles, without any one upon them.

The manner of doing this is as follows: Put an eaſy *caveſſon* upon the horſe's noſe, and make him go forwards round you, ſtanding quiet and holding the *longe*; and let another man, if you find it neceſſary, follow him with a whip. All this muſt be done very gently, and but a little at a time: for more horſes are ſpoilt by over-much work, than by any other treatment whatever; and that by

by very contrary effects; for sometimes it drives them into vice, madness and despair, and often stupifies and totally dispirits them.

The first obedience required in a horse is going forwards: Till he performs this duty freely, never even think of making him rein back, which would inevitably make him restive: As soon as he goes forwards readily, stop and caress him. You must remember in this, and likewise in every other exercise, to use him to go equally well to the right and left; and when he obeys, caress him and dismiss him immediately. If a horse, that is very young, takes fright and stands still, lead on another horse before him, which probably will induce him instantly to follow. Put a snaffle in his mouth; and when he goes freely, saddle him, girting him at first very loose. Let the cord, which you hold, be long and loose; but not so much, so as to endanger the horse's entangling his legs in it. It must be observed, that small circles, in the beginning, would constrain the horse too much, and put him upon defending himself. No bend must be required at first: never suffer him to gallop false; but whenever he attempts it, stop him without delay, and then set him off afresh. If he gallops of his own accord, and true, permit him to continue it; but if he does it not voluntarily, do not demand it of him at first. Should he fly and jump, shake the cord gently upon his nose without jerking it, and he will fall into his trot again. If he stands still, plunges or rears, let the man who holds the whip, make a noise with it; but never touch him, till it be absolutely necessary to make him go on. When you change hands, stop and caress him, and entice him by fair means to come up to you: For by presenting yourself, as some do, on a sudden before horses, and frightening them to the other side, you run a great risk of giving them a shyness. If he keeps his head too low, shake the *cavesson* to make him raise it: And in whatever the horse does, whether he walks, trots, or gallops, let it be a constant rule, that the motion be determined and really such as is inteded, without the least shuffling, pacing, or any other irregular gait.

The method of placing the rider and rendering him firm on horseback, with some occasional instructions for riders and the horses.

It is necessary that the greatest attention, and the same gentleness, that is used in teaching the horses, be observed likewise in teaching the rider, especially at the beginning. Every method and art must be practised to create and preserve, both in man and horse, all possible feeling and sensibility, contrary to the usage of most riding masters, who seem industriously to labour at abolishing these principles both in one and the other. As so many essential points depend upon the manner in which a man is at first placed on horseback, it ought to be considered and attended to with the strictest care and exactness.

The absurdity of putting a man, who perhaps has never before been upon a horse, on a rough trotting horse, on which he is obliged to stick with all the force of his arms and legs, is too obvious to need mentioning. This rough work, all at once, is plainly as detrimental at first, as it is excellent afterwards in proper time. No man can be either well, or firmly seated on horseback, unless he be master of the balance of his body, quite unconstrained, with a full possession of himself, and at his ease; none of which requisites can he enjoy, if his attention be otherwise engaged; as it must wholely be in a raw, unsuppled, and unprepared lad, who is put at once upon a rough horse: in such a distressful state he is forced to keep himself on at any rate, by holding to the bridle, (at the expence of the sensibility both of his own hand, and the horse's mouth,) and by clinging with his legs, in danger of his life, and to the certain depravation of a right feeling in the horse.

The first time a man is put on horseback, it ought to be upon a very gentle one, He never should be made to trot, till he is quite easy in the walk; nor gallop, till he is able to trot properly. The same must be observed in regard to horses: they should never be made to trot, till they are obedient, and their mouths are well formed on a walk; nor be made to gallop, till the same be effected on a trot. When he is arrived at such a degree of firmness in his seat, the more he trots, and the more he rides rough horses, the better. This is not only the best method, but also the easiest and the shortest: by it, a man is soon made sufficiently an horseman for a soldier; but by the other detestable methods, that are commonly used, a man, instead of improving, contracts all sorts of bad habits, and rides worse and worse every day; the horse too becomes daily more and more unfit for use. In proceeding according to the manner proposed, a man is rendered firm and easy upon the horse, both his own and the horse's sensibility is preserved, and each in a situation fit to receive and practise all lessons effectually.

Among the various methods that are used of placing people on horseback, few are directed by reason. Before you let the man mount, teach him to know, and always to examine, if the curb be well placed, (that is, when the horse has a bit in his mouth, which at first he should not; but only a snaffle, till the rider is firm in his seat, and the horse also somewhat taught;) and likewise if the nose-band be properly tight; the throat band loosish, and the mouth-piece neither too high nor too low in the horse's mouth, but rightly put so as not to wrinkle the skin, nor to hang lax; the girts drawn moderately, but not too tight; and the crupper and the breast plate properly adjusted. A very good and careful hand may venture on a bit at first, and succeed with it full as well, as by beginning with a snaffle alone: on colts, indeed, it is better, in all schools whatsoever, to avoid any pressure on the bars just at first, which a curb, though ever so delicately used, must in some degree occasion. When the bridle, *&c.* have been well looked to, let the man approach the horse gently near the shoulder; then taking the reins and an handful of the mane in his left hand, let him put his foot softly in the left stirrup, by pulling it towards him, least he touch the horse with his toe, then raising himself up, let him rest a moment on it with his body upright, but not stiff: and after that passing his right leg clear over the saddle without rubbing against any thing, let him seat himself gently down. He must

be

be cautious not to take the reins too ſhort, for fear of making the horſe rear, run, or fall back, or throw up his head; but let him hold them of an equal length, neither tight nor ſlack, and with the little finger betwixt them. It is fit that horſes ſhould be accuſtomed to ſtand ſtill to be mounted, and not to ſtir till the rider pleaſes. All ſoldiers ſhould be inſtructed to mount and diſmount equally well on both ſides, which may be of very great uſe in times of hurry and confuſion. Then place the man in his ſaddle, with his body rather back, and his head held up with eaſe, without ſtiffneſs; ſeated neither forwards, nor very backwards, with the breaſt puſhed out a little, and the lower part of the body likewiſe a little forwards; the thighs and legs turned in without conſtraint, and the feet in a ſtraight line, neither turned in nor out: By this poſition, the natural weight of the thighs has a proper and ſufficient preſſure of itſelf, and the legs are in readineſs to act, when called upon: they muſt hang down eaſy and naturally, and be ſo placed, as not to be wriggling about, touching and tickling the horſe's ſides, but always near them in caſe they ſhould be wanted, as well as the heels.

The body muſt be carefully kept eaſy and firm, and without any rocking, when in motion; which is a bad habit very eaſily contracted, eſpecially in galloping. The left elbow muſt be gently leant againſt the body, a little forwards; unleſs it be ſo reſted, the hand cannot be ſteady, but will be always checking, and conſequently have pernicious effects on the horſe's mouth: and the hand ought to be of equal height with the elbow; if it were lower, it would conſtrain and confine the motion of the horſe's ſhoulders; but, as the mouths of horſes are different, the place of the hand alſo muſt occaſionally differ: a leaning, low, heavy fore hand requires a high hand; and a horſe that pokes out his noſe, a low one. The right hand arm muſt be placed in ſymmetry with the left; only let the right hand be a little forwarder or backwarder, higher or lower, as occaſions may require, in order that both hands may be free: both arms muſt be a little bent at the elbow, to prevent ſtiffneſs.

A ſoldier's right hand ſhould be kept unemployed in riding; it carries the ſword, which is a ſufficient buſineſs for it.

There remains one farther obſervation, that ought not to be omitted, about the hand, that it muſt be kept clear of the body; *i. e.* about two inches and half forwards from it, with the nails turned oppoſite to the belly, and the wriſt a little rounded with eaſe; a poſition not leſs graceful than ready for ſlackening, tightening, and moving the reins from on ſide to the other, as may be found neceſſary.

When the men are well placed, the more rough trotting they have without ſtirrups, the better; but with a ſtrict care always, that their poſition be preſerved very exactly. In all caſes, great care muſt be taken to hinder their clinging with their legs: In ſhort, no ſticking by hands or legs is ever to be allowed of at any time. If the motion of the horſe be too rough, ſlacken it, till the rider grows by degrees more firm: and when he is quite firm and eaſy on his horſe in every kind of motion, ſtirrups may be given him; but he muſt never leave off trotting often without any.

The ſtirrups muſt be neither ſhort nor long; but of ſuch a length, that when the rider, being well placed, puts his feet into them, (about one third of the length of each foot from the point of it,) the points may be between two and three inches higher than the heels. The rider muſt not bear upon his ſtirrups, but only let the natural weight of his legs reſt on them: For if he bear upon them, he would be raiſed above and out of his ſaddle; which ſhould never be, except in charging ſword in hand, with the body inclined forwards at the very inſtant of attacking. Spurs may be given, as ſoon as the rider is grown familiar with ſtirrups, or even long before, if his legs are well placed.

A hand ſhould always be firm, but delicate: a horſe's mouth ſhould never be ſurpriſed by any ſudden tranſition of it, either from ſlack to tight, or from tight to ſlack. Every thing in horſemanſhip muſt be effected by degrees, but at the ſame time with ſpirit and reſolution. That hand which, by giving and taking properly, gains its point with the leaſt force, is the beſt; and the horſe's mouth, under this ſame hand's directions, will alſo conſequently be the beſt, ſuppoſing equal advantages in both from nature. This principle of gentleneſs ſhould be obſerved upon all occaſions in every branch of horſemanſhip. Sometimes the right hand may be neceſſary, upon ſome troubleſome horſes, to aſſiſt the left; but the ſeldomer this is done, the better; eſpecially in a ſoldier, who has a ſword to carry, and to make uſe of.

The ſnaffle muſt on all occaſions be uppermoſt; that is to ſay, the reins of it muſt be above thoſe of the bridle, whether the ſnaffle or the bit be uſed ſeperately, or whether they be both uſed together. When the rider knows enough, and the horſe is ſufficiently prepared and ſettled to begin any work towards ſuppling, one rein muſt be ſhortened according to the ſide worked to; but it muſt never be ſo much ſhortened, as to make the whole ſtrength reſt on that rein alone; for, not to mention that the work would be falſe and bad, one ſide of the horſe's mouth would by that means be always deadened; whereas on the contrary, it ſhould always be kept freſh by its own play, and by the help of the oppoſite rein's acting delicately in a ſomewhat ſmaller degree of tenſion; the joint effect of which produces in a horſe's mouth the proper, gentle and eaſy degree of *appui* or bearing.

A coward and a madman make alike bad riders, and are both alike diſcovered and confounded by the ſuperior ſenſe of the creature they are mounted upon, who is equally ſpoilt by both, though in very different ways. The coward, by ſuffering the animal to have his own way, not only confirms him in his bad habits, but creates new ones in him: and the madman, by falſe and violent motions and corrections, drives the horſe, through deſpair, into every bad and vicious trick that rage can ſuggeſt.

It is very requiſite in horſemanſhip, that the hand and legs ſhould act in correſpondence with each other in every thing; the latter always ſubſervient and aſſiſtant to the former. Upon circles, in walking, trotting, or galloping, the outward leg is the only one to be uſed, and that only for a moment at a time, in order to ſet off the horſe true,

true, or put him right, if he be falfe; and as foon as that is done, it muft be taken away again immediately: but if the horfe be lazy, or otherwife retains himfelf, both legs muft be ufed, and preffed to his fides at the fame time together. The lefs the legs are ufed in general, the better. Very delicate good riders, with horfes they have dreffed themfelves, will fcarcely ever want their help. By the term *outward* is underftood the fide which is more remote from the centre; and by *inward* is meant the fide next to the centre. In reining back, the rider fhould be careful not to ufe his legs, unlefs the horfe backeth on his fhoulders; in which cafe they muft be both applied gently at the fame time, and correfpond with the hand. If the horfe refufe to back at all, the riders legs muft be gently approached, till the horfe lifts up a leg, as if to go forwards; at which time, when that leg is in the air, the rein of the fame fide with that leg, which is lifted up, will eafily bring that fame leg backwards, and accordingly oblige the horfe to back: but if the horfe offers to rear, the legs muft be inftantly removed away. The inward rein muft be the tighter on circles, fo that the horfe may bend and look inwards; and the outward one croffed over a little towards it; and both held in the left hand.

Let the man and horfe begin on very flow motions, that they may have time to underftand, and reflect on what is taught them; and in proportion as the effects of the reins are better comprehended, and the manner of working becomes more familiar, the quicknefs of motion muft be increafed. Every rider muft learn to feel, without the help of the eye, when a horfe goes falfe, and remedy the fault accordingly: this is an intelligence, which nothing but practice, application and attention can give, in the beginning on flow motions. A horfe may not only gallop falfe, but alfo trot and walk falfe. If a horfe gallops falfe, that is to fay, if going to the right, he leads with the left leg; or if going to the left, he leads with the right; or in cafe he is difunited, *i. e.* if he leads with the oppofite leg behind to that which he leads with before; ftop him immediately, and put him off again properly: the method of effecting this, is by approaching your outward leg and putting your hand outwards, ftill keeping the inward rein the fhorter, and the horfe's head inwards, if poffible; and if he fhould ftill refift, then bend and pull his head outwards alfo, but replace it again, bent properly inwards, the moment he goes off true. A horfe is faid to be difunited to the right, when going to the right, and confequently leading with the right leg before, he leads with the left behind; and is faid to be difunited to the left, when going to the left, and confequently leading with the left leg before, he leads with the right behind. A horfe may at the fame time be both falfe and difunited; in correcting both which faults, the fame method muft be ufed. He is both falfe and difunited to the right, when in going to the right he leads with the left leg before, and the right behind; notwithftanding that hinder leg be with propriety more forward under his belly than the left, becaufe the horfe is working to the right: and he is falfe and difunited to the left, when in going to the left he leads with the right leg before, and the left behind; notwithftanding, as above, that hinder leg be with propriety more forward under his belly than the right, becaufe the horfe is working to the left.

In teaching men a right feat on horfeback, the greateft attention muft be given to prevent ftiffnefs, and fticking by force in any manner upon any occafion: ftiffnefs difgraces every right work; and fticking ferves only to throw a man (when difplaced) a great diftance from his horfe by the fpring he muft go off with: whereas by a proper equilibrating pofition of the body, and by the natural weight only of the thighs, he cannot but be firm, and fecure in his feat.

As the men become more firm, and the horfes more fupple, it is proper to make the circles lefs, but not too much fo, for fear of throwing the horfes forwards upon their fhoulders.

Some horfes, when firft the bit is put into their mouths, if great care be not taken, will put their heads very low. With fuch horfes, raife your right hand with the *bridoon* in it, and play at the fame time with the bit in the left hand, giving and taking.

On circles, the rider muft lean his body inwards; unlefs great attention be given to make him do it, he will be perpetually loofing his feat outwards. It is fcarce poffible for him to be difplaced if he leans his body properly inwards.

The method of fuppling horfes with men upon them, by the EPAULE en dedans, *&c. with and without a* longe, *on circles and on ftrait lines.*

WHEN a horfe is well prepared and fettled in all his motions, and the rider firm, it will be proper then to proceed on towards a farther fuppling and teaching of both.

In fetting out upon this new work, begin by bringing the horfe's head a little more inwards than before, pulling the inward rein gently to you by degrees. When this is done, try to gain a little on the fhoulders, by keeping the inward rein the fhorter, as before, and the outward one croffed over towards the inward one. The intention of thefe operations is this; the inward rein ferves to bring in the head, and procures the bend; whilft the outward one, that is a little croffed, tends to make that bend perpendicular, and as it fhould be, that is to fay, to reduce the nofe and the forehead to be in a perpendicular line with each other: it alfo ferves, if put forwards, as well as alfo croffed, to put the horfe forwards, if found neceffary, which is often requifite, many horfes being apt in this and other works rather to lofe their ground backwards than otherwife, when they fhould rather advance: if the nofe were drawn in towards the breaft beyond the perpendicular, it would confine the motion of the fhoulders, and have other bad effects. All other bends, befides what are above fpecified, are falfe. The outward rein, being croffed, not in a forward fenfe, but rather a little backwards, ferves alfo to prevent the outward fhoulder from getting too forwards, and makes it approach the inward one; which facilitates the inward leg's croffing over the outward one; which is the motion that fo admirably fupples the fhoulders. Care muft be taken, that the inward leg pafs over the outward one,

one, without touching it; this inward leg's crossing over must be helped also by the inward rein, which you must cross towards and over the outward rein every time the outward leg comes to the ground, in order to lift and help the inward leg over it: at any other time, but just when the outward leg comes to the ground, it would be wrong to cross the inward rein, or to attempt to lift up the inward leg by it; nay, it would be demanding an absolute impossibility, and lugging about the reins and horse to no purpose; because in this case, a very great part of the horse's weight resting then upon that leg, would render such an attempt, not only fruitless, but also prejudicial to the sensibility of the mouth, and probably oblige him to defend himself: and moreover, it would put the horse under a necessity of straddling before, and also of leading with the wrong leg, without being productive of any suppling motion whatsoever.

When the horse is thus far familiarly accustomed to what you have required of him, then proceed to effect by degrees the same crossing in his hinder legs. By bringing in the fore-legs more, you will of course engage the hinder ones in the same work: if they resist, the rider must bring both reins more inwards; and, if necessary, put back also, and approach his inward leg to the horse; and if the horse throws out his croup too far, the rider must bring both reins outwards, and if absolutely necessary, he must also make use of his outward leg, in order to replace the horse properly; observing that the croup should always be considerably behind the shoulders, which in all actions must go first; and the moment that the horse obeys, the rider must put his hand and leg again into their usual position.

Nothing is more ungraceful in itself, more detrimental to a man's seat, or more destructive of the sensibility of a horse's sides, than a continual wriggling unsettledness in a horseman's legs, which prevents the horse from ever going a moment together true, steady, or determined.

A horse should never be turned, without first moving a step forwards; and when it is doing, the rider must not lift up his elbow, and displace himself; a motion only of the hand from the one side to the other being sufficient for that purpose. It must also be a constant rule never to suffer a horse to be stopped, mounted or dismounted, but when he is well placed. The slower the motions are, when a man or horse is taught any thing, the better.

At first, the figures worked upon must be great, and afterwards made less by degrees, according to the improvement which the man and horse make: and the cadenced pace also, which they work in, must be accordingly augmented. The changes from one side to the other, must be in a bold determined trot, and at first quite straight forwards, without demanding any side motion on two *pistes*, which is very necessary to require afterwards, when the horse is sufficiently suppled. By two *pistes* is meant, when the fore-parts and hinder-parts do not follow, but describe two different lines.

In the beginning, a *longe* is useful on circles, and also on straight lines, to help both the rider and the horse; but afterwards when they are grown more intelligent, they should go alone. At the end of the lesson, rein back; and then put the horse, by a little at a time, forwards, by approaching both legs gently to his sides, and playing with the bridle: if he rears, push him out immediately into a full trot. Shaking the *cavesson* on the horse's nose, and also putting one's self before him and rather near to him, will generally make him back, though he otherwise refuse to do it: and moreover a slight use and approaching of the rider's legs, will sometimes be necessary in backing, in order to prevent the horse from doing it too much upon his shoulders; but the pressure of the legs ought to be very small, and taken quite away the moment that he puts himself enough upon his haunches. If the horse does not back upon a straight line properly, the rider must not be permitted to have recourse immediately to his leg, and so distort himself by it, but first try, if crossing over his hand and reins to which ever side may be necessary, will not be alone sufficient; which most frequently it will; if not, then employ the leg.

After a horse is well prepared and settled, and goes freely on in all his several paces, he ought to be in all his works kept, to a proper degree, upon his haunches, with his hinder legs well placed under him; whereby he will be always pleasant to himself and his rider, will be light in hand, and ready to execute whatever may be demanded of him, with facility, vigour, and quickness.

The common method that is used, of forcing a horse sideways, is a most glaring absurdity, and very hurtful to the animal in its consequences; for instead of suppling him, it obliges him to stiffen and defend himself, and often makes a creature, that is naturally benevolent, restive, frightened and vicious.

For horses, who have very long and high fore-hands, and who poke out their noses, a running snaffle is of excellent use; but for such as bore and keep their heads low, a common one is preferable; though any horse's head indeed may be kept up also with a running one, by the rider's keeping his hands very high and forwards: but whenever either is used alone without a briddle upon horses that carry their heads low and that bore, it must be sawed about from one side to the other.

This lesson of the *epaul en dedans*, should be taught to such people as are likely to become useful in helping to teach men and to break horses; and the more of such that can be found, the better: none others should ever be suffered upon any occasion to let their horses look any way besides the way they are going. But all horses whatever, as likewise all men, who are designed for the teaching others, must go thoroughly and perfectly through this excellent lesson, under the directions of intelligent instructors, and often practise it too afterwards, and when that is done, proceed to, and be finished by the lessons of the head and tail to the wall.

Of the head to the wall, and of the croup to the wall.

THIS lesson should be practised immediately after that of the *epaule en dedans*, in order to place the horse properly the way he goes, *&c.* The difference between the head to the wall, and the croup to the wall, consists in this; in the former, the fore parts are more remote from the centre, and go over more ground; in the latter, the hinder-parts are more remote from the center, and consequently

fequently go over more ground: in both, as likewife in all other leffons, the fhoulders muft go firft. In riding-houfes, the head to the wall is the eafier leffon of the two at firft, the line to be worked upon being marked by the wall, not far from his head.

The motion of the legs to the right, is the fame as that of the *epaule en dedans* to the left, and fo *vice verfa*; but the head is always bent and turned differently: in the *epaule en dedans*, the horfe looks the contrary way to that which he goes; in this he looks the way he is going.

In the beginning, very little bend muft be required; too much at once would aftonifh the horfe and make him defend himfelf: it is to be augmented by degrees. If the horfe abfolutely refufes to obey, it is a fign, that either he or his rider has not been fufficiently prepared by previous leffons. It may happen, that weaknefs or a hurt in fome part of the body, or fometimes temper, though feldom, may be the caufe of the horfe's defending himfelf: it is the rider's bufinefs to find out from whence the obftacle arifes; and if he finds it to be from the firft mentioned caufe, the previous leffons muft be refumed again for fome time; if from the fecond, proper remedies muft be applied; and if from the laft caufe, when all fair means that can be tried have failed, proper corrections with coolnefs and judgment muft be ufed.

In practifing this leffon to the right, bend the horfe to the right with the right rein; helping the left leg over the right (at the time when the right leg is juft come to the ground,) with the left rein croffed towards the right, and keeping the right fhoulder back with the right rein towards your body, in order to facilitate the left legs croffing over the right; and fo likewife *vice verfa* to the left, each rein helping the other by their properly mixed effects. In working to the right, the rider's left leg helps the hinder parts on to the right, and his right leg ftops them, if they get too forwards; and fo *vice verfa* to the left; but neither ought to be ufed, till the hand being employed in a proper manner has failed, or finds that a greater force is neceffary to bring what is required about than it can effect alone; for the legs fhould not only be correfponding with, but alfo fubfervient to the hand; and all unneceffary aids, as well as all force, ought always to be avoided, as much as poffible.

In the execution of all leffons, the equilibre of the rider's body is of great ufe to the horfe: it ought always to go with and accompany every motion of the animal; when to the right, to the right; and when to the left, to the left.

Upon all horfes, in every leffon and action, it muft be obferved, that there is no horfe but has his own peculiar appui or degree of bearing, and alfo a fenfibility of mouth, as likewife a rate of his own, which it is abfolutely neceffary for the rider to difcover and make himfelf acquainted with. A bad rider always takes off at leaft the delicacy of both, if not abfolutely deftroys it. The horfe will inform his rider when he has got his proper bearing in the mouth, by playing pleafantly and fteadily with his bit, and by the fpray about his chaps. A delicate and good hand will not only always preferve a light appui, or bearing, in its fenfibility; but alfo of a heavy one, whether naturally fo or acquired, make a light one. The lighter this appui can be made, the better; provided that the rider's hand correfponds with it; if it does not, the more the horfe is properly prepared, fo much the worfe. Inftances of this inconvenience of the beft of appuis, when the rider is not equally taught with the horfe, may be feen every day in fome gentlemen, who try to get their horfes bitted as they call it, without being fuitably prepared themfelves for riding them: the confequence of which is, that they ride in danger of breaking their necks; till at length after much hauling about, and by the joint infenfibility and ignorance of themfelves and their grooms, the poor animals gradually become mere fenfelefs, unfeeling pofts; and thereby grow, what they call, fettled. When the proper appui is found, and made of courfe as light as poffible, it muft not be kept duly fixed without any variation, but be played with; otherwife one equally continued tenfion of reins would render both the rider's hand and the horfe's mouth very dull. The flighteft, and frequent giving and taking, is therefore neceffary to keep both perfect.

Whatever pace or degree of quicknefs you work in, (be it ever fo faft, or ever fo flow,) it muft be cadenced; time is as neceffary for an horfeman as for a mufician.

This leffon of the head and of the tail to the wall, muft be taught every foldier: fcarce any manœuvre can be well performed without it. In clofing and opening of files, it is almoft every moment wanted.

The method of teaching horfes to ftand fire, noifes, alarms, fights, &c.

In order to make horfes ftand fire, the found of drums, and all forts of different noifes, you muft ufe them to it by degrees in the ftable at feeding-time; and inftead of being frightened at it, they will foon come to like it as a fignal for eating.

With regard to fuch horfes as are afraid of burning objects, begin by keeping them ftill at a certain diftance from fome lighted ftraw: carefs the horfe; and in proportion as his fright diminifhes, approach gradually the burning ftraw very gently, and increafe the fize of it. By this means he will very quickly be brought to be fo familiar with it, as to walk undaunted even through it.

As to horfes that are apt to lie down in the water, if animating them, and attacking them vigoroufly, fhould fail of the defired effect, then break a ftraw bottle full of water upon their heads, and let the water run into their ears, which is a thing they apprehend very much.

All troop-horfes muft be taught to ftand quiet and ftill when they are fhot off from, to ftop the moment you prefent, and not to move after firing, till they are required to do it; this leffon ought efpecially to be obferved in light-troops; in fhort, the horfes muft be taught to be fo cool and undifturbed, as to fuffer the rider to act upon him with the fame freedom as if he was on foot. Patience, coolnefs, and temper, are the only means requifite for accomplifhing this end. Begin by walking the horfe gently, then ftop and keep him from ftirring for fome time, fo as to accuftom him by degrees not to have the leaft idea of moving without orders: if he does, then back him;

and

and when you ſtop him, and he is quite ſtill, leave the reins quite looſe.

To uſe a horſe to fire-arms, firſt put a piſtol or carabine in the manger with his feed; then uſe him to the ſound of the lock and the pan; after which, when you are upon him, ſhew the piece to him, preſenting it forwards, ſometimes on one ſide, ſometimes on the other: when he is thus far reconciled, proceed to flaſh in the pan; after which, put a ſmall charge into the piece, and ſo continue augmenting it by degrees to the quantity which is commonly uſed: if he ſeems uneaſy, walk him forwards a few ſteps ſlowly; and then ſtop, back and careſs him. Horſes are often alſo diſquieted and unſteady at the claſh, and drawing, and returning of ſwords, all which they muſt be familiarized to by little and little, by frequency and gentleneſs.

It is very expedient for all cavalry in general, but particularly for light cavalry, that their horſes ſhould be very ready and expert in leaping over ditches, hedges, gates, *&c.* The leaps, of whatever ſort they are, which the horſes are brought to in the beginning, ought to be very ſmall ones; the riders muſt keep their bodies back, raiſe their hands a little in order to help the foreparts of the horſe up, and be very attentive to their equilibre. It is beſt to begin at a low bar covered with furze, which pricking the horſe's legs, if he does not raiſe himſelf ſufficiently, prevents his contracting a ſluggiſh and dangerous habit of touching, as he goes over, which any thing yielding and not pricking would give him a cuſtom of doing. Let the ditches you firſt bring horſes to, be narrow; and in this, as in every thing elſe, let the increaſe be made by degrees. Accuſtom them to come up to every thing which they are to leap over, and to ſtand coolly at it for ſome time; and then to raiſe themſelves gently up in order to form to themſelves an idea of the diſtance. When they leap well ſtanding, then uſe them to walk gently up to the leap, and to go over it without firſt halting at it; and after that practice is familiar to them, repeat the like in a gentle trot, and ſo by degrees faſter and faſter, till at length it is as familiar to them to leap flying on a full gallop, as any other way: all which is to be acquired with great facility by calm and ſoft means without any hurry.

As horſes are naturally apt to be frightened at the ſight and ſmell of dead horſes, it is adviſable to habituate them to walk over, and leap over carcaſſes of dead horſes: and as they are particularly terrified at this ſight, the greater gentleneſs ought conſequently to be uſed.

Horſes ſhould alſo be accuſtomed to ſwim, which often may be neceſſary upon ſervice; and if the men and horſes both are not uſed to it, both may be frequently liable to periſh in the water. A very ſmall portion of ſtrength is ſufficient to guide a horſe, any where indeed, but particularly in the water, where they muſt be permitted to have their heads, and be no ways conſtrained in any ſhape.

The unreaſonable rage in Britain of cutting off all extremities from horſes, is in all caſes a very pernicious cuſtom. It is particularly ſo in regard to a troop-horſe's tail. It is almoſt incredible, how much they ſuffer at the picket for want of it: conſtantly fretting, and ſweating, kicking about and laming one another, tormented, and ſtung off their meat, miſerable, and helpleſs; whilſt other horſes, with their tails on, bruſh off all flies, are cool and at their eaſe, and mend daily, whilſt the docked ones grow every hour more and more out of condition.

The method of reining back,—and of moving forwards immediately after,—of piaſing,—of pillars, &c.

Never finiſh your work by reining back with horſes that have any diſpoſition towards retaining themſelves; but always move them forwards and a little upon the haunches alſo after it, before you diſmount, (unleſs they retain themſelves very much indeed, in which caſe nothing at all muſt be demanded from the haunches.) This leſſon of reining back, and piafing, is excellent to conclude with, and puts an horſe well and properly on the haunches: It may be done, according as horſes are more or leſs ſuppled, either going forwards, backing, or in the ſame place: if it is done well advancing, or at moſt on the ſame ſpot, it is full ſufficient for a ſoldier's horſe: For to piafe in backing, is rather too much to be expected in the hurry, which cannot but attend ſuch numbers both of men and horſes as muſt be taught together in regiments. This leſſon muſt never be attempted at all, till horſes are very well ſuppled, and ſomewhat accuſtomed to be put together; otherwiſe it will have very bad conſequences, and create reſtiveneſs. If they refuſe to back, and ſtand motionleſs, the rider's legs muſt be approached with the greateſt gentleneſs to the horſe's ſides; at the ſame time as the hand is acting on the reins to ſolicite the the horſe's backing. This ſeldom fails of procuring the deſired effect, by raiſing one of the horſe's fore-legs, which being in the air, has no weight upon it, and is conſequently very eaſily brought backwards by a ſmall degree of tenſion in the reins. When this leſſon is well performed, it is very noble, and uſeful, and has a pleaſing air; it is an excellent one to begin teaching ſcholars with.

The leſſon is particularly ſerviceable in the pillars, for placing ſcholars well at firſt. Very few regimental riding-houſes have pillars, and it is fortunate they have not; for though, when properly made uſe of with ſkill, they are one of the greateſt and beſt diſcoveries in horſemanſhip; they muſt be allowed to be very dangerous and pernicious, when they are not under the direction of a very knowing perſon.

The method of curing reſtiveneſſes, vices, defences, ſtarting, &c.

Whenever a horſe makes reſiſtance, one ought, before a remedy or correction is thought of, to examine very minutely all the tackle about him, if any thing hurts or tickles him, whether he has any natural or accidental weakneſs, or in ſhort any the leaſt impediment in any part. For want of this precaution, many fatal diſaſters happen: the poor dumb animal is frequently accuſed falſely of being reſtive and vicious; is uſed ill without reaſon, and, being forced into deſpair, is in a manner obliged to act accordingly, be his temper and inclination ever ſo well

well disposed. It is very seldom the case, that a horse is really and by nature vicious; but if such be found, he will despise all caresses, and then chastisements become necessary.

Correction, according as you use it, throws a horse into more or less violent action, which, if he be weak, he cannot support: but a vitious strong horse is to be considered in a very different light, being able both to undergo and consequently to profit by all lessons; and is far preferable to the best-natured weak one upon earth. Patience and science are never-failing means to reclaim such a horse: in whatsoever manner he defends himself, bring him back frequently with gentleness (not however without having given him proper chastisement, if necessary,) to the lesson which he seems most averse to. Horses are by degrees made obedient, through the hope of recompence and the fear of punishment: how to mix these two motives judiciously together, is a very difficult matter; it requires much thought and practice; and not only a good head, but a good heart likewise. The coolest, and best natured rider, will always succeed best. By a dextrous use of the incitements above mentioned, you will gradually bring the horse to temper and obedience; mere force and want of skill and coolness, would only tend to confirm him in bad tricks. If he be impatient or choleric, never strike him, unless he absolutely refuses to go forwards; which you must resolutely oblige him to do, and which will be of itself a correction, by preventing his having time to meditate, and put in execution any defence by retaining himself. Resistance in horses, you must consider, is sometimes a mark of strength and vigour, and proceeds from spirits, as well as sometimes from vice and weakness. Weakness frequently drives horses into vitiousness, when any thing wherein strength is necessary is demanded from them; nay, it inevitably must: great care therefore should always be taken to distinguish from which of these two causes any remedy or punishment is thought of. It may sometimes be a bad sign, when horses do not at all defend themselves, and proceed from a sluggish disposition, a want of spirit, and of a proper sensibility. Whenever one is so fortunate as to meet with a horse of just the right spirit, activity, delicacy of feeling, with strength and good-nature, he cannot be cherished too much; for such a one is a rare and inestimable jewel, and, if properly treated, will in a manner do every thing of himself. Horses are oftener spoilt by having too much done to them, and by attempts to dress them in too great an hurry, than by any other treatment.

If after a horse has been well suppled, and there are no impediments, either natural or accidental, if he still persists to defend himself, chastisements then become necessary: but whenever this is the case, they must not be frequent, but always firm, though always as little violent as possible: for they are both dangerous and very prejudicial, when frequently or slightly played with; and still more so, when used too violently.

It is impossible, in general, to be too circumspect in lessons of all kinds, in aids, chastisements, or caresses. Some have quicker parts, and more cunning, than others. Many will imperceptibly gain a little every day on their rider. Various, in short, are their dispositions and capacities. It is the rider's business to find out their different qualities, and to make them sensible how much he loves them, and desires to be loved by them; but at the same time that he does not fear them, and will be master.

Plunging is a very common defence among restive and vitious horses: if they do it in the same place, or backing, they must, by the rider's legs and spurs firmly applied, be obliged to go forwards, and their heads kept up high. But if they do it flying forwards, keep them back, and ride them gently and very slow for a good while together. Of all bad tempers and qualities in horses, those which are occasioned by harsh treatment and ignorant riders, are the worst.

Rearing is a bad vice, and, in weak horses especially, a very dangerous one. Whilst the horse is up, the rider must yield his hand, and when the horse is descending, he must vigorously determine him forwards: if this be done at any other time but whilst the horse is coming down, it may add a spring to his rearing, and make him fall backwards. With a good hand on them, horses seldom persist in this vice; for they are themselves naturally much afraid of falling backwards. If this method fails, you must make the horse kick up behind, by getting somebody on foot to strike him behind with a whip; or, if that will not effect it, by pricking him with a goad.

Starting often proceeds from a defect in the sight; which therefore must be carefully looked into. Whatever the horse is afraid of, bring him up to it gently; if you caress him every step he advances, he will go quite up to it by degrees, and soon grow familiar with all sorts of objects. Nothing but great gentleness can correct this fault: for if you inflict punishment, the apprehension of chastisement becomes prevalent, and causes more starting than the fear of the object. If you let him go by the object, without bringing him up to it, you increase the fault, and confirm him in his fear: the consequence of which is, he takes his rider perhaps a quite contrary way from what he was going, becomes his master, and puts himself and the person upon him every moment in great danger.

With such horses as are to a very great degree fearful of any objects, make a quiet horse, by going before them, gradually entice them to approach nearer and nearer to the thing they are afraid of. If the horse, thus alarmed, be undisciplined and head-strong, he will probably run away with his rider; and if so, his head must be kept up high, and the snaffle sawed backwards and forwards from right to left, taking up and yielding the reins of it, as also the reins of the bit: but this latter must not be sawed backwards and forwards, like the snaffle, but only taken up, and yielded properly. No man ever yet did, or ever will stop a horse, or gain any one point over him, by main force, or by pulling a dead weight against him.

Remarks and hints on Shoeing.

As feet differ, so should shoes accordingly. The only system of farriers, is to shoe in general with excessive heavy and

and clumſy ill-ſhaped ſhoes, and very many nails, to the total deſtruction of the foot. The cramps they annex, tend to deſtroy the bullet; and the ſhoes made in the ſhape of a walnut-ſhell prevent the horſe's walking upon the firm baſis which God has given him for that end, and thereby oblige him to ſtumble and fall. They totally pare away alſo, and lay bare the inſide of the animal's foot with their deteſtable butteris, and afterwards put on very long ſhoes, whereby the foot is hindred from having any preſſure at all upon the heels, which preſſure otherwiſe might ſtill perchance, notwithſtanding their dreadful cutting, keep the heels properly open, and the foot in good order. The frog ſhould never be cut out; but as it will ſometimes become ragged, it muſt be cleaned every now and then, and the ragged pieces cut off with a knife. In one kind of foot indeed a conſiderable cutting away muſt be allowed of, but not of the frog; we mean that very high feet muſt be cut down to a proper height; becauſe if they were not, the frog, though not cut, would ſtill be ſo far above the ground, as not to have any bearing on it, whereby the great tendon muſt inevitably be damaged, and conſequently the horſe would go lame.

The weight of ſhoes muſt greatly depend on the quality and hardneſs of the iron. If the iron be very good, it will not bend; and in this caſe, the ſhoes cannot poſſibly be made too light: care however muſt be taken, that they be of a thickneſs ſo as not to bend; for bending would force out the nails, and ruin the hoof. That part of the ſhoe which is next the horſe's heel, muſt be narrower than any other, (as is ſeen in the draught, plate 101. fig. 4.) that ſtones may be thereby prevented from getting under it, and ſticking there; which otherwiſe would be the caſe; becauſe the iron, when it advances inwardly beyond the bearing of the foot, forms a cavity, wherein ſtones being lodged would remain, and, by preſſing againſt the foot, lame the horſe. The part of the ſhoe, which the horſe walks upon, ſhould be quite flat, and the inſide of it likewiſe; only juſt ſpace enough being left next the foot, to put in a picker, (which ought to be uſed every time the horſe comes into the ſtable,) and alſo to prevent the ſhoe's preſſing upon the ſole. Four nails on each ſide hold better than a gteater number, and keep the hoof in a far better ſtate. The toe of the horſe muſt be cut ſhort, and nearly ſquare, (the angles only juſt rounded off,) nor muſt any nails be driven there; this method prevents much ſtumbling, eſpecially in deſcents, and ſerves, by throwing nouriſhment to the heels, to ſtrengthen them; on them the horſe ſhould in ſome meaſure walk, and the ſhoe be made of a proper length accordingly; by this means, narrow heels are prevented, and many other good effects produced. Many people drive a nail at the toe, but it is an abſurd practice. Leaving room to drive one there cauſes the foot to be of an improper length; and moreover that part of the hoof is naturally ſo brittle, that even when it is kept well greaſed, the the nail there ſeldom ſtays in, but tears out and damages the hoof. That the directions for ſhoeing a proper length may be the more clear and intelligible, we have annexed (plate 101.) a draught of a foot ſhoed a proper length ſtanding on a plain ſurface, and with it a draught of the right kind of ſhoe.

In wet, ſpungy, and ſoft ground, where the foot ſinks in, the preſſure upon the heels is of courſe greater, than on hard ground; and ſo indeed it ſhould be upon all accounts. The hinder feet muſt be treated in the ſame manner as the fore-ones; and the ſhoes the ſame: except in hilly and ſlippery countries, they may not improperly be turned up a little behind: but turning up the fore-ſhoes is of no ſervice, and is certain ruin to the fore-legs, eſpecially to the bullets. In deſcending hills, cramps are apt to throw horſes down, by ſtopping the fore-legs, out of their proper baſis and natural bearing, when the hinder ones are rapidly preſſed; which unavoidably muſt be the caſe, and conſequently cannot but puſh the horſe upon his noſe. With them on a plain ſurface, a horſe's foot is always thrown forwards on the toe, out of its proper bearing, which is very liable to make the horſe ſtumble. The notion of their utility in going up hills is a falſe one. In aſcending, the toe is the firſt part of the foot, which bears on, takes hold of the ground, and whether the horſe draws or carries, and conſequently the buſineſs is done before the part where the cramps are comes to the ground. Ice-nails are preferable to any thing to prevent ſlipping, as alſo to help horſes up hill, the moſt forward ones taking hold of the ground early, conſiderably before the heels touch the ground: they muſt be ſo made, as to be, when driven in, ſcarce half inch above the ſhoe, and alſo have four ſides ending at the top in a point. They are of great ſervice to prevent ſlipping on all kinds of places, and by means of them a horſe is not thrown out of his proper baſis. They muſt be made of very good iron. If they are not, the heads of them will be perpetually breaking off. From the race-horſe to the cart-horſe, the ſame ſyſtem of ſhoeing ſhould be obſerved. The ſize, thickneſs, and weight of them only ſhould differ. The ſhoe of a race-horſe muſt of courſe be lighter than that of a ſaddle horſe; that of a ſaddle horſe lighter than that of a coach or bât horſe; and theſe laſt more ſo than a cart, waggon, or artillery horſe. At preſent all ſhoes in general are too *heavy*; if the iron is good, ſhoes need not be ſo thick as they are now generally made. The utmoſt ſeverity ought to be inflicted upon all thoſe who clap ſhoes on hot: This unpardonable lazineſs of farriers in making feet thus fit ſhoes, inſtead of ſhoes fitting feet, dries up the hoof, and utterly deſtroys them. Frequent removals of ſhoes are detrimental and tear the foot; but ſometimes they are very neceſſary: this is an inconvenience which half-ſhoes are liable to; for the end of the ſhoe, being very ſhort, is apt to work ſoon into the foot, and conſequently muſt then be moved.

For the *Natural Hiſtory* and *Treatment of the Diſeaſes* of *Horſes*, ſee EQUUS, and FARRIERY.

HORSHAM, a market-town and borough of Suſſex, ſituated twenty miles north weſt of Lewis, in W. long. 22', N. lat. 51° 10'. It ſends two members to parliament.

HORTAGILERS, in the grand feignior's court, upholfterers, or tapeftry-hangers. The grand feignior has conftantly four hundred in his retinue when he is in the camp: thefe go always a day's journey before him, to fix upon a proper place for his tent, which they prepare firft; and afterwards thofe of the officers, according to their rank.

HORTULANUS, in ornithology. See EMBERIZA.

HORTUS SICCUS, a DRY-GARDEN, an appellation given to a collection of fpecimens of plants, carefully dried and preferved.

Take a fpecimen of a plant in flower, and with it one of its bottom-leaves, if it have any; bruife the ftalk, if too rigid; flit it, if too thick; fpread out the leaves and flowers on paper; cover the whole with more paper, and lay a weight over all. At the end of eighteen hours take out the plants, now perfectly flatted; lay them on a bed of dry common fand; fift over them more dry fand, to the depth of two inches, and thus let them lie about three weeks: the lefs fucculent dry much fooner, but they take no harm afterwards. If the floor of a garret be covered in fpring with fand two inches deep, leaving fpace for walking to the feveral parts, it will receive the collection of a whole fummer, the covering of fand being fifted over every parcel as laid in. They need no farther care, from the time of laying them, till they are taken up to be ftuck on paper. The cement ufed is a folution of gum-arabic in water.

Plants may be dried very well without fand, by only putting them frequently into frefh quires of paper, or a few by only preffing them between the leaves of a book; but the fand-method preferves the colour beft, and is done with leaft trouble.

HOSANNA, a Hebrew word, fignifying *Save now*, or *Save, we befeech thee*; from the frequent ufe of which, during the feaft of tabernacles, the whole folemnity got the appellation of *Hofanna Rabbi*.

HOSEA, a canonical book of the Old Teftament, fo called from the prophet of that name, its author, who was the fon of Beri, and the firft of the leffer prophets. He lived in the kingdom of Samaria, and delivered his prophecies under the reign of Jeroboam II. and his fucceffors, kings of Ifrael; and under the reigns of Uzziah, Jotham, Ahaz, and Hezekiah, kings of Judah. His principal defign is to publifh the grofs idolatries of the people of Ifrael and Judah, to denounce the divine vengeance againft them, and to foretel the captivity in Affyria.

HOST, denotes either a perfon who entertains another, or the perfon fo entertained; but it is now generally ufed in the firft of thefe fenfes.

HOST, in the church of Rome, a name given to the elements ufed in the eucharift, or rather to the confecrated wafer; which they pretend to offer up every day, a new hoft or facrifice, for the fins of mankind.

They pay adoration to the hoft, upon a falfe prefumption that the elements are no longer bread and wine, but tranfubftantiated into the real body and blood of Chrift. See TRANSUBSTANTIATION.

HOSTAGE, a perfon given up to an enemy as a fecurity for the performance of the articles of a treaty.

HOT-BEDS, in gardening, beds made with frefh horfe-dung, or tanner's bark, and covered with glaffes to defend them from cold winds.

HOTTONIA, WATER-VIOLET, in botany, a genus of the pentandria monogynia clafs. The corolla is fhaped like a jug; the ftamina are fixed to the tube of the corolla; and the capfule has but one cell. There are two fpecies, none of them natives of Britain.

HOVINGHAM, a market-town of the eaft riding of Yorkfhire, feventeen miles north-eaft of York.

HOULSWORTHY, a market-town of Devonfhire, thirty-eight miles north-weft of Exeter.

HOUND. See CANIS.

HOUR, in chronology, an aliquot part of a natural day, ufually a 24th, fometimes a 12th. See ASTRONOMY, DIALING, GEOGRAPHY.

HOUSE, a habitation, or place built with conveniencies for dwelling in. See ARCHITECTURE.

HOUSE, in aftrology, denotes the twelfth part of the heavens.

HOUSTONIA, in botany, a genus of the tetrandria monogynia clafs. The corolla confifts of one bell-fhaped petal; and the feeds are two, and furrowed. There are two fpecies, none of them natives of Britain.

HOY, in naval architecture, a fmall veffel, fitted only with one maft.

HOYE, a town of Weftphalia, capital of a county of the fame name, and fubject to the elector of Hanover: E. long. 9°, N. lat. 53° 5′.

HUDSON'S BAY, a large mediterranean fea of north America, fituated between 51° and 63° of N. lat. and of unequal breath from 130 to 35 leagues.

HUDSON'S *ftreights*, giving entrance into Hudfon's bay, lie between 65° and 75° of W. lon.

HUDSON'S *river*, rifes near the lake Champlain, in Canada, and falls into the Atlantic, a little below the city of New-York.

HUE AND CRY, in law, the purfuit of a perfon who has committed felony on the highway.

HUEGLY, a large town in the Eaft Indies, fituated on an ifland in the moft wefterly branch of the river Ganges, in the province of Bengal: E. long. 87° N. lat. 23°.

HUETTE, a city of Spain, in the province of New Caftile, fixty-feven miles eaft of Madrid: W. lon. 2° 45′, N. lat. 40° 35′.

HUGUENOTS, a name given by way of contempt to the Calvinifts of France.

The name had its rife in the year 1560; but authors are not agreed as to its origin. The moft plaufible opinion, however, is that of Pafquier, who obferves, that at Tours, the place where they were firft thus denominated, the people had a notion, that an apparition or hobgoblin, called king Hugon, ftrolled about the ftreets in the night-time; from whence as thofe of the reformed religion met chiefly in the night to pray, *&c.* they called them Huguenots, that is, the difciples of king Hugon.

HULKS, large veffels ufed in fetting the mafts of fhips.

HULL, in the fea-language, is the main body of a fhip, without either mafts, yards, fails, or rigging. Thus to ftrike a hull in a ftorm is to take in her fails, and to lafh the helm on the lee-fide of the fhip; and to hull. or lie a-hull, is faid of a fhip whofe fails are thus taken in, and helm lafhed a lee.

HULL, in geography, a ftrong fea port town in the eaft riding of Yorkfhire, fituated on the river Hull, near the mouth of the Humber, thirty-two miles fouth-eaft of York.

HULPEN, a town of the Auftrian Netherlands, in the province of Brabant, fituated nine miles fouth eaft of Bruffels: E long. 4° 22′. N. lat. 50° 42′.

HUMAN, in general, is an appellation given to whatever relates to mankind: thus we fay, the human foul, human body, human laws, *&c.*

HUMANITY, the peculiar nature of man, whereby he is diftinguifhed from all other beings.

HUMANITIES, in the plural, fignify grammar, rhetoric, and poetry, known by the name of *literæ humaniores*; for teaching of which, there are profeffors in the univerfities of Scotland, called humanifts.

HUMBER, a river formed by the Trent, the Oufe and feveral other ftreams united. It divides Yorkfhire from Lincolnfhire, and falls into the German Sea at Holdernefs.

HUMBLE-BEE. See APIS.

HUMERUS, in anatomy. See ANAT. p. 176.

Luxation of the HUMERUS See SURGERY.

HUMIDITY, that quality in bodies whereby they are capable of wetting other bodies. This differs very much from fluidity, and feems to be merely a relative thing, depending upon the congruity of the component particles of the liquor to the pores of fuch particular bodies, as it is capable of adhering to, penetrating a little into, or wetting. Thus, for inftance, quickfilver is not a moift thing with regard to our hands or clothes, but may be called fo in reference to gold, tin, or lead, to whofe furfaces it will perfectly adhere, and render them foft and moift.

HUMMING-BIRD. See TROCHILUS.

HUMOUR, in a general fenfe, denotes much the fame with liquid or fluid. See FLUID.

HUMOUR. See WIT.

HUMULUS, in botany, a genus of the diœcia pentandria clafs. The calix of the male is divided into five parts, and it has no corolla. The calix of the female confifts of one entire leaf opening at one fide; the corolla is wanting; it has two ftyli; and the nut has two valves, and is inclofed within the calix. There is but one fpecies, *viz.* the lupulus, or hop, a native of Britain. See HOP.

HUNDRED, *hundredum*, or *centuria*, a part or divifion of a county, which was anciently fo called from its containing an hundred families, or from its furnifhing an hundred able men for the king's wars. After king Alfred's dividing this kingdom into counties, and giving the government of each county to a fheriff, thefe counties were divided into hundreds, of which the conftable was the chief officer. The grants of hundreds were at firft made by the king to particular perfons but they are not now held by grant or prefcription; their jurifdiction being devolved to the county-court; a few of them only excepted, that have been by privilege annexed to the crown, or granted to fome great fubjects, and ftill remain in the nature of a franchife.

HUNGARY, a kingdom bounded by the Carpathian mountains, which divide it from Poland, on the north; by Tranfilvania and Walachia on the eaft; by the river Drave, which feparates it from Sclavonia, on the fouth; and by Auftria and Moravia on the weft. It is one continued plain of 300 miles long, and is fituated between 16° and 23° of E lon. and between 45° and 49° of N. lat. It is now fubject to the emprefs queen.

HUNGARY WATER, a diftilled-water, fo denominated from a queen of Hungary, for whofe ufe it was firft prepared.

Quincy gives the following directions for making it. Take of frefh gathered flowers of rofemary, two pounds; rectified fpirits of wine, two quarts; put them together, and diftil them immediately in balneo.

Or, Take of frefh tops of rofemary, one pound and a half; proof fpirit, one gallon; and diftil in balneo till five pints are obtained.

HUNGER, an uneafy fenfation, which creates an appetite or defire of food.

Hunger is by fome attributed to a fharp acrimonious humour, which vellicates the coats of the ftomach; others, who deny the exiftence of any fuch liquor, attribute it to the attrition or rubbing of the coats of the ftomach; and others, again, account for it from the acidity of the blood.

HUNGERFORD, a market-town of Berkfhire, fituated on the river Kennet, twenty-four miles weft of Reading.

HUNNINGHEN, a town of Germany, in the langraviate of Alface, fituated on the Rhine, three miles north of Bafil: E long. 7° 35′, N. lat. 47° 37′.

HUNNOBY, a market-town in the eaft riding of Yorkfhire, fituated thirty four miles north eaft of York.

HUNTING the exercife or diverfion of purfuing four-footed beafts of game.

Four-footed beafts are hunted in the fields, woods, and thickets, and that both with guns and greyhounds.

Birds, on the contrary, are either fhot in the air, or taken with nets and other devices, which exercife is called fowling; or they are purfued and taken by birds of prey, which is called hawking.

The purfuing of four-footed beafts, as badgers, deer, does, roebucks, foxes, hares, *&c.* properly termed hunting, is a noble exercife, ferving not only to recreate the mind, but to ftrengthen the body, whet the ftomach, and chear the fpirits.

HUNTINGDON, the capital of Huntingdonfhire, fituated on the river Oufe, fifty-fix miles north of London: W. lon. 15′, and N. lat 52° 23′.

It fends two members to parliament.

HUQUAM, a province of China, bounded by Honan on

on the north, and by Quamſi and Canton on the ſouth; lying between 25° and 30° of north latitude.

HURA, the SAND BOX TREE, in botany, a genus of the monoecia monadelphia claſs. The male has no calix; the corolla conſiſts of four petals; it has eight ſtamina, and four glandular bearded nectaria; the calix and corolla of the female are the ſame as in the male; the ſtylus is filiform; the ſtigma is peltated; the capſule has four valves, and but one ſeed. There is only one ſpecies, a native of Mexico.

HURDLES, in fortification, twigs of willows or oſiers interwoven cloſe together, ſuſtained by long ſtakes, and uſually laden with earth.

HURDLES, in huſbandry, certain frames, made either of ſplit timber, or of hazel-rods, watled together, to ſerve for gates in incloſures, or to make ſheep-folds, *&c.*

HURDS, or HORDS, *of flax*, or *hemp*, the coarſer parts ſeparated in the dreſſings from the tear or fine ſtuff. See FLAX.

HURLE BONE, in a horſe, a bone near the middle of the buttock, very apt to go out of its ſockets with a hurt or ſtrain.

HURON, a vaſt lake of North America, ſituated between 84° and 89° W. long. and between 43° and 46° N lat. from whence the country contiguous to it is called the country of the Hurons, whoſe language is ſpoken over a great extent in the ſouthern parts of north America.

HURRICANE, a furious ſtorm of wind, owing to a contrariety of winds. See WIND and WHIRLWIND.

Hurricanes are frequent in the Weſt-indies, where they make terrible ravages, by rooting up trees, deſtroying houſes and ſhipping, and the like.

HUSBAND, a man joined or contracted with a woman in marriage.

HUSBANDRY. See AGRICULTURE.

HUSK, the ſame with what botaniſts call the calix, or cup of a flower. See BOTANY, p. 636, *&c.*

HUSO in ichthyology. See ACCIPENSER.

HUSSARS, a kind of irregular cavalry armed with the ſabre and bayonet, are retained in the ſervice of moſt princes or the continent.

They are very reſolute partiſans, and better in an invaſion or haſty expedition than in a ſet battle.

HUSSITES, the diſciples of John Huſs, a Bohemian, and curate of the chapel of Bethlehem at Prague; who, about the year 1414, embraced and defended the opinions of Wickliff of England, for which he was cited before the council of Conſtance, and, refuſing to renounce his ſuppoſed errors. he was condemned to be burnt alive, which ſentence was accordingly executed upon him at Conſtance.

It is evident in what the pretended hereſy of John Huſs and Jerom of Prague, who ſuffered with him, conſiſted, from the anſwer they made to the council, when they were admoniſhed to conform to the ſentiments of the church: They were lovers, they ſaid, of the holy goſpel, and true diſciples of Chriſt; that the church of Rome, and all other churches of the world, were widely departed from the apoſtolical tradition; that the clergy ran after pleaſures and riches, lorded it over the people, affected the higheſt ſeats at entertainments, bred horſes and dogs; and the revenues of the church, which belonged to the poor members of Chriſt, were conſumed in vanity and wantonneſs; and that the prieſts were ignorant of the commandments of God, or, if they did know them, paid but little regard to them. The followers of Huſs were alſo called Calixtins, Taberites, and Bohemian brethren.

HUSTINGS, a court held in Guildhall before the lord-mayor and aldermen of London, and reckoned the ſupreme court of the city. Here deeds may be inrolled, recoveries paſſed, out-lawries ſued out, and replevins and writs of error determined. In this court alſo is the election of aldermen, of the four members of parliament for the city, *&c.*

This court is very ancient, as appears by the laws of Edward the Confeſſor.

Some other cities have likewiſe had a court bearing the ſame name, as Wincheſter, York, *&c.*

HUSUM, a port-town of Sleſwic or ſouth Jutland, ſituated on the German ſea; ſubject to the duke of Holſtein Gottorp: E. long. 8° 30′, N. lat. 54° 40.

HUTHERFIELD, a market-town in the weſt riding of Yorkſhire: W. long. 1° 34′, N. lat. 53° 37′.

HUY, a ſtrong town in the biſhopric of Liege, ſituated on the Maes, ſixteen miles north-eaſt of Namur: E. long. 5° 15, N. lat. 50° 35′.

HYACINTH, in botany. See HYACINTHUS.

HYACINTH, in natural hiſtory, a genus of pellucid gems, whoſe colour is red with an admixture of yellow.

The hyacinth, though leſs ſtriking to the eye than any other red gems, is not without its beauty in the fineſt ſpecimens. It is found of various ſizes, from that of a pin's head to the third of an inch in diameter. Like common cryſtal, it is ſometimes found columnar, and ſometimes in a pebble-form; and is always hardeſt and brighteſt in the larger maſſes.

Its colour is a dull or deadiſh red, with an admixture of yellow in it; and this mixed colour is found in all the variety of tints that a prevalence of the red or of the yellow in different degrees is capable of giving it.

Our jewelers allow all thoſe gems to be hyacinths or jacinths, that are of a due hardneſs with this mixed colour; and as they are of very different beauty and value in their ſeveral degrees and mixture of colours, they divide them into four kinds; three of which they call hyacinths, but the fourth, very improperly, a ruby. 1. When the ſtone is in its moſt perfect ſtate, and of a pure and bright flame-colour, neither the red nor the yellow prevailing, in this ſtate they call it hyacintha la belle. 2. When it has an over proportion of the red, and that of a duſkier colour than the fine high red in the former, and the yellow that appears in a faint degree in it is not a fine, bright, and clear, but a duſky browniſh-yellow, then they call it the ſaffron hyacinth. 3. Such ſtones as are of a dead whitiſh-yellow, with a very ſmall proportion of red in them, they call amber-hyacinths. And, 4. When the

the ſtone is of a fine deep red, blended with a duſky and very deep yellow, they call it a rubacelle. But though the over-proportion of a ſtrong red in this gem has made people refer it to the claſs of rubies, its evident mixture of yellow ſhews that it truly belongs to the hyacinths.

The hyacinth la belle is found both in the Eaſt and Weſt Indies. The oriental are the harder, but the American are often equal to them in colour. The rubacelle is found only in the Eaſt Indies, and is generally brought over among the rubies, but it is of little value: the other varieties are found in Sileſia and Bohemia.

HYACINTHUS, in botany, a genus of the hexandria monogynia claſs. The corolla is bell ſhaped; and there are three melliferous pores in the germen. There are 13 ſpecies, only one of which, *viz.* the non-ſcriptus, Engliſh hyacinth, or hare bells, is a native of Britain.

HYADES, in aſtronomy, ſeven ſtars in the bull's head, famous among the poets for the bringing of rain. See ASTRONOMY, p. 487.

HYATIDES, in medicine, little tranſparent veſicles or bladders, full of water, ſometimes found ſolitary, and ſometimes in cluſters, upon the liver, and various other parts, eſpecially in hydropical conſtitutions.

HYDATOSCOPIA, called alſo hydromancy, a kind of divination or method of foretelling future events by means of water.

HYDNUM, in botany, a genus of the cryptogamia fungi claſs: it is an horizontal fungus, echinated or beſet with ſharp-pointed fibres on its under part. There are four ſpecies, only one of which, *viz.* the imbricatum, or common hydnum, is a native of Britain.

HYDRA, in aſtronomy. See ASTRONOMY, p. 487.

HYDRAGOGUES, among phyſicians, remedies which evacuate a large quantity of water in dropſies.

Quincy obſerves, that the ſtrongeſt cathartics chiefly anſwer to the character of hydragogues, in that by their forcibly ſhaking and vellicating the bowels and their appendages, they ſqueeze out water enough to make the ſtools appear little elſe.

The principal hydragogues, in the common opinion, are the juices of elder, of the root of iris, of ſoldanella, mechoacan, jalop, *&c.*

HYDRANGÆA, in botany, a genus of the decandria digynia claſs. The capſule has two cells, and a double beak. There is but one ſpecies, a native of Virginia.

HYDRAULICS, the ſcience of the motion of fluids, and the conſtruction of all kinds of inſtruments and machines relating thereto.

As the conſtruction of hydraulic engines depends upon the knowledge of the general laws of fluids, it will be better to give the deſcription of them under the article hydroſtatics. See HYDROSTATICS.

HYDRENTEROCELE, in ſurgery, a ſpecies of hernia, wherein the inteſtines deſcend into the ſcrotum, together with a quantity of water.

HYDROCELE, in ſurgery, denotes any hernia ariſing from water; but is particularly uſed for ſuch a one of the ſcrotum which ſometimes grows to the ſize of one's head, without pain, but exceeding troubleſome to the patient. See SURGERY.

HYDROCEPHALUS, in ſurgery, a preternatural diſtention of the head, to an uncommon ſize, by a ſtagnation and extravaſation of the lymph, which, when collected within ſide of the bones of the cranium, the hydrocephalus is then termed internal; as it is external, when retained betwixt the common integuments and the cranium. See SURGERY.

HYDROCHARIS, the LITTLE WATER-LILY, in botany, a genus of the diœcia decandria claſs. The ſpatha of the male conſiſts of two leaves, the calix of three ſegments, and the corolla of three petals. The calix of the female conſiſts of three ſegments, and the corolla of three petals; it has ſix ſtyli; and the capſule has ſix cells and many ſeeds. There is but one ſpecies, *viz.* the morſus ranæ, or frog bit, a native of Britain.

HYDROCORAX, in ornithology. See BUCEROS.

HYDROCOTYLE, in botany, a genus of the pentandria digynia claſs. The umbella is ſimple; the involucrum conſiſts of four leaves; the petals are entire, and the ſeeds are roundiſh and compreſſed. There are five ſpecies, only one of them, *viz.* the vulgaris, march penny wort, or white rot, is a native of Britain.

HYDROGRAPHY, the art of meaſuring and deſcribing the ſea, rivers, lakes, and canals.

With regard to the ſea, it gives an account of its tides, counter-tides, ſoundings, bays, gulphs, creeks, *&c.* as alſo of the rocks, ſhelves, ſands, ſhallows, promontories, harbours, the diſtance and bearing of one port from another, with every thing that is remarkable, whether out at ſea, or on the coaſt.

HYDROMANCY, a method of divination by water, practiſed by the ancients in this manner. They filled a cup or bowl of water: then faſtening a ring to a piece of thread tied to their finger, held it over the water, and repeated a certain form of words, deſiring to be ſatisfied with regard to their inquiry; and if the queſtion was anſwered in the affirmative, the ring would ſtrike the ſides of the bowl of its own accord.

Another kind of hydromancy was to look upon the water in which the figure of ſeveral dæmons uſed to appear. This expedient Numa is ſaid to have made uſe of, to ſettle the ceremonies of religion.

This way of divination is ſaid to have been uſed firſt by the Perſians, and afterwards approved by Pythagoras.

HYDROMEL, among phyſicians, water empregnated with honey, either before or after fermentation.

Vinous hydromel, commonly called mead, is ſaid to be good for the gravel. See the article MEAD.

HYDROMETER, an inſtrument to meaſure the gravity, denſity, velocity, force, *&c.* of water and other fluids. See HYDROSTATICS.

HYDROPHACE, in botany. See LEMNA.

HYDROMPHALUS, in medicine and ſurgery, a tumour in the navel, ariſing from a collection of water.

HYDROPHANÆ, in natural hiſtory, a genus of ſemi-pellucid gems, compoſed of cryſtal and earth; the latter ingredient being in large proportion, and mixed imperfectly,

imperfectly, as in the chalcedony; and giving a general cloudiness or mistiness to the stone, but of so imperfect and irregular an admixture, as not to be capable of so good a polish as the chalcedony; and appearing of a dusky and foul surface, till thrown into water, in which they become lucid, and in some degree transparent, either in part or totally; also changing their colour, which returns to them on being taken out of the water.

To this genus belong the oculus beli of authors, or whitish-grey hydrophanes, variegated with yellow, and with a black central nucleus; and the oculus mundi, or lapis mutabilis, which is likewise a whitish-grey kind without veins.

HYDROPHOBIA, an aversion or dread of water; a terrible symptom of the rabies canina. See MEDICINE.

HYDROPHYLLUM, in botany, a genus of the pentandria monogynia class. The corolla is bell-shaped; the stigma is bifid; and the capsule is roundish with two valves. There are two species, none of them natives of Britain.

HYDROPS, in medicine. See MEDICINE.

HYDROSCOPE, an instrument anciently used for the measuring of time.

The hydroscope was a kind of water-clock, consisting of a cylindrical tub, conical at bottom: the cylinder was graduated, or marked out with divisions, to which the top of the water becoming successively contiguous, as it trickled out at the vertex of the cone, pointed out the hour.

HYDROSTATICS.

THE science of HYDROSTATICS treats of the nature gravity, pressure, and motion of fluids in general; and of weighing solids in them.

A fluid is a body that yields to the least pressure or difference of pressures. Its particles are so exceedingly small, that they cannot be discerned by the best of microscopes; they are hard, since no fluid, except air or steam, can be pressed into a less space than it naturally possesses; and they are round and smooth, since they are so easily moved among one another.

All bodies, both fluid and solid, press downwards by the force of gravity: but fluids have this wonderful property, that their pressure upwards and sidewise is equal to their pressure downwards; and this is always in proportion to their perpendicular height, without any regard to their quantity: for, as each particle is quite free to move, it will move towards that part or side on which the pressure is least. And hence, no particle or quantity of a fluid can be at rest, till it is every way equally pressed.

(Plate XCIX. fig. 2.) To shew by experiment that fluids press upward as well as downward, let AB be a long upright tube filled with water near to its top; and CD a small tube open at both ends, and immersed into the water in the large one: if the immersion be quick, you will see the water rise in the small tube to the same height that it stands in the great one, or until the surfaces of the water in both are on the same level: which shews that the water is pressed upward into the small tube by the weight of what is in the great one; otherwise it could never rise therein. contrary to its natural gravity; unless the diameter of the bore were so small, that the attraction of the tube would raise the water; which will never happen, if the tube be as wide as that in a common barometer. And as the water rises no higher in the small tube than till its surface be on a level with the surface of the water in the great one, this shews that the pressure is not in proportion to the quantity of water in the great tube, but in proportion to its perpendicular height therein: for there is much more water in the great tube all around the small one, than what is raised to the same height in the small one, as it stands in the great.

Take out the small tube, and let the water run out of it; then it will be filled with air. Stop its upper end with the cork C, and it will be full of air all below the cork: this done, plunge it again to the bottom of the water in the great tube, and you will see the water rise up in it to the height E; which shews that the air is a body, otherwise it could not hinder the water from rising up to the same height as it did before, namely, to A; and in so doing. it drove the air out at the top; but now the air is confined by the cork C: and it also shews that the air is a compressible body; for if it were not so, a drop of water could not enter into the tube.

The pressure of fluids being equal in all directions, it follows, that the sides of a vessel are as much pressed by a fluid in it, all around in any given ring of points, as the fluid below that ring is pressed by the weight of all that stands above it. Hence the pressure upon every point in the sides, immediately above the bottom, is equal to the pressure upon every point of the bottom. To shew this by experiment, let a hole be made at E (fig. 3.) in the side of the tube AB close by the bottom; and another hole of the same size in the bottom, at C; then pour water into the tube, keeping it full as long as you chuse the holes should run, and have two two basons ready to receive the water that runs through the two holes, until you think there is enough in each bason; and you will find, by measuring the quantities, that they are equal; which shews that the water run with equal speed through both holes; which it could not have done, if it had not been equally pressed through them both: for if a hole of the same size be made in the side of the tube, as about *f*, and if all three are permitted to run together, you will find that the quantity run through the hole at *f* is much less than what has run in the same time through either of the holes C or *e*.

In

Plate XCIX.

Fig. 1.

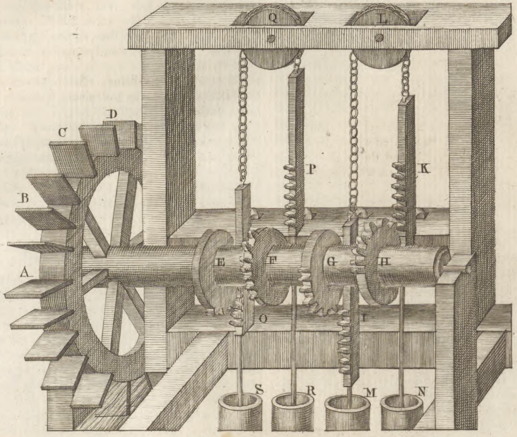


Fig. 2.

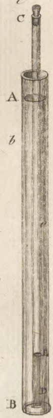


Fig. 3.

Fig. 4.

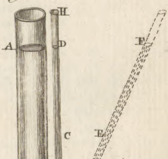


Fig. 5.

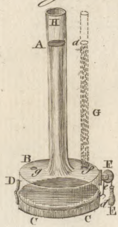


Fig. 6.

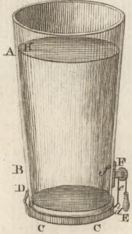


Fig. 8.

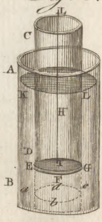


Fig. 9.

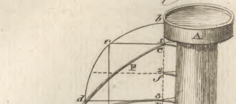


Fig. 7.

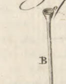


Fig. 11.

Fig. 10.

A. Bell Sculp.

In the ſame figure, let the tube be re-curved from the bottom at C into the ſhape DE, and the hole at C be ſtopt with a cork. Then pour water into the tube to any height, as *Ag*, and it will ſpout up in a jet EFG, nearly as high as it is kept in the tube AB, by continuing to pour in as much there as runs through the hole E; which will be the caſe whilſt the ſurface *Ag* keeps at the ſame height. And if a little ball of cork G be laid upon the top of the jet, it will be ſupported thereby, and dance upon it. The reaſon why the jet riſes not quite ſo high as the ſurface of the water *Ag*, is owing to the reſiſtance it meets with in the open air: for if a tube, either great or ſmall, was ſcrewed upon the pipe at E, the water would riſe in it until the ſurfaces of the water in both tubes were on the ſame level; as will be ſhewn by the next experiment.

The hydroſtatic paradox.

Any quantity of a fluid, how ſmall ſoever, may be made to balance and ſupport any quantity, how great ſoever. This is deſervedly termed *the hydroſtatical paradox*, which we ſhall firſt ſhew by an experiment, and then account for it upon the principle above-mentioned, namely, that *the preſſure of fluids is directly as their perpendicular height, without any regard to their quantity.*

Let a ſmall glaſs tube DCG, (fig. 4.) open at both ends, and bended at B, be joined to the end of a great one AI at *cd*, where the great one is alſo open; ſo that theſe tubes in their openings may freely communicate with each other. Then pour water through a ſmall-necked funnel into the ſmall tube at H; this water will run through the joining of the tubes at *cd*, and riſe up into the great tube: and if you continue pouring until the ſurface of the water comes to any part, as A, in the great tube, and then leave off, you will ſee that the ſurface of the water in the ſmall tube will be juſt as high at D; ſo that the perpendicular altitude of the water will be the ſame in both tubes, however ſmall the one be in proportion to the other. This ſhews, that the ſmall column DCG balances and ſupports the great column A*cd*; which it could not do if their preſſures were not equal againſt one another in the recurved bottom at B.—If the ſmall tube be made longer, and inclined in the ſituation GEF, the ſurface of the water in it will ſtand at F, on the ſame level with the ſurface A in the great tube; that is, the water will have the ſame perpendicular height in both tubes, although the column in the ſmall tube is longer than that in the great one; the former being oblique, and the latter perpendicular.

Since then the preſſure of fluids is directly as their perpendicular heights, without any regard to their quantities, it appears that whatever the figure or ſize of veſſels be, if they are of equal heights, and if the areas of their bottoms are equal, the preſſures of equal heights of water are equal upon the bottoms of theſe veſſels; even though the one ſhould hold a thouſand or ten thouſand times as much water as would fill the other. To confirm this part of the hydroſtatical paradox by an experiment, let two veſſels be prepared of equal heights, but very unequal contents, ſuch as AB in fig. 5. and AB in fig. 6. Let each veſſel be open at both ends, and their bottoms D*d* D*d* be of equal widths. Let a braſs bottom CC be exactly fitted to each veſſel, not to go into it, but for it to ſtand upon; and let a piece of wet leather be put between each veſſel and its braſs bottom, for the ſake of cloſeneſs. Join each bottom to its veſſel by a hinge D, ſo that it may open like the lid of a box; and let each bottom be kept up to its veſſel by equal weights E and E, hung to lines which go over the pulleys F and F (whoſe blocks are fixed to the ſides of the veſſels at *f*) and the lines tied to hooks at *d* and *d*, fixed in the braſs bottoms oppoſite to the hinges D and D. Things being thus prepared and fitted, hold the veſſel AB (fig. 5.) upright in your hands over a baſon on a table, and cauſe water to be poured into the veſſel ſlowly, till the preſſure of the water bears down its bottom at the ſide *d*, and raiſes the weight E; and then part of the water will run out at *d*. Mark the height at which the ſurface H of the water ſtood in the veſſel, when the bottom began to give way at *d*; and then, holding up the other veſſel AB (fig. 4.) in the ſame manner, cauſe water to be poured into it at H; and you will ſee that when the water riſes to A in this veſſel, juſt as high as it did in the former, its bottom will alſo give way at *d*, and it will loſe part of the water.

The natural reaſon of this ſurpriſing phenomenon is, that ſince all parts of a fluid at equal depths below the ſurface are equally preſſed in all manner of directions, the water immediately below the fixed part B*f* (fig. 4.) will be preſſed as much upward againſt its lower ſurface within the veſſel, by the action of the column A*g*, as it would be by a column of the ſame height, and of any diameter whatever; (as was evident by the experiment with the tube, fig. 3.) and therefore, ſince action and reaction are equal and contrary to each other, the water immediately below the ſurface B*f* will be preſſed as much downward by it, as if it was immediately touched and preſſed by a column of the height *g*A, and of the diameter B*f*: and therefore, the water in the cavity BD*df* will be preſſed as much downward upon its bottom CC, as the bottom of the other veſſel (fig. 5.) is preſſed by all the water above it.

To illuſtrate this a little farther, let a hole be made at *f* (fig. 5.) in the fixed top B*f*, and let a tube G be put into it; then, if water be poured into the tube A, it will (after filling the cavity B*d*) riſe up into the tube G, until it comes to a level with that in the tube A; which is manifeſtly owing to the preſſure of the water in the tube A, upon that in the cavity of the veſſel below it. Conſequently, that part of the top B*f*, in which the hole is now made, would, if corked up, be preſſed upward with a force equal to the weight of all the water which is ſupported in the tube G: and the ſame thing would hold at *g*, if a hole were made there. And ſo if the whole cover or top B*f* were full of holes, and had tubes as high as the middle one A*g* put into them, the water in each tube would riſe to the ſame height as it is kept into the tube A, by pouring more into it, to make up the deficiency that it ſuſtains by ſupplying the others, until they were all full: and then the water in the tube A would ſupport equal heights of water in all the reſt of the

the tubes, Or, if all the tubes except A, or any other one, were taken away, and a large tube equal in diameter to the whole top B*f* were placed upon it, and cemented to it; and then if water were poured into the tube that was left in either of the holes, it would aſcend through all the reſt of the holes, until it filled the large tube to the ſame height that it ſtands in the ſmall one, after a ſufficient quantity had been poured into it: which ſhews, that the top B*f* was preſſed upward by the water under it, and before any hole was made in it, with a force equal to that wherewith it is now preſſed downward by the weight of all the water above it in the great tube. And therefore, the reaction of the fixed top B*f* muſt be as great, in preſſing the water downward upon the bottom CC, as the whole preſſure of the water in the great tube would have been, if the top had been taken away, and the water in that tube left to preſs directly upon the water in the cavity BD*df*.

The hydroſtatic bellows.

Perhaps the beſt machine in the world for demonſtrating the upward preſſure of fluids, is the hydroſtatic bellows A (fig. 7.) which conſiſts of two thick oval boards, each about 16 inches broad, and 18 inches long, covered with leather, to open and ſhut like a common bellows, but without valves; only a pipe B, about three feet high, is fixed into the bellows at *e*. Let ſome water be poured into the pipe at *c*, which will run into the bellows, and ſeparate the boards a little. Then lay three weights *b*, *c*, *d*, each weighing 100 pounds, upon the upper board; and pour more water into the pipe B, which will run into the bellows, and raiſe up the board with all the weights upon it; and if the pipe be kept full, until the weights are raiſed as high as the leather which covers the bellows will allow them, the water will remain in the pipe, and ſupport all the weights, even though it ſhould weigh no more than a quarter of a pound, and they 300 pounds: nor will all their force be able to cauſe them to deſcend and force the water out at the top of the pipe.

The reaſon of this will be made evident, by conſidering what has been already ſaid of the reſult of the preſſure of fluids of equal heights without any regard to their quantity. For, if a hole be made in the upper board, and a tube be put into it, the water will riſe in the tube to the ſame height that it does in the pipe; and would riſe as high (by ſupplying the pipe) in as many tubes as the board could contain holes. Now, ſuppoſe only one hole to be made in any part of the board, of an equal diameter with the bore of the pipe B; and that the pipe holds juſt a quarter of a pound of water; if a perſon claps his finger upon the hole, and the pipe be filled with water, he will find his finger to be preſſed upward with a force equal to a quarter of a pound. And as the ſame preſſure is equal upon all equal parts of the board, each part, whoſe area is equal to the area of the whole, will be preſſed upward with a force equal to that of a quarter of a pound: the ſum of all which preſſures againſt the under ſide of an oval board 16 inches broad, and 18 inches long, will amount to 300 pounds; and therefore ſo much weight will be raiſed up and ſupported by a quarter of a pound of water in the pipe.

Hence, if a man ſtands upon the upper board, and blows into the bellows through the pipe B, he will raiſe himſelf upward upon the board: and the ſmaller the bore of the pipe is, the eaſier he will be able to raiſe himſelf. And then, by clapping his finger upon the top of the pipe, he can ſupport himſelf as long as he pleaſes; provided the bellows be air-tight, ſo as not to loſe what is blown into it.

Upon this principle of the upward preſſure of fluids, a piece of lead may be made to ſwim in water, by immerſing it to a proper depth, and keeping the water from getting above it. Let CD (fig. 8.) be a glaſs tube, open at both ends, and EFG a flat piece of lead, exactly fitted to the lower end of the tube, not to go within it, but for it to ſtand upon; with a wet leather between the lead and tube to make cloſe work. Let this leaden bottom be half an inch thick, and held cloſe to the tube by pulling the packthread IHL upward at L with one hand, whilſt the tube is held in the other by the upper end C. In this ſituation, let the tube be immerſed in water in the glaſs veſſel AB, to the depth of ſix inches below the ſurface of the water at K; and then, the leaden bottom EFG will be plunged to the depth of ſomewhat more than eleven times its own thickneſs: holding the tube at that depth, you may let go the thread at L; and the lead will not fall from the tube, but will be kept to it by the upward preſſure of the water below it, occaſioned by the height of the water at K above the level of the lead. For as lead is 11.33 times as heavy as its bulk of water, and is in this experiment immerſed to a depth ſomewhat more than 11.33 times its thickneſs, and no water getting into the tube between it and the lead, the column of water E*abc*G below the lead is preſſed upward againſt it by the water KDEGL all around the tube; which water being a little more than 11.33 times as high as the lead is thick, is ſufficient to balance and ſupport the lead at the depth KE. If a little water be poured into the tube upon the lead, it will increaſe the weight upon the column of water under the lead, and cauſe the lead to fall from the tube to the bottom of the glaſs veſſel, where it will lie in the ſituation *bd*. Or, if the tube be raiſed a little in the water, the lead will fall by its own weight, which will then be too great for the preſſure of the water around the tube upon the column of water below it.

Let two pieces of wood be plained quite flat, ſo as no water may get in between them when they are put together: let one of the pieces, as *bd*, be cemented to the bottom of the veſſel AB (fig. 8.) and the other piece be laid flat and cloſe upon it, and held down to it by a ſtick, whilſt water is poured into the veſſel; then remove the ſtick, and the upper piece of wood will not riſe from the lower one: for, as the upper one is preſſed down both by its own weight and the weight of all the water over it, whilſt the contrary preſſure of the water is kept off by the wood under it, it will lie as ſtill as a ſtone would do in its place. But if it be raiſed ever ſo little at any edge, ſome water will then get under it; which being acted upon by the water above, will immediately preſs it upward; and as it is lighter than its bulk of water, it will riſe, and float upon the ſurface of the water.

All fluids weigh juſt as much in their own element as they

they do in open air. To prove this by experiment, let as much ſhot be put into a phial, as, when corked, will make it ſink in water: and being thus charged, let it be weighed, firſt in air, and then in water, and the weights in both both caſes wrote down. Then, as the phial hangs ſuſpended in water, and counterpoiſed, pull out the cork, that water may run into it, and it will deſcend, and pull down that end of the beam. This done, put as much weight into the oppoſite ſcale as will reſtore the equipoiſe; which weight will be found to anſwer exactly to the additional weight of the phial when it is again weighed in air, with the water in it.

The velocity with which water ſpouts out at a hole in the ſide or bottom of a veſſel, is as the ſquare root of the depth or diſtance of the hole below the ſurface of the water. For, in order to make double the quantity of a fluid run through one hole as through another of the ſame ſize, it will require four times the preſſure of the other, and therefore muſt be four times the depth of the other below the ſurface of the water: and for the ſame reaſon, three times the quantity running in an equal time through the ſame ſort of hole, muſt run with three times the velocity, which will require nine times the preſſure; and conſequently muſt be nine times as deep below the ſurface of the fluid: and ſo on.—To prove this by an experiment, let two pipes, as C and *g* (fig. 9.) of equal ſized bores, be fixed into the ſide of the veſſel AB; the pipe *g* being four times as deep below the ſurface of the water at *b* in the veſſel as the pipe C is: and whilſt theſe pipes run, let water be conſtantly poured into the veſſel, to keep the ſurface ſtill at the ſame height. Then, if a cup that holds a pint be ſo placed as to receive the water that ſpouts from the pipe C, and at the ſame moment a cup that holds a quart be ſo placed as to receive the water that ſpouts from the pipe *g*, both cups will be filled at the ſame time by their reſpective pipes.

The horizontal diſtance, to which a fluid will ſpout from a horizontal pipe, in any part of the ſide of an upright veſſel below the ſurface of the fluid, is equal to twice the length of a perpendicular to the ſide of the veſſel, drawn from the mouth of the pipe to a ſemicircle deſcribed upon the altitude of the fluid: and therefore, the fluid will ſpout to the greateſt diſtance poſſible from a pipe whoſe mouth is at the centre of the ſemicircle; becauſe a perpendicular to its diameter (ſuppoſed parallel to the ſide of the veſſel) drawn from that point, is the longeſt that can poſſibly be drawn from any part of the diameter to the circumference of the ſemicircle. Thus, if the veſſel AB (fig. 9.) be full of water, the horizontal pipe D be in the middle of its ſide, and the ſemicircle N*edcb* be deſcribed upon D as a centre, with the radius or ſemidiameter D*g*N, or D*fb*, the perpendicular D*d* to the diameter N*Db* is the longeſt that can be drawn from any part of the diameter to the circumference N*edcb*. And if the veſſel be kept full, the jet G will ſpout from the pipe D, to the horizontal diſtance NM, which is double the length of the perdendicular D*d*. If two other pipes as C and E, be fixed into the ſide of the veſſel at equal diſtances above and below the pipe D, the perpendiculars C*c* and E*e*, from theſe pipe to the ſemicircle, will be equal; and the jets F and H ſpouting from them will each go to the horizontal diſtance NK; which is double the length of the equal perpendiculars C*c* or D*d*.

Fluids by their preſſure may be conveyed over hills and valleys in bended pipes, to any height not greater than the level of the ſprings from whence they flow. But when they are deſigned to be raiſed higher than the ſprings, forcing engines muſt be uſed; which ſhall be deſcribed when we come to treat of pumps.

A *ſyphon*, generally uſed for decanting liquors, is a bended pipe, whoſe legs are of unequal lengths; and the ſhorteſt leg muſt always be put into the liquor intended to be decanted, that the perpendicular altitude of the column of liquor in the other leg may be longer than the column in the immerſed leg, eſpecially above the ſurface of the water. For, if both columns were equally high in that reſpect, the atmoſphere, which preſſes as much upward as downward, and therefore acts as much upward againſt the column in the leg that hangs without the veſſel, as it acts downward upon the ſurface of the liquor in the veſſel, would hinder the running of the liquor through the ſyphon, even though it were brought over the bended part by ſuction. So that there is nothing left to cauſe the motion of the liquor, but the ſuperior weight of the column in the longer leg, on account of its having the greater perpendicular height.

Let D (fig. 10.) be a cup filled with water to C, and ABC a ſyphon, whoſe ſhorter leg BCF is immerſed in the water from C to F. If the end of the other leg were no lower than the line AC, which is level with the ſurface of the water, the ſyphon would not run, even though the air ſhould be drawn out of it at the mouth A. For although the ſuction would draw ſome water at firſt, yet the water would ſtop at the moment the ſuction ceaſed; becauſe the air would act as much upward againſt the water at A, as it acted downward for it by preſſing on the ſurface at C. But if the leg AB comes down to G, and the air be drawn out at G by ſuction, the water will immediately follow, and continue to run, until the ſurface of the water in the cup comes down to F; becauſe, till then, the perpendicular height of the column BAG will be greater than that of the column CB; and conſequently, its weight will be greater, until the ſurface comes down to F; and then the ſyphon will ſtop, though the leg CF ſhould reach to the bottom of the cup. For which reaſon, the leg that hangs without the cup is always made long enough to reach below the level of its bottom; as from *d* to E: and then, when the ſyphon is emptied of air by ſuction at E, the water immediately follows, and by its continuity brings away the whole from the cup; juſt as pulling one end of a thread will make the whole clue follow.

If the perpendicular height of a ſyphon, from the ſurface of the water to its bended top at B, be more than 33 feet, it will draw no water, even though the other leg were much longer, and the ſyphon quite emptied of air, becauſe the weight of a column of water 33 feet high is equal to the weight of as thick a column of air, reaching from the ſurface of the earth to the top of the atmoſphere; ſo that there will then be an equilibrium; and conſequently, though there would be weight enough of air upon the ſurface C to make the water aſcend in the leg

leg CB almoft to the height B, if the fyphon were emptied of air, yet the weight would not be fufficient to force the water over the bend; and therefore, it could never be brought into the leg BAC.

Tantalus's cup.

LET a hole be made quite through the bottom of the cup A (fig. 11.) and the longer leg of the bended fyphon BCED be cemented into the hole, fo that the end D of the fhorter leg DE may almoft touch the bottom of the cup within. Then, if water be poured into this cup, it will rife in the fhorter leg by its upward preffure, extruding the air all the way before it through the longer leg: and when the cup is filled above the bend of the fyphon at F, the preffure of the water in the cup will force it over the bend of the fyphon: and it will defcend in the longer leg CBG, and run through the bottom, until the cup be emptied.

This is generally called *Tantalus's cup*, and the legs of the fyphon in it are almoft clofe together; and a little hollow ftatue, or figure of a man, is fometimes put over the fyphon to conceal it; the bend E being with the neck of the figure as high as the chin. So that poor thirfty *Tantalus* ftands up to the chin in water, imagining it will rife a little higher, and he may drink; but inftead of that, when the water comes up to his chin, it immediately begins to defcend; and fo, as he cannot ftoop to follow it, he is left as much pained with thirft as ever.

The fountain at command.

THE device called *the fountain at command* acts upon the fame principle with the fyphon in the cup. Let two veffels A and B (Plate C. fig. 1.) be joined together by the pipe C which opens into them both. Let A be open at top, B clofe both at top and bottom (fave only a fmall hole at *b* to let the air get out of the veffel B) and A be of fuch a fize as to hold about fix times as much water as B. Let a fyphon DEF be foldered to the veffel B, fo that the part DE*e* may be within the veffel, and F without it; the end D almoft touching the bottom of the veffel, and the end F below the level of D: the veffel B hanging at A by the pipe C (foldered into both) and the whole fupported by the pillars G and H upon the ftand I. The bore of the pipe muft be confiderably lefs than the bore of the fyphon.

The whole being thus conftructed, let the veffel A be filled with water, which will run through the pipe C, and fill the veffel B. When B is filled above the top of the fyphon at E, the water will run through the fyphon, and be difcharged at F. But fince the bore of the fyphon is larger than the bore of the pipe, the fyphon will run fafter than the pipe, and will foon empty the veffel B; upon which the water will ceafe from running through the fyphon at F, until the pipe C re-fills the veffel B, and then it will begin to run as before. And thus the fyphon will continue to run and ftop alternately, until all the water in the veffel A has run through the pipe C.—So that after a few trials, one may eafily guefs about what time the fyphon will ftop, and when it will begin to run: and then to amufe others, he may call out *ftop*, or *run*, accordingly.

Upon this principle, we may eafily account for *intermitting* or *reciprocating fprings*. Let AA (fig. 2.) be part of a hill, within which there is a cavity BB; and from this cavity a vein or channel running in the direction BCDE. The rain that falls upon the fide of the hill will fink and ftrain through the fmall pores and crannies G, G, G, G; and fill the cavity H with water. When the water rifes to the level HHC, the vein BCDE will be filled to C, and the water will run through CDF as through a fyphon; which running will continue until the cavity be emptied, and then it will ftop until the cavity be filled again.

The common pump.

THE *common fucking pump*, with which we draw water out of wells, is an engine both pneumatic and hydraulic. It confifts of a pipe open at both ends, in which is a moveable pifton, bucket, or fucker, as big as the bore of the pipe in that part wherein it works; and is leathered round, fo as to fit the bore exactly; and may be moved up and down, without fuffering any air to come between it and the pipe or pump-barrel.

We fhall explain the conftruction both of this and the forcing pump by pictures of glafs models, in which both the action of the piftons and motion of the valves are feen.

Hold the model DCBL (fig. 3.) upright in the veffel of water K, the water being deep enough to rife at leaft as high as from A to L. The valve *a* on the moveable bucket G, and the valve *b* on the fixed box H, (which box quite fills the bore of the pipe or barrel at H) will each lie clofe, by its own weight, upon the hole in the bucket and box, until the engine begins to work. The valves are made of brafs, and covered underneath with leather for clofing the holes the more exactly: and the bucket G is raifed and depreffed alternately by the handle E and rod D *d*, the bucket being fuppofed at B before the working begins.

Take hold of the handle E, and thereby draw up the bucket from B to C, which will make room for the air in the pump all the way below the bucket to dilate itfelf, by which its fpring is weakened, and then its force is not equivalent to the weight or preffure of the outward air upon the water in the veffel K: and therefore, at the firft ftroke, the outward air will prefs up the water through the notched foot A, into the lower pipe, about as far as *e*: this will condenfe the rarefied air in the pipe between *e* and C to the fame ftate it was in before; and then, as its fpring within the pipe is equal to the force or preffure of the outward air, the water will rife no higher by the firft ftroke; and the valve *b*, which was raifed a little by the dilation of the air in the pipe, will fall, and ftop the hole in the box H; and the furface of the water will ftand at *e*. Then, deprefs the pifton or bucket from C to B, and as the air in the part B cannot get back again through the valve *b*, it will (as the bucket defcends) raife the valve *a*, and fo make its way through the upper part of the barrel *d* into the open air. But upon raifing the bucket

bucket G a ſecond time, the air between it and the water in the lower pipe at *e* will be again left at liberty to fill a larger ſpace; and ſo its ſpring being again weakened, the preſſure of the outward air on the water in the veſſel K will force more water up into the lower pipe from *e* to *f*; and when the bucket is at its greateſt height C, the lower valve *b* will fall, and ſtop the hole in the box H as before. At the next ſtroke of the bucket or piſton, the water will riſe through the box H towards B, and then the valve *b*, which was raiſed by it, will fall when the bucket G is at its greateſt height. Upon depreſſing the bucket again, the water cannot be puſhed back through the valve *b*, which keeps cloſe upon the hole whilſt the piſton deſcends. And upon raiſing the piſton again, the outward preſſure of the air will force the water up thro' H, where it will raiſe the valve, and follow the bucket to C. Upon the next depreſſion of the bucket G, it will go down into the water in the barrel B; and as the water cannot be driven back through the now cloſe valve *b*, it will raiſe the valve *a* as the bucket deſcends, and will be lifted up by the bucket when it is next raiſed. And now, the whole ſpace below the bucket being full, the water above it cannot ſink when it is next depreſſed; but upon its depreſſion, the valve *a* will riſe to let the bucket go down; and when it is quite down, the valve *a* will fall by its weight, and ſtop the hole in the bucket. When the bucket is next raiſed, all the water above it will be lifted up, and begin to run off by the pipe F. And thus, by raiſing and depreſſing the bucket alternately, there is ſtill more water raiſed by it; which getting above the pipe F, into the wide top I, will ſupply the pipe, and make it run with a continued ſtream.

So, at every time the bucket is raiſed, the valve *b* riſes, and the valve *a* falls; and at every time the bucket is depreſſed, the valve *b* falls, and *a* riſes.

As it is the preſſure of the air or atmoſphere which cauſes the water to riſe and follow the piſton or bucket G as it is drawn up; and ſince a column of water 33 feet high is of equal weight with as thick a column of the atmoſphere from the earth to the very top of the air; therefore, the perpendicular height of the piſton or bucket from the ſurface of the water in the well muſt always be leſs than 33 feet; otherwiſe the water will never get above the bucket. But, when the height is leſs, the preſſure of the atmoſphere will be greater than the weight of the water in the pump, and will therefore raiſe it above the bucket; and when the water has once got above the bucket, it may be lifted thereby to any height, if the rod D be made long enough, and a ſufficient degree of ſtrength be employed, to raiſe it with the weight of the water above the bucket; without ever lengthening the ſtroke.

The force required to work a pump, will be as the height to which the water is raiſed, and as the ſquare of the diameter of the pump-bore, in that part where the piſton works. So that, if two pumps be of equal heights, and one of them be twice as wide in the bore as the other, the wideſt will raiſe four times as much water as the narroweſt; and will therefore require four times as much ſtrength to work it.

The wideneſs or narrowneſs of the pump, in any other part beſides that in which the piſton works, does not make the pump either more or leſs difficult to work; except what difference may ariſe from the friction of the bore, which is always greater in a narrow bore than in a wide one, becauſe of the greater velocity of the water.

The pump-rod is never raiſed directly by ſuch a handle as E at the top, but by means of a lever, whoſe longer arm (at the end of which the power is applied) generally exceeds the length of the ſhorter arm five or ſix times; and, by that means, gives five or ſix times as much advantage to the power. Upon theſe principles, it will be eaſy to find the dimenſions of a pump that ſhall work with a given force, and draw water from any given depth. But, as theſe calculations have been generally neglected by pump-makers (either for want of ſkill or induſtry) the following table was calculated by the late ingenious Mr Booth for their benefit. In this calculation, he ſuppoſed the handle of the pump to be a lever increaſing the power five times; and had often found that a man can work a pump four inches diameter, and 30 feet high above the bucket, and diſcharge $27\frac{1}{2}$ gallons of water (Engliſh wine meaſure) in a minute. Now, if it be required to find the diameter of a pump, that ſhall raiſe water with the ſame eaſe from any other height above the bucket; look for that height in the firſt column, and over againſt it in the ſecond you have the diameter or width of the pump; and in the third, you find the quantity of water which a man of ordinary ſtrength can diſcharge in a minute.

Height of the pump above the bucket.	Diameter of the bore where the bucket works.		Water diſcharged in a minute, Engliſh wine-meaſure.	
Feet.	Inches.	100 parts.	Gallons.	Pints.
10	6	.93	81	6
15	5	.65	54	4
20	4	.90	40	8
25	4	.38	32	6
30	4	.00	27	2
35	3	.70	23	3
40	3	.47	20	4
45	3	.26	18	1
50	3	.10	16	3
55	2	.95	14	7
60	2	.83	13	5
65	2	.71	12	4
70	2	.62	11	5
75	2	.53	10	7
80	2	.44	10	2

The forcing-pump.

The *forcing-pump* raiſes water through the box H (fig. 4) in the ſame manner as the ſucking-pump does, when the plunger or piſton *g* is lifted up by the rod D*d*. But this plunger has no hole through it, to let the water in the

barrel BC get above it when it is depreſſed to B, and the valve b (which roſe by the aſcent of the water through the box H when the plunger g was drawn up) falls down and ſtops the hole in H, the moment that the plunger is raiſed to its greateſt height. Therefore, as the water between the plunger g and box H can neither get through the plunger upon its deſcent, nor back again into the lower part of the pump Le, but has a free paſſage by the cavity around H into the pipe MM, which opens into the air-veſſel KK at P; the water is forced through the pipe MM by the deſcent of the plunger, and driven into the air-veſſel; and in running up through the pipe at P, it opens the valve a; which ſhuts at the moment the plunger begins to be raiſed, becauſe the action of the water againſt the under ſide of the valve then ceaſes.

The water, being thus forced into the air-veſſel KK by repeated ſtrokes of the plunger, gets above the lower end of the pipe GHI, and then begins to condenſe the air in the veſſel KK. For, as the pipe GH is fixed air-tight into the veſſel below F, and the air has no way to get out of the veſſel but through the mouth of the pipe at I, and cannot get out when the mouth I is covered with water, and is more and more condenſed as the water riſes upon the pipe, the air then begins to act forcibly by its ſpring againſt the ſurface of the water, at H: and this action drives the water up through the pipe IH GF, from whence it ſpouts in a jet S to a great height; and is ſupplied by alternately raiſing and depreſſing of the plunger g, which conſtantly forces the water that it raiſes through the valve H, along the pipe MM, into the air-veſſel KK.

The higher that the ſurface of the water H is raiſed in the air-veſſel, the leſs ſpace will the air be condenſed into, which before filled that veſſel; and therefore the force of its ſpring will be ſo much the ſtronger upon the water, and will drive it with the greater force through the pipe at F: and as the ſpring of the air continues whilſt the plunger g is riſing, the ſtream or jet S will be uniform, as long as the action of the plunger continues: and when the valve b opens, to let the water follow the plunger upward, the valve a ſhuts, to hinder the water, which is forced into the air-veſſel, from running back by the pipe MM into the barrel of the pump.

If there was no air-veſſel to this engine, the pipe GHI would be joined to the pipe MMN at P; and then the jet S would ſtop every time the plunger is raiſed, and run only when the plunger is depreſſed.

Mr Newſham's water-engine, for extinguiſhing fire, conſiſts of two forcing-pumps, which alternately drive water into a cloſe veſſel of air; and by forcing the water into that veſſel, the air in it is thereby condenſed, and compreſſes the water ſo ſtrongly, that it ruſhes out with great impetuoſity and force through a pipe that comes down into it; and makes a continued uniform ſtream by the condenſation of the air upon its ſurface in the veſſel.

By means of forcing pumps, water may be raiſed to any height above the level of a river or ſpring; and machines may be contrived to work theſe pumps, either by a running ſtream, a fall of water, or by horſes. An inſtance in each ſort will be ſufficient to ſhew the method.

Firſt, by a running ſtream, or a fall of water. Let AA (fig. 5.) be a wheel turned by the fall of water BB; and have any number of cranks (ſuppoſe ſix) as C, D, E, F, G, H, on its axis, according to the ſtrength of the fall of water, and the height to which the water is intended to be raiſed by the engine. As the wheel turns round, theſe cranks move the levers c, d, e, f, g, h, up and down, by the iron rods i, k, l, m, n, o; which alternately raiſe and depreſs the piſtons by the other iron rods p, q, r, s, t, u, w, x, y, in twelve pumps; nine whereof, as L, M, N, O, P, Q, R, S, T, appear in the plate; the other three being hid behind the work at V. And as pipes may go from all theſe pumps, to convey the water (drawn up by them to a ſmall height) into a cloſe ciſtern, from which the main-pipe proceeds, the water will be forced into this ciſtern by the deſcent of the piſtons. And as each pipe, going from its reſpective pump into the ciſtern, has a valve at its end in the ciſtern, theſe valves will hinder the return of the water by the pipes; and therefore, when the ciſtern is once full, each piſton upon its deſcent will force the water (conveyed into the ciſtern by a former ſtroke) up the main pipe, to the height the engine was intended to raiſe it: which height depends upon the quantity raiſed, and the power that turns the wheel. When the power upon the wheel is leſſened by any defect of the quantity of water turning it, a proportionable number of the pumps may be laid aſide, by diſengaging their rods from the vibrating levers.

This figure is a repreſentation of the engine erected at Blenheim for the Duke of Marlborough, by the late ingenious Mr Alderſea. The water-wheel is $7\frac{1}{2}$ feet in diameter, according to Mr Switzer's account in his Hydraulics.

When ſuch a machine is placed in a ſtream that runs upon a ſmall declivity, the motion of the levers and action of the pumps will be but ſlow; ſince the wheel muſt go once round for each ſtroke of the pumps. But, when there is a large body of ſlow running water, a cog or ſpur-wheel may be placed upon each ſide of the water-wheel AA, upon its axis, to turn a trundle upon each ſide; the cranks being upon the axis of the trundle. And by proportioning the cog-wheels to the trundles, the motion of the pumps may be made quicker, according to the quantity and ſtrength of the water upon the firſt wheel; which may be as great as the workman pleaſes, according to the length and breadth of the float-boards or wings of the wheel. In this manner, the engine for raiſing water at London-Bridge is conſtructed; in which the water-wheel is 20 feet diameter, and the flots 14 feet long.

A quadruple pump-mill for raiſing water.

THE engine is repreſented in Plate 99. fig. 1. In which ABCD is a wheel, turned by water according to the order of the letters. On the horizontal axis are four ſmall wheels, toothed almoſt half round; and the parts of their edges on which there are no teeth are cut down ſo as to be even with the bottoms of the teeth where they ſtand.

The teeth of theſe four wheels take alternately into the

the teeth of four racks, which hang by two chains over the pullies Q and L; and to the lower ends of these racks there are four iron rods fixed, which go down into the four forcing pumps, S, R, M, and N. And, as the wheels turn, the racks and pump-rods are alternately moved up and down.

Thus, suppose the wheel G has pulled down the rack I, and drawn up the rack K by the chain: as the last tooth of G just leaves the uppermost tooth of I, the first tooth of H is ready to take into the lowermost tooth of the rack K, and pull it down as far as the teeth go; and then the rack I is pulled upward through the whole space of its teeth, and the wheel G is ready to take hold of it, and pull it down again, and so draw up the other.—— In the same manner, the wheels E and F work the racks O and P.

These four wheels are fixed on the axle of the great wheel in such a manner, with respect to the positions of their teeth, that whilst they continue turning round, there is never one instant of time in which one or other of the pump rods is not going down and forcing the water. So that, in this engine, there is no occasion for having a general air-vessel to all the pumps, to procure a constant stream of water flowing from the upper end of the main pipe.

From each of these pumps, near the lowest end, in the water, there goes off a pipe, with a valve on its farthest end from the pump; and these ends of the pipes all enter one close box, into which they deliver the water: and into this box, the lower end of the main conduct pipe is fixed. So that, as the water is forced or pushed into the box, it is also pushed up the main pipe to the height that it is intended to be raised,

A pump-engine to go by horses.

WHERE a stream or fall of water cannot be had, and gentlemen want to have water raised, and brought to their houses from a rivulet or spring; this may be effected by a horse-engine, working three forcing-pumps which stand in a reservoir filled by the spring or rivulet: the pistons being moved up and down in the pumps by means of a triple crank ABC, which, as it is turned round by the trundle G (Plate 100. fig. 6.) raises and depresses the rods D, E, F. if the wheel has three times as many cogs as the trundle has staves or rounds, the trundle and cranks will make three revolutions for every one of the wheel: and as each crank will fetch a stroke in the time it goes round, the three cranks will make nine strokes for every turn of the great wheel.

The cranks should be made of cast iron, because that will not bend; and they should each make an angle of 120 with both of the others, as at *a*, *b*, *c*; which is (as it were) a view of their radii, in looking endwise at the axis: and then there will be always one or other of them going downward, which will push the water forward with a continued stream into the main pipe. For, when *b* is almost at its lowest situation, and is therefore just beginning to lose its action upon the piston which it moves, *c* is beginning to move downward, which will by its piston continue the propelling force upon the water: and when *c* is come down to the position of *b*, *a* will be in the position of *c*.

The more perpendicularly the piston rods move up and down in the pumps, the freer and better will their strokes be: but a little deviation from the perpendicular will not be material. Therefore, when the pump-rods D, E, and F go down into a deep well, they may be moved directly by the cranks, as is done in a very good horse-engine of this sort at the late Sir James Creed's at Greenwich, which forces up water about 64 feet from a well under ground, to a reservior on the top of his house. But when the cranks are only at a small height above the pumps, the pistons must be moved by vibrating levers, as in the above engine at Blenheim: and the longer the levers are, the nearer will the strokes be to a perpendicular.

Let us suppose, that in such an engine as Sir James Creed's, the great wheel is twelve feet diameter, the trundle four feet, and the radius or length of each crank nine inches, working a piston in its pump. Let there be three pumps in all, and the bore of each pump be four inches diameter. Then, if the great wheel has three times as many cogs as the trundle has staves, the trundle and cranks will go three times round for each revolution of the horses and wheel, and the three cranks will make nine strokes of the pumps in that time, each stroke being 18 inches (or double the length of the crank) in a four-inch bore. Let the diameter of the horse-walk be 18 feet, and the perpendicular height to which the water is raised above the surface of the well be 64 feet.

If the horses go at the rate of two miles an hour (which is very moderate walking) they will turn the great wheel 187 times round in an hour.

In each turn of the wheel the pistons make nine strokes in the pumps, which amount to 1683 in an hour.

Each stroke raises a column of water 18 inches long, and four inches thick, in the pump barrels; which column, upon the descent of the piston, is forced into the main pipe, whose perpendicular altitude above the surface of the well is 64 feet.

Now, since a column of water 18 inches long, and four inches thick, contains 226.18 cubic inches, this number multiplied by 1683 (the strokes in an hour) gives 380661 for the number of cubic inches of water raised in an hour.

A gallon, in wine-measure, contains 231 cubic inches, by which divide 380661, and it quotes 1468 in round numbers, for the number of gallons raised in an hour; which, divided by 63, gives $26\frac{1}{7}$ hogsheads ——If the horses go faster, the quantity raised will be so much the greater.

In this calculation it is supposed that no water is wasted by the engine. But as no forcing engine can be supposed to lose less than a fifth part of the calculated quantity of water, between the pistons and barrels, and by the opening and shutting of the valves, the horses ought to walk almost $2\frac{1}{2}$ miles *per* hour to fetch up this loss.

A column of water four inches thick, and 64 feet high, weighs $349\frac{9}{10}$ pounds averdupoise, or $424\frac{5}{11}$ pounds troy; and this weight, together with the friction of the engine, is the resistance that must be overcome by the strength of the horses.

The

The horſe tackle ſhould be ſo contrived, that the horſes may rather puſh on than drag the levers after them. For if they draw, in going round the walk, the outſide leather-ſtraps will rub againſt their ſides and hams; which will hinder them from drawing at right angles to the levers, and ſo make them pull at a diſadvantage. But if they puſh the levers before their breaſts, inſtead of dragging them, they can always walk at right angles to theſe levers.

It is no ways material what the diameter of the main or conduct pipe be: for the whole reſiſtance of the water therein, againſt the horſes, will be according to the height to which it is raiſed, and the diameter of that part of the pump in which the piſton works; as we have already obſerved. So that by the ſame pump, an equal quantity of water may be raiſed in (and conſequently made to run from) a pipe of a foot diameter, with the ſame eaſe as in a pipe of five or ſix inches; or rather with more eaſe, becauſe its velocity in a large pipe will be leſs than in a ſmall one, and therefore its friction againſt the ſides of the pipe will be leſs alſo.

And the force required to raiſe water depends not upon the length of the pipe, but upon the perpendicular height to which it is raiſed therein above the level of the ſpring. So that the ſame force, which would raiſe water to the height AB (fig. 7.) in the upright pipe *AiklmnopqB*, will raiſe it to the ſame height or level BIH in the oblique pipe AEFGH. For the preſſure of the water at the end A of the latter, is no more than its preſſure againſt the end A of the former.

The weight or preſſure of water at the lower end of a pipe, is always as the ſine of the angle to which the pipe is elevated above the level parallel to the horizon. For, although the water in the upright pipe AB would require a force applied immediately to the lower end A, equal to the weight of all the water in it, to ſupport the water, and a little more to drive it up and out of the pipe; yet if that pipe be inclined from its upright poſition to an angle of 80 degrees (as in A 80), the force required to ſupport or to raiſe the ſame cylinder of water will then be as much leſs as the ſine 80 *h* is leſs than the radius AB; or as the ſine of 80 degrees is leſs than the ſine of 90. And ſo, decreaſing as the ſign of the angle of elevation leſſens, until it arrives at its level AC or place of reſt, where the force of the water is nothing at either end of the pipe. For, although the abſolute weight of the water is the ſame in all poſitions, yet its preſſure at the lower end decreaſes, as the ſine of the angle of elevation decreaſes; as will appear plainly by a farther conſideration of the figure.

Let two pipes, AB and BC, of equal lengths and bores, join each other at A; and let the pipe AB be divided into 100 equal parts, as the ſcale S is; whoſe length is equal to the length of the pipe.—Upon this length, as a radius, deſcribe the quadrant BCD, and divide it into 90 equal parts or degrees.

Let the pipe AC be elevated to 10 degrees upon the quadrant, and then filled with water; then, part of the water that is in it will riſe in the pipe AB, and if it be kept full of water, it will raiſe the water in the pipe AB from A to *i*; that is, to a level *i* 10 with the mouth of the pipe at 10: and the upright line *a* 10, equal to A*i*, will be the ſine of 10 degrees elevation; which being meaſured upon the ſcale S, will be about 17.4 of ſuch parts as the pipe contains 100 in length: and therefore, the force or preſſure of the water at A, in the pipe A 10, will be to the force or preſſure at A in the pipe AB as 17.3 to 100.

Let the ſame pipe be elevated to 20 degrees in the quadrant, and if it be kept full of water, part of that water will run into the pipe AB, and riſe therein to the height A*k*, which is equal to the length of the upright line *b* 20, or to the ſine of 20 degrees elevation; which, being meaſured upon the ſcale S, will be 34.2 of ſuch parts as the pipe contains 100 in length; and therefore the preſſure of the water at A, in the full pipe A 20, will be to its preſſure, if that pipe were raiſed to the perpendicular ſituation AB, as 34.2 to 100.

Sine of	Parts	Sine of	Parts	Sine of	Parts	Sine of	Parts	Sine of	Parts
D. 1	17	D. 19	325	D. 37	602	D. 55	819	D. 73	956
2	35	20	342	38	616	56	829	74	961
3	52	21	358	39	629	57	839	75	966
4	70	22	375	40	643	58	848	76	970
5	87	23	391	41	656	59	857	77	974
6	104	24	407	42	669	60	866	78	978
7	122	25	423	43	682	61	875	79	982
8	139	26	438	44	695	62	883	80	985
9	156	27	454	45	707	63	891	81	988
10	174	28	469	46	719	64	899	82	990
11	191	29	485	47	731	65	906	83	992
12	208	30	500	48	743	66	913	84	994
13	225	31	515	49	755	67	920	85	996
14	242	32	530	50	766	68	927	86	997
15	259	33	545	51	777	69	934	87	998
16	276	34	559	52	788	70	940	88	999
17	292	35	573	53	799	71	945	89	1000
18	309	36	588	54	809	72	951	90	1000

Elevate the pipe to the pofition A 30 on the quadrant; and if it be fupplied with water, the water will rife from it into the pipe AB, to the height *Al*, or to the fame level with the mouth of the pipe at 30. The fine of this elevation, or of the angle of 30 degrees, is *c* 30; which is juft equal to half the length of the pipe, or to 50 of fuch parts of the fcale as the length of the pipe contains 100. Therefore, the preffure of the water at A, in a pipe elevated 30 degrees above the horizontal level, will be equal to one half of what it would be, if the fame pipe ftood upright in the fituation AB.

And thus, by elevating the pipe to 40, 50, 60, 70, and 80 degrees on the quadrant, the fines of thefe elevations will be *d* 40, *e* 50, *f* 60, *g* 70, and *h* 80; which will be equal to the heights *Am*, *An*, *Ao*, *Ap*, and *Aq*; and thefe heights meafured upon the fcale 8 will be 64.3, 76.6, 86.6, 94.0, and 98.5; which exprefs the preffures at A in all thefe elevations, confidering the preffure in the upright pipe AB as 100.

Becaufe it may be of ufe to have the lengths of all the fines of a quadrant from 0 degrees to 90, we have given the foregoing table, fhewing the length of the fine of every degree in fuch parts as the whole pipe (equal to the radius of the quadrant) contains 1000. Then the fines will be integral or whole parts in length. But if you fuppofe the length of the pipe to be divided only into 100 equal parts, the laft figure of each part or fine muft be cut off as a decimal; and then thofe which remain at the left hand of this feparation will be integral or whole parts.

Thus, if the radius of the quadrant (fuppofed to be equal to the length of the pipe AC) be divided into 1000 equal parts, and the elevation be 45 degrees, the fine of that elevation will be equal to 707 of thefe parts; but if the radius be divided into 100 equal parts, the fame fine will be only 70.7 or $70\frac{7}{10}$ of thefe parts. For, as 1000 is to 707, fo is 100 to 70.7.

As it is of great importance to all engine makers, to know what quantity and weight of water will be contained in an upright round pipe of a given diameter and height, fo as, by knowing what weight is to be raifed, they may proportion their engines to the force which they can offord to work them; we fhall fubjoin tables fhewing the number of cubic inches of water contained in an upright pipe of a round bore, of any diameter from one inch to fix and a half; and of any height from one foot to two hundred: together with the weight of the faid number of cubic inches, both in troy and avoirdoirdupoife ounces. The number of cubic inches divided by 231, will reduce the water to gallons in wine-meafure; and divided by 382, will reduce it to the meafure of ale-gallons. Alfo, the troy ounces divided by 12, will reduce the weight to troy pounds: and the avoirdupoife ounces divided by 16, will reduce the weight to avoirdupoife pounds.

And here we muft repeat it again, that the weight or preffure of the water acting againft the power that works the engine muft always be eftimated according to the perpendicular height to which it is to be raifed, without any regard to the length of the conduct pipe, when it has an oblique pofition; and as if the diameter of that pipe were juft equal to the diameter of that part of the pump in which the pifton works. Thus by the tables on the two following pages, the preffure of the water againft an engine whofe pump is of a $4\frac{1}{2}$ inch bore, and the perpendicular height of the water in the conduct-pipe is 80 feet, will be equal to 8057.5 troy ounces, and to 8848.2 avoirdupoife ounces; which makes 671.4 troy pounds, and 553 avoirdupoife.

EXAMPLE. *Required the number of cubic inches, and the weight of the water, in an upright pipe* 278 *feet high, and* $1\frac{1}{2}$ *inch diameter?*

	Feet.	*Cubic inches.*	*Troy oz.*	*Avoir. oz.*
	200	4241.1	2238.2	2457.8
	70	1484.1	783.3	860.2
	8	169.6	89.5	98.3
Anfw.	278	5895.1	3111.0	3416.3

Here the neareft fingle decimal figure is only taken into the account; and the whole, being reduced by divifion, amounts to $25\frac{1}{2}$ wine-gallons in meafure, to $259\frac{1}{4}$ pounds troy, and $213\frac{1}{2}$ pounds avoirdupoife.

Thefe tables were at firft calculated to fix decimal places for the fake of exactnefs; but in tranfcribing them there are no more than two decimal figures taken into the account, and fometimes but one; becaufe there is no neceffity for computing to hundredth parts of an inch or of an ounce in practice.

The fire engine.

THE *fire-engine* comes next in order to be explained: but as it would be difficult, even by the beft plates, to give a particular defcription of its feveral parts, fo as to make the whole intelligible, we fhall only explain the principles upon which it is conftructed.

1. Whatever weight of water is to be raifed, the pump-rod muft be loaded with weights fufficient for that purpofe, if it be done by a forcing-pump, as is generally the cafe: and the power of the engine muft be fufficient for the weight of the rod, in order to bring it up.

2. It is known, that the atmofphere preffes upon the furface of the earth with a force equal to 15 pounds upon every fquare inch.

3. When water is heated to a certain degree, the particles thereof repel one another, and conftitute an elaftic fluid, which is generally called fteam or vapour.

4. Hot fteam is very elaftic; and when it is cooled by any means, particularly by its being mixed with cold water, its elafticity is deftroyed immediately, and it is reduced to water again.

5. If a veffel be filled with hot fteam, and then clofed fo as to keep out the external air and all other fluids; when that fteam is by any means condenfed, cooled, or reduced to water, that water will fall to the bottom of the veffel; and the cavity of the veffel will be almoft a perfect vacuum.

6. Whenever a vacuum is made in any veffel, the air by its weight will endeavour to rufh into the veffel, or

to drive in any other body that will give way to its preſſure; as may be eaſily ſeen by a common ſyringe. For, if you ſtop the bottom of a ſyringe, and then draw up the piſton, if it be ſo tight as to drive out all the air before it, and leave a vacuum within the ſyringe, the piſton being let go will be driven down with a great force.

7. The force with which the piſton is drove down, when there is a vacuum under it, will be as the ſquare of the diameter of the bore in the ſyringe. That is to ſay, it will be driven down with four times as much force in a ſyringe of a two-inch bore, as in a ſyringe of one inch: for the areas of circles are always as the ſquares of their diameters.

8. The preſſure of the atmoſphere being to 15 pounds upon every ſquare inch, it will be equal to about 12 pounds upon every circular inch. So that if the bore of the ſyringe be round, and one inch in diameter, the piſton will be preſt down into it by a force nearly equal to 12 pounds: but if the bore be two inches diameter, the piſton will be preſt down with four times that force.

And hence it is eaſy to find with what force the atmoſphere preſſes upon any given number either of ſquare or circular inches.

Theſe being the principles upon which this engine is conſtructed, we ſhall next deſcribe the chief working parts of it: which are, 1. A boiler. 2. A cylinder and piſton. 3. A beam or lever.

The boiler is a large veſſel made of iron or copper; and commonly ſo big as to contain about 2000 gallons.

The cylinder is about 40 inches diameter, bored ſo ſmooth, and its leathered piſton fitting ſo cloſe, that little or no water can get between the piſton and ſides of the cylinder.

Things being thus prepared, the cylinder is placed upright, and the ſhank of the piſton is fixed to one end of the beam, which turns on a centre like a common balance.

The boiler is placed under the cylinder, with a communication between them, which can be opened and ſhut occaſionally.

The boiler is filled about half full of water, and a ſtrong fire is made under it: then, if the communication between the boiler and the cylinder be opened, the cylinder will be filled with hot ſteam; which would drive the piſton quite out at the top of it. But there is a contrivance by which the piſton, when it is near the top of the cylinder, ſhuts the communication at the top of the boiler within.

This is no ſooner ſhut, than another is opened, by which a little cold water is thrown upwards in a jet into the cylinder, which mixing with the hot ſteam, condenſes it immediately; by which means a vacuum is made in the cylinder, and the piſton is preſſed down by the weight of the atmoſphere; and ſo lifts up the loaded pump-rod at the other end of the beam.

HYDROSTATICAL TABLES.

1 Inch diameter.				$1\frac{1}{2}$ Inches diameter.			
Feet high.	Solidity in cubic inches.	Weight in Troy ounces.	In avoirdupoiſe ounces.	Feet high.	Solidity in cubic inches.	Weight in Troy ounces.	In avoirdupoiſe ounces.
1	9.42	4.97	5.46	1	21.21	11.19	12.29
2	18.85	9.95	10.92	2	42.42	22.38	24.58
3	28.27	14.92	16.38	3	63.62	33.57	36.87
4	37.70	19.89	21.85	4	84.8	44.76	49.16
5	47.12	24.87	27.31	5	106.03	55.95	61.45
6	56.55	29.84	32.77	6	127.23	67.15	73.73
7	65.97	34.82	38.23	7	147.44	78.34	86.02
8	75.40	39.79	43.69	8	169.65	89.53	98.31
9	84.82	44.76	49.16	9	190.85	100.72	110.60
10	94.25	49.74	54.62	10	212.06	111.91	122.89
20	188.49	99.48	109.24	20	424.12	223.82	245.78
30	282.74	149.21	163.86	30	636.17	335.73	368.68
40	376.99	198.95	218.47	40	848.23	447.64	491.57
50	471.24	248.69	273.09	50	1060.29	559.55	614.46
60	565.49	298.43	327.71	60	1272.35	671.46	737.35
70	659.73	348.17	382.33	70	1484.40	783.37	860.24
80	753 98	397.90	436.95	80	1696.46	895.28	983.14
90	843.23	447.64	491.57	90	1908.52	1007.19	1106.03
100	942.48	497.38	546.19	100	2120.58	1119.09	1228.92
200	1884.96	994.76	1092.38	200	4241.15	2238.18	2457.84

2 Inches diameter.				$2\frac{1}{2}$ Inches diameter.			
1	37.70	19.89	21.85	1	58.90	31.08	34.14
2	75.40	39.79	43.69	2	117.81	62.17	68.27
3	113.10	59.68	65.54	3	176.71	93.26	102.41
4	150.80	79.58	87.39	4	235.62	124.34	136.55
5	188.50	99.47	109.24	5	294 52	155.43	170.68
6	226.19	119.37	131.08	6	353.43	186.52	204.82
7	263.89	139.26	152.93	7	412.33	217.60	238.96
8	301.59	159.16	174.78	8	471.24	248.69	273.09
9	339.29	179 06	196.63	9	530.14	279.77	307.23
10	376.99	198.95	218.47	10	589.05	310.86	341.37
20	753.98	397.90	436 95	20	1178.10	621.72	682.73
30	1130.97	596.85	665.42	30	1767.15	932.58	1024.10
40	1507.97	795.80	873.90	40	2356.20	1243.44	1365.47
50	1884.96	994.75	1092.37	50	2545.25	1554.30	1706.83
60	2261.95	1193.70	1310.85	60	3534.29	1865.16	2048.20
70	2638.94	1392.65	1529.32	70	4123.34	2176.02	2389.27
80	3015.93	1591.60	1747.80	80	4712.39	2486.88	2730.94
90	3392.92	1790.56	1966.27	90	5301.44	2797.74	3072.30
100	3769.91	1989.51	2184.75	100	5890.49	3108.60	2413.67
200	7539.82	3979.00	4369.50	200	11780.98	6217.20	4827.34

HYDROSTATICAL TABLES.

3 Inches diameter.

Solidity in cubic inches.	Weight in Toy ounces.	In avoir dupoise ounces.
84.8	44.76	49.16
169.6	89.53	98.31
254.5	134.29	147.47
239.3	179.06	199.63
424.1	223.82	245.78
508.9	268.58	294.94
593.7	313.35	344.10
698.6	358.11	393.25
763.4	402.87	442.41
848.2	447.64	491.57
1696.5	895.28	983.14
2244.7	1342.92	1474.70
3392.9	1790.56	1966.27
4241.1	2238.19	2457.84
5089.4	2685.83	2949.41
5937.6	3133.47	3440.98
6785.8	3581.11	3932.55
7634.1	4028.75	4424.12
8482.3	4476.39	4915.68
16964.6	8952.78	9821.36

3½ Inches diameter.

Feet high.	Solidity in cubic inches.	Weight in Troy ounces.	In avoir dupoise ounces.
1	115.4	60.9	66.9
2	230.9	121.8	133.8
3	346.4	182.8	200.7
4	461.8	243.7	267.6
5	577.3	304.6	334.5
6	692.7	365.6	401.4
7	808.2	426.5	468.4
8	923.6	487.4	535.3
9	1039.1	548.3	602.2
10	1154.5	609.2	669.1
20	2309.1	1218.6	1338.2
30	3463.6	1827.9	2007.2
40	4618.1	1437.1	2676.3
50	5772.7	3046.4	3345.4
60	6927.2	3655.7	4014.5
70	8081.7	4265.0	4683.6
80	9236.3	4874.3	5352.6
90	10390.8	5483.6	6021.7
100	11545.4	6092.9	6690.8
200	23090.7	12185.7	13381.5

5 Inches diameter.

Feet high.	Solidity in cubic inches.	Weight in Troy ounces.	In avoir dupoise ounces.
1	235.6	124.3	136.5
2	471.2	248.7	273.1
3	706.8	373.0	409.6
4	942.5	497.4	546.2
5	1178.1	621.8	682.7
6	1413.7	746.1	819.3
7	1649.3	870.4	955.8
8	1884.9	994.8	1092.4
9	2120.6	1119.1	1228.9
10	2356.2	1243.4	1365.5
20	4712.4	2486.9	2730.9
30	7068.6	3730.3	4096.4
40	9424.8	4973.8	5461.9
50	11781.0	6217.2	6827.3
60	14137.2	7460.6	8192.8
70	16493.4	8704.1	9558.3
80	18849.6	9947.5	10923.7
90	21205.8	11191.0	12289.2
100	23562.0	12434.4	13654.7
200	47124.0	24868.8	27309.3

5½ Inches diameter.

Feet high.	Solidity in cubic inches.	Weight in Troy ounces.	In avoir dupoise ounces.
1	285.1	150.5	164.3
2	570.2	300.9	328.5
3	855.3	451.4	492.8
4	1140.4	601.8	657.1
5	1425.5	752.2	921.3
6	1710.6	902.7	985.6
7	1995.7	1053.2	1149.9
8	2280.8	1203.6	1314.2
9	2565.9	1354.1	1478.4
10	2851.0	1504.6	1642.7
20	5702.0	3009.1	3285.4
30	8553.0	4513.7	4928.1
40	11404.0	6018.2	6570.8
50	14255.0	7522.9	8213.5
60	17106.0	9027.4	9856.2
70	19957.0	10531.9	11498.9
80	22808.0	12036.5	13141.6
90	25659.0	13541.1	14784.3
100	28510.0	15045.1	16426.9
200	57020.0	30091.2	32853.9

4 inches diameter.

150.8	79.6	87.4
301.6	159.2	174.8
452.4	238.7	262.2
603.2	318.	349.6
754.0	497.9	436.9
904.8	477.5	524.3
1055.6	557.1	611.7
1206.4	636.6	699.1
1357.2	716.2	786.5
1508.0	795.8	873.9
3115.9	1591.6	1747.8
4523.9	2387.4	2621.7
6631.9	318 .2	3495.6
7539.8	3997.0	4369.5
9047.8	4774.8	5243.4
10555.8	5570.6	6117.3
12063.7	6366.4	6991.2
13571.7	7162.2	7865.1
15079.7	7958.0	8739.1
30159.3	15916.0	17478.2

4½ Inches diameter.

1	190.8	100.7	110.6
2	381.7	201.4	221.2
3	572.6	302.2	331.8
4	763.4	402.9	442.4
5	954.3	503.6	553.0
6	1145.1	604.3	663.6
7	1337.9	705.0	774.2
8	1526.8	805.7	884.8
9	1717.7	906.5	995.4
10	1908.5	1007.2	1106 0
20	3817.0	2014.4	2212.1
30	5725.6	3021.6	3818 1
40	7644.1	4028.7	4424.1
50	7542.6	5035.9	5530.1
60	11451.1	6043.1	6636.2
70	13359.6	7050.3	7742.2
80	15268.2	8057.5	8848.2
90	17176.7	9064.7	9954.3
100	19085.2	10071.9	11060.3
200	38170.4	2014 .8	22120.6

6 Inches diameter.

1	339.3	179.0	196.6
2	678.6	358.1	393.3
3	1017.9	537.2	589.9
4	1357.2	716.2	786.5
5	1696.5	895.3	983.1
6	2035.7	1074.3	1179.8
7	2375.0	1253.4	1376.4
8	2714.3	1432.4	1573.0
9	3053.6	1611.5	1769.6
10	3392.9	1790.6	1966.3
20	6785.8	3581.1	3932.5
30	10178.8	5371.7	5898.8
40	13571.7	7162.2	7865.1
50	16964.6	8952.8	9831.4
60	20357.5	10743.3	11797.6
70	23759.5	12533.9	13763.9
80	27143.4	14324.4	15730.2
90	30536.3	16115.0	17696.5
100	33929.2	17905.6	19662.7
200	67858.1	35811.2	39325.4

6½ Inches diameter.

1	398.2	210.1	230.7
2	797.4	420.3	461.4
3	1195.6	630.4	692.1
4	1593.8	840.6	922.8
5	1991.9	1050.8	1153.6
6	2390.1	1260.9	1384.3
7	2788.3	1471.1	1615.0
8	3186.5	1681.2	1845.7
9	3584.7	1891.3	2076.4
10	3982.0	2101.5	2307.1
20	7965.8	4202.9	4614.3
30	11941.8	6304.4	6921.4
40	15931.7	8405.9	9228.6
50	19914.6	10507.4	11535.7
60	23897.6	12608.9	13842.9
70	27880.5	14710.4	16150.0
80	31863.4	16811.8	18457.2
90	35846.3	18913.3	20764.3
100	39829.3	21014.8	23071.5
200	79658.6	42029.6	46143.0

If the cylinder be 42 inches in diameter, the piſton will be preſſed down with a force greater than 20000 pounds, and will conſequently lift up that weight at the oppoſite end of the beam: and as the pump-rod with its plunger is fixed to that end, if the bore where the plunger works were 10 inches diameter, the water would be forced up through a pipe of 180 yards perpendicular height.

But, as the parts of this engine have a good deal of friction, and muſt work with a conſiderable velocity, and there is no ſuch thing as making a perfect vacuum in the cylinder, it is found that no more than 8 pounds of preſſure muſt be allowed for, on every circular inch of the piſton in the cylinder, that it may make about 16 ſtrokes in a minute, about 6 feet each.

Where the boiler is very large, the piſton will make between 20 and 25 ſtrokes in a minute, and each ſtroke 7 or 8 feet; which, in a pump of 9 inches bore, will raiſe upwards of 300 hogſheads of water in an hour.

It is found by experience, that a cylinder 40 inches diameter will work a pump 10 inches diameter and 100 yards long: and hence we can find the diameter and length of a pump that can be worked by any other cylinder.

For the conveniency of thoſe who would make uſe of this engine for raiſing water, we ſhall ſubjoin part of a table calculated by Mr. Beighton, ſhewing how any given quantity of water may be raiſed in an hour, from 48 to 440 hogſheads; at any given depth, from 15 to 100 yards; the machine working at the rate of 16 ſtrokes *per* minute, and each ſtroke being 6 feet long.

One example of the uſe of this table, will make the whole plain. Suppoſe it were required to draw 150 hogſheads *per* hour, at 90 yards depth; in the ſecond column from the right hand, I find the neareſt number, *viz.* 149 hogſheads 40 gallons; againſt which, on the right hand, I find the diameter of the bore of the pump muſt be 7 inches; and in the ſame collateral line, under the given depth 90, I find 27 inches, the diameter of the cylinder fit for that purpoſe.—And ſo for any other.

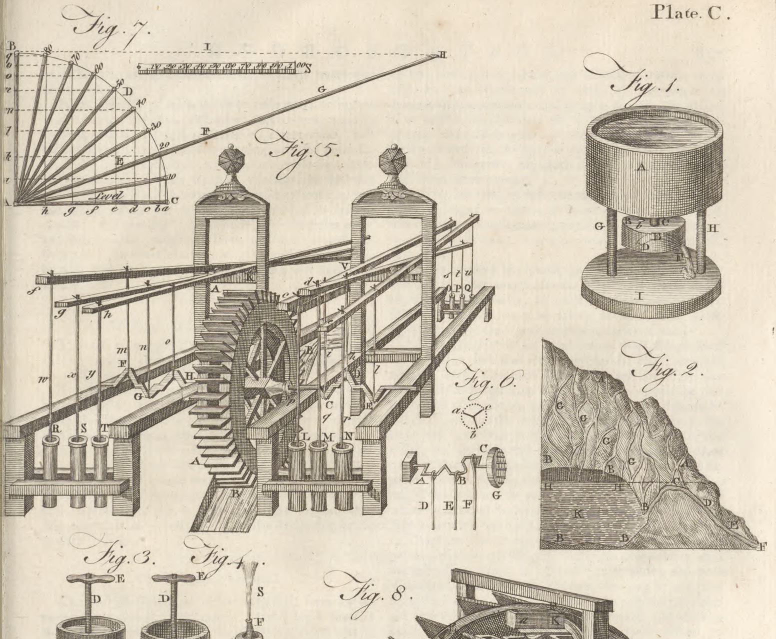
A Table ſhewing the Power of the Engine for raiſing Water by Fire;
Calculated to the Meaſure of Ale-gallons, at 282 cubic Inches *per* Gallon.

Diameter of the Cylinder in Inches.	The depth to be drawn in yards.													In one hour.		Diam. of pump.
	15	20	25	30	35	40	45	50	60	70	80	90	100	Hogſh.	Gal.	Inches.
	18½	21¾	24	26½	28½	30½	32½	34¼	37¼	40	—	—	—	440		12
	17	19¾	22	24¾	26¼	28	29¾	31¼	34¼	37	39½	—	—	369	33	11
	15½	18	20	22	23¾	25¼	27	28¾	31¼	33¾	36	38¼	40	304	48	10
	14	16¼	18	20	21½	23	24¼	25	28	30½	33	35	36½	247	7	9
	13½	15¼	17¼	19	20¼	21¾	23	24	26¼	28½	31	32½	35¼	221	15	8½
	12½	14½	16½	18½	19	20½	21½	23	25	27	29	30½	32½	195	22	8
	12	14	15½	17½	18¾	19¾	21	22	24¼	26	28	29½	31½	182	13	7¾
	11	13¾	15	16½	18	19	20	21¼	23¼	25	27	28½	30¼	172	30	7½
	10¾	13	14	15½	16¾	18¾	19	20½	22	24	25½	27	28½	149	40	7
	10	12	13	14	15½	16¼	18	19	20	22	23	24½	26¼	128	54	6½
	9½	11	12	13	14	15½	16	17	19	20½	22	23	24½	110	1	6
		10	11	12	13	14	15	15¾	17	19	20	21	22¼	94	30	5½
			10	11	11¼	13	13¼	14	15½	16¾	18½	19¼	20¼	66	61	5
				10	10	11¼	12	13½	14	15	16	17	18¼	60	60	4½
					9	10	11	11½	12	13½	14	15	16	48	51	4

The Perſian wheel.

Water may be raiſed by means of a ſtream AB (Plate 100. fig. 8.) turning a wheel CDE, according to the order of the letters, with buckets *a,a,a,a,* &c. hung upon the wheel by ſtrong pins *b,b,b,b,* &c. fixed in the ſide of the rim: but the wheel muſt be made as high as the water is intended to be raiſed above the level of that part of the ſtream in which the wheel is placed. As the wheel turns, the buckets on the right hand go down into the water, and are thereby filled; and go up full on the left hand, until they come to the top at K; where they ſtrike againſt the end *n* of the fixed trough M, and are thereby overſet, and empty the water into the trough; from which it may be conveyed in pipes to the place which it is deſigned for: and as each bucket gets over the trough, it falls into a perpendicular poſition again, and goes down empty, until it comes to the water at A, where it is filled as before. On each bucket is a ſpring *r*, which going over the top or crown of the bar *m* (fixed to the trough M) raiſes the bottom of the bucket above above the level of

Plate. C.



A. Bell Sc.

of its mouth, and fo caufes it to empty all its water into the trough.

Sometimes this wheel is made to raife water no higher than its axis; and then, inftead of buckets hung upon it, its fpokes C, *d*, *e*, *f*, *g*, *h* are made of a bent form, and hollow within; thefe hollows opening into the holes C, D, E, F, in the outfide of the wheel, and alfo into thofe at O in the box N upon the axis. So that, as the holes C, D, *&c.* dip into the water, it runs into them; and as the wheel turns, the water rifes in the hallow fpokes, *c*, *d*, &c. and runs out in a ftream P from the holes at O, and falls into the trough Q, from whence it is conveyed by pipes. And this is a very eafy way of raifing water, becaufe the engine requires neither men nor horfes to turn it.

Of the fpecific gravities of bodies.

The art of weighing different bodies in water, and thereby finding their fpecific gravities, or weights, bulk for bulk, was invented by Archimedes.

The fpecific gravities of bodies are as their weights, bulk for bulk: thus a body is faid to have two or three times the fpecific gravity of another, when it contains two or three times as much matter in the fame fpace.

A body immerfed in a fluid will fink to the bottom, if it be heavier than its bulk of the fluid. If it be fufpended therein, it will lofe as much of what it weighed in air, as its bulk of the fluid weighs. Hence, all bodies of equal bulk, which would fink in fluids, lofe equal weights when fufpended therein. And unequal bodies lofe in proportion to their bulks.

The hydroftatic balance.

The *hydroftatic balance* differs very little from a common balance that is nicely made: only it has a hook at the bottom of each fcale, on which fmall weights may be hung by horfe-hairs, or by filk threads. So that a body, fufpended by the hair or thread, may be immerfed in water without wetting the fcale from which it hangs.

If the body thus fufpended under the fcale, at one end of the balance, be firft counterpoifed in air by weights in the oppofite fcale, and then immerfed in water, the equilibrium will be immediately deftroyed. Then, if as much weight be put into the fcale from which the body hangs as will reftore the equilibrium (without altering the weights in the oppofite fcale) that weight which reftores the equilibrium will be equal to the weight of a quantity of water as big as the immerfed body. And if the weight of the body in air be divided by what it lofes in water, the quotient will fhew how much that body is heavier than its bulk of water. Thus, if a guinea fufpended in air be counterbalanced by 129 grains in the oppofite fcale of the balance; and then, upon its being immerfed in water, it becomes fo much lighter as to require $7\frac{1}{4}$ grains put into the fcale over it, to reftore the equilibrium; it fhews that a quantity of water of equal bulk with the guinea, weighs $7\frac{1}{4}$ grains, or 7.25; by which divide 129 (the weight of the guinea in air) and the quotient will be 17.793; which fhews that the guinea is 17.793 times as heavy as its bulk of bulk of water. And thus any piece of gold may be tried, by weighing it firft in air, and then in water; and if, upon dividing the weight in air by the lofs in water, the quotient comes out to be 17.793, the gold is good; if the quotient be 18, or between 18 and 19, the gold is very fine; but if it be lefs than $17\frac{1}{7}$, the gold is too much allayed, by being mixed with fome other metal.

If filver be tried in this manner, and found to be 11 times as heavy as water, it is very fine; if it be $10\frac{1}{2}$ times as heavy, it is ftandard; but if it be of any lefs weight compared with water, it is mixed with fome lighter metal, fuch as tin.

By this method the fpecific gravities of all bodies that will fink in water may be found. But as to thofe which are lighter than water, as moft forts of wood are, the following method may be taken, to fhew how much lighter they are than their refpective bulks of water.

Let an upright ftud be fixed into a thick flat piece of brafs, and in this ftud let a fmall lever, whofe arms are equally, long turn upon a fine pin as an axis. Let the thread which hangs from the fcale of the balance be tied to one end of the lever, and a thread from the body to be weighed tied to the other end. This done, put the brafs and lever into a veffel: then pour water into the veffel, and the body will rife and float upon it, and draw down the end of the balance from which it hangs: then, put as much weight in the oppofite fcale as will raife that end of the balance, fo as to pull the body down into the water by means of the lever; and this weight in the fcale will fhew how much the body is lighter than its bulk of water.

There are fome things which cannot be weighed in this manner, fuch as quickfilver, fragments of diamonds, *&c.* becaufe they cannot be fufpended in threads; and muft therefore be put into a glafs bucket, hanging by a thread from the hook of one fcale, and counterpoifed by weights put into the oppofite fcale. Thus, fuppofe you want to know the fpecific gravity of quickfilver, with refpect to that of water; let the empty bucket be firft counterpoifed in air, and then the quickfilver put into it and weighed. Write down the weight of the bucket, and alfo of the quickfilver; which done, empty the bucket, and let it be immerfed in water as it hangs by the thread, and counterpoifed therein by weights in the oppofite fcale: then, pour the quickfilver into the bucket in the water, which will caufe it to preponderate; and put as much weight into the oppofite fcale as will reftore the balance to an equipoife; and this weight will be the weight of a quantity of water equal in bulk to the quickfilver. Laftly, divide the weight of the quickfilver in air, by the weight of its bulk of water, and the quotient will fhew how much the quickfilver is heavier than its bulk of water.

If a piece of brafs, glafs, lead, or filver, be immerfed and fufpended in different forts of fluids, its different loffes of weight therein will fhew how much it is heavier than its bulk of the fluid; the fluid being lighteft, in which the immerfed body lofes leaft of its aerial weight A folid bubble of glafs is generally ufed for finding the fpecific gravities of fluids.

Hence we have an eafy method of finding the fpecific gravities both of folids and fluids, with regard to the re-

ſpective bulks of common pump water, which is generally made a ſtandard for comparing all the others by.

In conſtructing tables of ſpecific gravities with accuracy, the gravity of water muſt be repreſented by unity or 1.000, where three cyphers are added, to give room for expreſſing the ratios of other gravities in decimal parts, as in the following table.

Take away the decimal point from the numbers in the right hand column, or (which is the ſame) multiply them by 1000, and they will ſhew how many ounces avoirdupoiſe are contained in a cubic foot of each body.

How to find out the quantity of adulteration in metals.

THE uſe of the table of ſpecific gravities will beſt appear by an example. Suppoſe a body to be compounded of of gold and ſilver, and it is required to find the quantity of each metal in the compound.

Firſt find the ſpecific gravity of the compound, by weighing it in air and in water, and dividing its aerial weight by what it loſes thereof in water, the quotient will ſhew its ſpecific gravity, or how many times it is heavier than its bulk of water. Then, ſubtract the ſpecific gravity of ſilver (found in the table) from that of the compound, and the ſpecific gravity of the compound from that of gold; the firſt remainder ſhews the bulk of gold, and the latter the bulk of ſilver, in the whole compound: and if theſe remainders be multiplied by the reſpective ſpecific gravities, the products will ſhew the proportion of weights of each metal in the body. Example.

Suppoſe the ſpecific gravity of the compounded body to be 13; that of ſtandard ſilver (by the table) is 10.5, and that of gold 19.63: therefore 10.5 from 13, remains 2.5, the proportional bulk of the gold; and 13 from 19.63, remains 6.63, the proportional bulk of ſilver in the compound. Then, the firſt remainder 2.5, multiplied by 19.63, the ſpecific gravity of gold, produces 49.075 for the proportional weight of gold; and the laſt remainder 6.63 multiplied by 10.5, the ſpecific gravity of ſilver, produces 69.615 for the proportional weight of ſilver in the whole body. So that, for every 49.07 ounces or pounds of gold, there are 69.6 pounds or ounces of ſilver in the body.

Hence it is eaſy to know whether any ſuſpected metal be genuine, or allayed, or counterfeit; by finding how much it is heavier than its bulk of water, and comparing the ſame with the table: if they agree, the metal is good; if they differ, it is allayed or counterfeited.

How to try ſpirituous liquors.

A CUBICAL inch of good brandy, rum, or other proof ſpirits, weighs 235.7 grains; therefore, if a true inch cube of any metal weighs 235.7 grains leſs in ſpirits than in air, it ſhews the ſpirits are proof. If it loſes leſs of its aerial weight in ſpirits, they are above proof: if it loſes more, they are under. For, the better the ſpirits are, they are the lighter; and the worſe, the heavier.

The hydrometer is one of the moſt uſeful inſtruments of the philoſophic kind; for though the hydroſtatical balance be the moſt general inſtrument for finding the

A TABLE of the ſpecific Gravities of the ſeveral ſolid and fluid Bodies.

A cubic inch of	Troy weight oz.	pw.	gr.	Avoirdup. oz.	drams	Comparative weight.
Very fine gold	10	7	3.83	1	5.80	19.637
Standard gold	9	19	6.44	10	14.90	18.888
Guinea gold	9	7	17.18	10	4.76	17.793
Moidore gold	9	0	19.84	9	14.71	17.140
Quickſilver	7	7	11.61	8	1.45	14.019
Lead	5	19	17.55	6	9.08	11.325
Fine ſilver	5	16	23.23	6	6.66	11.087
Standard ſilver	5	11	3.36	6	1.54	10.535
Copper	4	13	7.04	5	1.89	8.843
Plate braſs	4	4	9.60	4	10.09	8.000
Steel	4	2	20.12	4	8.70	7.852
Iron	4	0	15.20	4	6.77	7.645
Block tin	3	17	5.68	4	3.79	7.321
Spelter	3	14	12.86	4	1.42	7.065
Lead ore	3	11	17.76	3	14.96	6.800
Glaſs of antimony	2	15	16.89	3	0.89	5.280
German antimony	2	2	4.80	2	5.04	4.000
Copper ore	2	1	11.83	2	4.43	3.775
Diamond	1	15	20.88	1	15.48	3.400
Clear glaſs	1	13	5.58	1	13.16	3.150
Lapis lazuli	1	12	5.27	1	12.27	3.054
Welch aſbeſtos	1	10	17.57	1	10.97	2.913

The

HYDROMETERS

Plate CI.

Fig. 1.

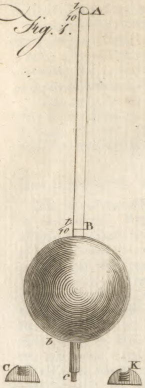


Fig. 2.

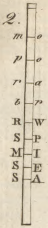


Fig. 3.

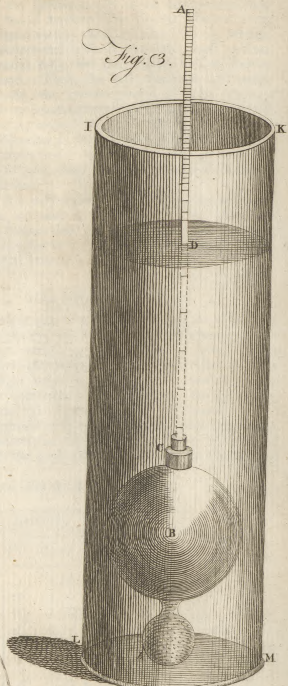


Fig. 4.

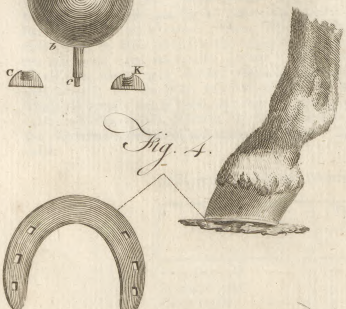


Fig. 5. HYSTRIX or Porcupine

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The Table concluded.

A cubic inch of	Troy weight. oz.	pw.	gr.	Avoirdup. oz.	drams.	Comparative weight.
White marble	1	8	13.41	1	9.06	2.707
Black ditto	1	8	12.65	1	9.02	2 704
Rock cryſtal	1	8	1.00	1	8.61	2.658
Green glaſs	1	7	15.38	1	8.26	2.620
Cornelian ſtone	1	7	1.21	1	7.73	2 568
Flint	1	6	19.63	1	7.53	2.542
Hard paving ſtone	1	5	22.87	1	6.77	2.460
Live ſulphur	1	1	2.40	1	2.52	2.000
Nitre	1	0	1.08	1	1.59	1.900
Alabaſter	0	19	18.74	1	1.35	1.875
Dry ivory	0	19	6.09	1	0.89	1.825
Brimſtone	0	18	23 76	1	0 66	1.800
Alum	0	17	21.92	0	15.72	1.714
Ebony	0	11	18.82	0	10.34	1.117
Human blood	0	11	2.89	0	9.76	1 054
Amber	0	10	20.79	0	9.54	1.030
Cow's milk	0	10	20 79	0	9.54	1.030
Sea water	0	10	20.79	0	9.54	1 030
Pump water	0	10	13.30	0	9.26	1.000
Spring water	0	10	12.94	0	9.25	0 999
Diſtilled water	0	10	11.42	0	9.20	0 993
Red wine	0	10	11.42	0	9.20	0 993
Oil of amber	0	10	7 63	0	9.06	0.978
Proof ſpirits	0	9	19 73	0	8.62	0 931
Dry oak	0	9	18.00	0	8 56	0.925
Olive oil	0	9	15 17	0	8.45	0 913
Pure ſpirits	0	9	3 27	0	8.02	0.866
Spirit of Turpentine	0	9	2.76	0	7 99	0.864
Oil of Turpentine	0	8	8.53	0	7.33	0.772
Dry Crabtree	0	8	1.69	0	7 08	0 765
Saſſafras wood	0	5	2.04	0	4.46	0.482
Cork	0	2	12.77	0	2.21	0.240

ſpecific gravities of all ſorts of bodies yet the hydrometer is beſt ſuited to find thoſe of fluids in particular, both as to eaſe and expedition.

This inſtrument ſhould be made of copper, ſince ivory imbibes ſpirituous liquours, and thereby alters its gravity; and glaſs is apt to break The moſt ſimple kind, uſed for finding the ſtrength of ſpirits, conſiſts of a copper-ball B*b* Plate 101. (fig 1. n° 1.) with a braſs wire, AB, $\frac{1}{4}$ of an inch thick, ſoldered into it. The upper part of this wire being filed flat on one ſide, is marked proof at *m*, becauſe it ſinks exactly to this mark in proof ſpirits. There are other two marks at A and B, to ſhew whether the liquor be $\frac{1}{10}$ above or below proof, according as the hydrometer ſinks to A or emerges to B, when a braſs weight as C or K has been ſcrewed on at the bottom *c*. There are alſo weights to be ſcrewed on, for ſhewing the ſpecific gravities of fluids quite to common water. The round part of the wire above the ball, may be marked ſo as to repreſent river water when it ſinks to R W, (*ibid* n° 2.) the weight which fits the inſtrument for river water being ſcrewed on at *c*: alſo when put into ſpring-water, mineral water, ſea-water, and water of ſalt ſprings, it will emerge or riſe gradually to the marks SP, MI, SE, SA; and, on the contrary, when put into Briſtol-water, rain-water, port-wine, and mountain wine, it will ſucceſſively ſink to the marks, *br*, *ra*, *po*, *mo*.

Another kind, which ſerves to diſtinguiſh the ſpecific differences of fluids to great nicety, conſiſts of a large hollow ball B, (*ibid*. n° 3.) with a ſmaller ball *b* under it, partly filled with quick ſilver or ſmall ſhot, and ſcrewed on to the lower part of the former, in order to render it but little ſpecifically lighter than water: it has alſo a ſmall ſhort neck at C, into which is ſcrewed the graduated braſs-wire AC, which by its weight cauſes the body of the inſtrument to deſcend in the fluid, with part of the ſtem.

When this inſtrument is ſwimming in the liquor, contained in the jar ILMK, the part of the fluid diſplaced

placed by it will be equal in bulk to the part of the inftrument under water, and equal in weight to that of the whole inftrument. Suppofe the weight of the whole were 4000 grains, then it is evident we can by this means compare together the different bulks of 4000 grains of various forts of fluids. For if the weight A be fuch as fhall caufe the aræometer to fink in rain-water, till its furface comes to the middle point of the ftem 20; and if, after this, it be immerfed in common fpring water, and the furface is obferved to ftand $\frac{1}{10}$ of an inch below the middle point 20; it is evident that the fame weight of each water differs in bulk only by the magnitude of $\frac{1}{10}$ of an inch in the ftem.

Now fuppofe the ftem were ten inches long, and weighed 100 grains, then every tenth of an inch would be one grain weight; and fince the ftem is of brafs, and brafs is about eight times heavier than water, the fame bulk of water will be equal to $\frac{1}{8}$ of a grain; and confequently to the $\frac{1}{8}$ of $\frac{1}{4000}$ part, that is, a 3200dth part of the whole bulk, which is a degree of exactnefs as great as can be defired. Yet the inftrument is capable of ftill greater exactnefs, by making the ftem or neck confift of a flat thin flip of brafs, inftead of one that is round or cylindrical: by this means we increafe the furface, which is the moft requifite thing; and diminifh the folidity, by which the inftrument is rendered more exact.

In order to adapt this inftrument to all forts of ufes, there ought to be two different ftems to fcrew on and off in a fmall hole at *a*. One ftem fhould be fuch a nice thin flip of brafs, or rather of fteel, like a watch-fpring fet ftraight, as we have juft mentioned, on one fide of which ought to be the feveral marks or divifions to which it will fink in various forts of waters, as rain-water, river-water, fpring-water, fea-water, falt fpring-water, *&c*. And on the other fide you mark the divifion to which it finks in various lighter fluids, as hot bath water, Briftol water, Lincomb water, Chelten water, port-wine, mountain, madeira, and various other forts of wine. But in this cafe the weight A on the top muft be a little lefs than before, when it was ufed for the heavier waters.

But, in cafe of trying the ftrength of fpirituous liquors, a common cylindric ftem will do beft, becaufe of its ftrength and fteadinefs; and this ought to be fo contrived, that, when immerfed in what is called proof-fpirit, the furface of the fpirit may be upon the middle point 20; which is eafily done by duly adjufting the fmall weight A on the top, and making the ftem of fuch a length, that, when immerfed in water, it may juft cover the ball, and rife to *a*; but, when immerfed in pure fpirit, it may arife to the top at A; then by dividing the upper and lower parts *a* 20, A 20, into ten equal parts each, when the inftrument is immerfed in any fort of fpirituous liqour, it will immediately fhew how much it is above or below proof.

This proof-fpirit confifts of half water and half alcohol or pure fpirit: that is, fuch as when poured upon gunpowder, and fet on fire, will burn all away, and permit the powder to take fire, which it will, and flafh as in the open air. But if the fpirit be not fo highly rectified, there will remain fome phlegm or water, which will make the powder wet, and unfit to take fire. This proof-fpirit of any kind weighs feven pounds twelve ounces per gallon.

The common method of fhaking the fpirits in a vial, and, by raifing a crown of bubbles, to judge by the manner of their rifing or breaking away whether the fpirit be proof or near it, is very precarious, and capable of great fallacy. There is no way fo eafy, quick, certain, and philofophical, as this by the aræometer, which will demonftrate infallibly the difference of bulks, and confequently fpecific gravities, in equal weights of fpirits, to the 30, 40, or 50 thoufandth part of the whole, which is a degree of accuracy beyond which nothing can be defired.

All bodies expand with heat, and contract with cold; but fome more and fome lefs than others: and therefore the fpecific gravities of bodies are not precifely the fame in fummer as in winter. It has been found, that a cubic inch of good brandy is 10 grains heavier in winter than in fummer; as much fpirit of nitre, 20 grains; vinegar 6 grains, and fpring water 3. Hence it is moft profitable to buy fpirits in winter, and fell them in fummer, fince they are always bought and fold by meafure. It has been found, that 32 gallons of fpirits in winter will make 33 in fummer.

The expanfion of all fluids is proportionable to the degree of heat; that is, with a double or triple heat a fluid will expand two or three times as much.

Upon thefe principles depends the conftruction of the thermometer, in which the globe or bulb, and part of the tube, are filled with a fluid, which, when joined to the barometer, is fpirits of wine tinged, that it may be the more eafily feen in the tube. But when thermometers are made by themfelves, quickfilver is generally ufed.

In the thermometer, a fcale is fitted to the tube, to fhew the expanfion of the quickfilver, and confequently the degree of heat. And, as *Farenheit's* fcale is moft in efteem at prefent, we fhall explain the conftruction and graduation of thermometers according to that fcale.

Firft, let the globe or bulb, and part of the tube, be filled with a fluid; then immerfe the bulb in water juft freezing, or fnow juft thawing; and even with that part in the fcale where the fluid then ftands in the tube, place the number 32, to denote the freezing point: then put the bulb under your arm pit, when your body is of a moderate degree of heat, fo that it may acquire the fame degree of heat with your fkin; and when the fluid has rifen as far as it can by that heat, there place the number 97: then divide the fpace between thefe numbers into 65 equal parts, and continue thofe divifions both above 97 and below 32, and number them accordingly.

This may be done in any part of the world; for it is found that the freezing point is always the fame in all places, and the heat of the human body differs but very little: fo that the thermometers made in this manner will

will agree with one another: and the heat of ſeveral bodies will be ſhewn by them, and expreſſed by the number upon the ſcale, thus.

Air, in ſevere cold weather, in our climate, from 15 to 25. Air in winter, from 26 to 42. Air in ſpring and autumn, from 43 to 53. Air at midſummer, from 65 to 68. Extreme heat of the ſummer ſun, from 86 to 100. Butter juſt melting, 95. Alcohol boils with 174 or 175. Brandy with 190. Water 212. Oil of turpentine 550. Tin melts with 408, and lead with 540. Milk freezes about 30, vinegar 28, and blood 27.

A body ſpecifically lighter than a fluid will ſwim upon its ſurface, in ſuch a manner, that a quantity of the fluid equal in bulk with the immerſed part of the body, will be as heavy as the whole body. Hence, the lighter a fluid is, the deeper a body will ſink in it; upon which depends the conſtruction of the hydrometer or water-poiſe.

From this we can eaſily find the weight of a ſhip, or any other body that ſwims in water. For, if we multiply the number of cubic feet which are under the ſurface, by 62.5, the number of pounds in one foot of freſh water; or by 63, the number of pounds in a foot of ſalt water; the product will be the weight of the ſhip, and all that is in it. For, ſince it is the weight of the ſhip that diſplaces the water, it muſt continue to ſink until it has removed as much water as is equal to it in weight; and therefore the part immerſed muſt be equal in bulk to ſuch a portion of the water as is equal to the weight of the whole ſhip.

To prove this by experiment, let a ball of ſome light wood, ſuch as fir or pear-tree, be put into water contained in a glaſs veſſel; and let the veſſel be put into a ſcale at one end of a balance, and counterpoiſed by weights in the oppoſite ſcale: then, marking the height of the water in the veſſel, take out the ball; and fill up the veſſel with water to the ſame height that it ſtood at when the ball was in it; and the ſame weight will counterpoiſe it as before.

From the veſſel's being filled up to the ſame height at which the water ſtood when the ball was in it, it is evident that the quantity poured in is equal in magnitude to the immerſed part of the ball; and from the ſame weight counterpoiſing, it is plain that the water poured in is equal in weight to the whole ball.

In troy weight, 24 grains make a pennyweight, 20 pennyweight make an ounce, and 12 ounces a pound. In avoirdupoiſe weight, 16 drams make an ounce, and 16 ounces a pound. The troy pound contains 5760 grains, and the avoirdupoiſe pound 7000: and hence, the avoirdupoiſe dram weighs 27.34375 grains, and the avoirdupoiſe ounce 437.5.

H Y P

HYGROMETER, a machine, or inſtrument whereby to meaſure the degrees of drineſs, or moiſture of the air, or rather of the atmoſphere.

There are divers ſorts of hygrometers; for whatever body either ſwells or ſhrinks, by dryneſs or moiſture, is capable of being formed into an hygrometer. Such are woods of moſt kinds particularly aſh, deal, poplar, *&c.* Such alſo is catgut, the beard of a wild oat, *&c.*

HYMEN, in anatomy. See ANATOMY, p. 277.

HYMENÆA, in botany, a genus of the decandria monogynia claſs. The calix conſiſts of five ſegments, and the corolla of five petals; and the pod is filled with a farinaceous pulp. There is but one ſpecies, a native of America.

HYMENÆAL, ſomething belong to marriage, ſo called from hymen.

HYMN, a religious ſong. The hymns ſung in the chriſtian church, as diſtinguiſhed from the pſalms, are pieces of poetry compoſed by pious but not inſpired authors.

HYOIDES, in anatomy. See ANATOMY, p. 166.

HYOSCYAMUS, HEN-BANE, in botany, a genus of the pentandria monogynia claſs. The corolla is obtuſe and funnel ſhaped; the ſtamina are inclined; and the capſule is operculated, and conſiſts of two cells. There are ſix ſpecies, only one of which, *viz.* the niger, or common hen-bane, is a native of Britain. The leaves, *&c.* of this plant are highly narcotic and poiſonous, and now diſregarded in practice.

HYOTHYROIDES, in anatomy. See ANATOMY, p. 300.

H Y P

HYPANTE, or HYPERPANTE, a name given by the Greeks to the feaſt of the preſentation of Jeſus in the temple.

This word, which ſignifies lowly or humble meeting, was given to this feaſt, from the meeting of old Simon and Anna the propheteſs in the temple, when Jeſus was brought thither.

HYPECUM, *wild* CUMIN, in botany, a genus of the tetrandria digynia claſs. The calix conſiſts of two leaves, and the corolla of four petals, the two outermoſt of which are broader, and divided into three ſegments. There are four ſpecies, none of them natives of Britain.

HYPERBATON, in grammar, a figurative conſtruction inverting the natural and proper order of words and ſentences.

HYPERBOLA. See CONIC SECTIONS.

HYPERBOLE, in rhetoric, a figure, whereby the truth and reality of things are exceſſively either enlarged or diminiſhed.

An object uncommon with reſpect to ſize, either very great of its kind or very little, ſtrikes us with ſurpriſe; and this emotion forces upon the mind a momentary conviction that the object is greater or leſs than it is in reality: the ſame effect, preciſely, attends figurative grandeur or littleneſs; and hence the hyperbole, which expreſſes this momentary conviction. A writer, taking advantage of this natural deluſion, enriches his deſcription greatly by the hyperbole: and the reader, even in his cooleſt moments, reliſhes this figure, being ſenſible that it is the operation of nature upon a warm fancy.

It cannot have efcaped obfervation, that a writer is generally more fuccefsful in magnifying by a hyperbole than in diminifhing The reafon is, that a minute object contracts the mind, and fetters its powers of imagination; but that the mind, dilated and inflamed with a grand object, moulds objects for its gratification with great facility. Longinus, with refpect to a diminifhing hyperbole, cites the following ludicrous thought from a comic poet: "He was owner of a bit of ground not larger than a Lacedemonian letter." But, for the reafon now given, the hyperbole has by far the greater force in magnifying objects; of which take the following examples:

> For all the land which thou feeft, to thee will I give it, and to thy feed for ever. And I will make thy feed as the duft of the earth: fo that if a man can number the duft of the earth, then fhall thy feed alfo be numbered. *Genefis* xiii. 15. 16.

> Illa vel intactæ fegetis per fumma volaret
> Gramina: nec teneras curfu læfiffet ariftas.
> *Æneid.* vii. 808.

> ———Atque imo barathri ter gurgite vaftos
> Sorbet in abruptum fluctus, rurfufque fub auras
> Erigit alternos, et fidera verberat unda.
> *Æneid.* iii. 421.

> ———Horrificis juxta tonat Ætna ruinis,
> Interdumque atram prorumpit ad æthera nubem,
> Turbine fumantem piceo et candente favilla:
> Attollitque globos flammarum, et fidera lambit.
> *Æneid.* iii. 571.

Speaking of Polyphemus,

> ———Ipfe arduus, altaque pulfat
> Sidera. *Æneid.* iii. 619.

> ———When he fpeaks,
> The air, a charter'd libertine, is ftill.
> *Henry* V. *act* 1. *fc.* 1.

> Now fhield with fhield, with helmet helmet clos'd,
> To armour armour, lance to lance oppos'd,
> Hoft againft hoft with fhadowy fquadrons drew,
> The founding darts in iron tempefts flew,
> Victors and vanquifh'd join promifcuous cries,
> And fhrilling fhouts and dying groans arife;
> With ftreaming blood the flipp'ry fields are dy'd,
> And flaughter'd heroes fwell the dreadful tide.
> *Iliad* iv. 508.

Quintilian is fenfible that this figure is natural: "For," fays he, "not contented with truth, we naturally incline to augment or diminifh beyond it; and for that reafon the hyperbole is familiar even among the vulgar and illiterate:" and he adds, very juftly, "That the hyperbole is then proper, when the fubject of itfelf exceeds the common meafure." From thefe premiffes, one would not expect the following inference, the only reafon he can find for juftifying this figure of fpeech, "Conceditur enim amplius dicere, quia dici quantum eft, non poteft: meliufque ultra quam citra ftat oratio." (We are indulged to fay more than enough, becaufe we cannot fay enough; and it is better to be above than under.) In the name of wonder, why this flight and childifh reafoning, when immediately before he had obferved, that the hyperbole is founded on human nature? we could not refift this perfonal ftroke of criticifm; intended not againft our author, for no human creature is exempt from error, but againft the blind veneration that is paid to the ancient claffic writers, without diftinguifhing their blemifhes from their beauties.

Having examined the nature of this figure, and the principle on which it is erected; let us proceed to the rules by which it ought to be governed. And, in the firft place, it is a capital fault, to introduce an hyperbole in the defcription of an ordinary object or event; for in fuch a cafe, it is altogether unnatural, being deftitute of furprife, its only foundation. Take the following inftance, where the fubject is extremely familiar, *viz.* fwimming to gain the fhore after a fhipwreck,

> I faw him beat the furges under him,
> And ride upon their backs; he trod the water;
> Whofe enmity he flung afide, and breafted
> The furge moft fwoln that met him: his bold head
> 'Bove the contentious waves he kept, and oar'd
> Himfelf with his good arms, in lufty ftrokes
> To th' *fhore*, that o'er his wave-borne bafis bow'd,
> As ftooping to relieve him. *Tempeft, act* 2. *fc.* 1.

In the next place, it may be gathered from what is faid, that an hyperbole can never fuit the tone of any difpiriting paffion: forrow in particular will never prompt fuch a figure; and for that reafon the following hyperboles muft be condemned as unnatural:

> *K. Rich.* Aumerle, thou weep'ft, my tender-hearted coufin!
> We'll make foul weather with defpifed tears;
> Our fighs, and they, fhall lodge the fummer-corn,
> And make a dearth in this revolting land.
> *Richard* II. *act* 3. *fc.* 6.

> Draw them to Tyber's bank, and weep your tears
> Into the channel, till the loweft ftream
> Do kifs the moft exalted fhores of all.
> *Julius Cæfar, act* 1. *fc.* 1.

Thirdly, a writer, if he wifh to fucceed, ought always to have the reader in his eye: he ought in particular never to venture a bold thought or expreffion, till the reader be warmed and prepared. For this reafon, an hyperbole in the beginning of a work can never be in its place. Example:

> Jam pauca aratro jugera regiæ
> Moles relinquent. *Horat. Carm. lib.* 2. *ode* 15.

In the fourth place, the niceft point of all, is to afcertain the natural limits of an hyperbole, beyond which being overftrained it has a bad effect. Longinus, (chap. iii.) with great propriety of thought, enters a caveat againft an hyperbole of this kind: he compares it to a bowftring, which relaxes by overftraining, and produceth an effect directly oppofite to what is intended. To afcertain any precife boundary, would be difficult, if

not impracticable. We ſhall therefore only give a ſpecimen of what may be reckoned overſtrained hyperboles. No fault is more common among writers of inferior rank; and inſtances are found even among thoſe of the fineſt taſte; witneſs the following hyperbole, too bold even for an Hotſpur.

Hotſpur, talking of Mortimer:

In ſingle oppoſition hand to hand,
He did confound the beſt part of an hour
In changing hardiment with great Glendower.
Three times they breath'd, and three times did they drink,
Upon agreement, of ſwift Severn's flood;
Who then affrighted with their bloody looks,
Ran fearfully among the trembling reeds,
And hid his criſp'd head in the hollow bank,
Blood-ſtained with theſe valiant combatants.
Firſt Part Henry IV. *act* 1. *ſc.* 4.

Speaking of Henry V.

England ne'er had a King until his time:
Virtue he had, deſerving to command:
His brandiſh'd ſword did blind men with its beams:
His arms ſpread wider than a dragon's wings:
His ſparkling eyes, replete with awful fire,
More dazzled, and drove back his enemies,
Than mid-day ſun fierce bent againſt their faces.
What ſhould I ſay? his deeds exceed all ſpeech:
He never lifted up his hand, but conquer'd.
Firſt Part Henry VI. *act* 1. *ſc.* 1.

Laſtly, An hyperbole, after it is introduced with all advantages, ought to be comprehended within the feweſt words poſſible: as it cannot be reliſhed but in the hurry and ſwelling of the mind, a leiſurely view diſſolves the charm, and diſcovers the deſcription to be extravagant at leaſt, and perhaps alſo ridiculous. This fault is palpable in a ſonnet which paſſeth for one of the moſt complete in the French language: Phillis, in a long and florid deſcription, is made as far to outſhine the ſun as he outſhines the ſtars:

Le ſilence regnoit ſur la terre et ſur l'onde,
L'air devenoit ſerain et l'Olimp vermeil,
Et l'amoureux Zephir affranchi du ſomeil,
Reſſuſcitoit les fleurs d'une haleine feconde.

L'Aurore deployoit l'or de ſa treſſe blonde,
Et ſemoit de rubis le chemin du ſoleil;
Enfin ce Dieu venoit au plus grand appareil
Qu'il ſoit jamais venu pour eclairer le monde:

Quand la jeune Philis au viſage riant,
Sortant de ſon palais plus clair que l'orient,
Fit voir une lumiere et plus vive et plus belle.

Sacre flambeau du jour, n'en ſoiez point jaloux,
Vous parutes alors auſſi peu devant elle,
Que les feux de la nuit avoient fait devant vous.
Malleville.

There is in Chaucer a thought expreſſed in a ſingle line, which ſets a young beauty in a more advantageous light than the whole of this much laboured poem:

Up roſe the ſun, and up roſe Emelie.

HYPERCATALECTIC, in the Greek and Latin poetry, is applied to a verſe, which has one or two ſyllables too much, or beyond the regular and juſt meaſure: as,

Muſæ ſorores ſunt Minervæ.
Alſo,
Muſæ ſorores Palladis lugent.

HYPERICUM, *St* JOHN'S WORT, a genus of the polyadelphia polyandria claſs. The calix conſiſts of five ſegments, and the corolla of five petals; and the filaments are numerous, and bound in five bundles. There are twenty-nine ſpecies, eight of them natives of Britain.

HYPERSARCOSIS, in medicine and ſurgery, an exceſs of fleſh, or rather a fleſhy execreſcence, ſuch as thoſe generally ariſing upon the lips of wounds, *&c.*

HYPHEN, an accent or character, in grammar, implying that two words are to be joined, or connected into one compound word, and marked thus -; as, pre eſtabliſhed, five-leaved, *&c.*

Hyphens alſo ſerve to connect the ſyllables of ſuch words as are divided by the end of the line.

HYPNOTIC, in the materia medica, ſuch medicines as any way produce ſleep, whether called narcotics, hypnotics, opiates, or ſoporifics.

HYPNUM, in botany, a genus of the cryptogamia muſci claſs. There are forty two ſpecies, all natives of Britain.

HYPOCAUSTUM, among the Greeks and Romans, a ſubterraneous place, wherein was a furnace to heat the baths.

Another ſort of hypocaſtum was a kind of kiln, to heat their winter-parlours.

Among the moderns, it is that place where the fire is kept that warms a ſtove or hot-houſe.

HYPOCHAERIS, in botany a genus of the ſyngeneſia polygamia æqualis claſs. The receptacle is paleaceous; the calix is imbricated; and the pappus is plumoſe. There are four ſpecies, two of them natives of Britain, *viz.* the radicata, or long-rooted hawkweed; and the maculata, or ſpotted hawkweed.

HYPOCHONDRIA, in anatomy. See ANATOMY, p. 256.

HYPOCHONDRIAC PASSION. See MEDICINE.

HYPOCYSTIS, in pharmacy, an inſpiſſated juice, obtained from the ſeſſile aſarum, much reſembling the true Egyptian acacia.

They gather the fruit, while unripe, and expreſs the juice, which they evaporate over a very gentle fire, to the conſiſtence of an extract, and then form into cakes, and expoſe them to the ſun to dry.

Hypocyſt is an aſtringent, and that of conſiderable power; it is good againſt diarrhœas and hœmorrhages of all kinds, and may be uſed in repellent gargariſms in the manner of the acacia; but it is very rarely met with genuine in our ſhops, the german acacia being uſually ſold under its name.

HYPOGASTRIC, an appellation given to the internal branch of the iliac artery.

HYPOGASTRIUM, in anatomy. See ANATOMY. p. 256.

HYPOPHYLLOCARPODENDRON, in botany. See LEUCODENDRON.

HYPOPYON, in medicine, a collection of purulent matter under the cornea of the eye.

HYPOSTASIS, among divines, signifies a person or substance; chiefly used in speaking of the persons of the Trinity.

HYPOTHEC, in Scots law, a right of security established by law to creditors upon the goods and effects of their debtors, for payment of certain debts. See LAW, tit. 20. § 13.

HYPOTHENAR, in anatomy. See ANATOMY, p. 200.

HYPOTHENUSE, in geometry, the longest side of a right-angled triangle, or it is that side which subtends the right angle.

HYPOTHESIS, in general, denotes something supposed to be true, or taken for granted, in order to prove or illustrate a point in question.

Hypotheses, however elegant and artful, ought to be first proved by repeated observations and constant experience, before they are received as truths.

HYSSOPUS, in botany, a genus of the didynamia gymnospermia class. The inferior lip of the corolla has a small crenated segment; and the stamina are erect and distant. There are three species, none of them natives of Britain. The leaves are said to be good in asthmas, coughs, and other disorders of the lungs.

HYSTERICS, or HYSTERIC PASSION. See MEDICINE.

HYSTERON PROTERON, in grammar and rhetoric, a species of the hyperbaton, wherein the proper order of construction is so inverted, as that the part of any sentence which should naturally come first is placed last; as in this of Terence, *valet & vivit*, for *vivit & valet;* and in the following of Virgil, *moriamur & in media arma ruamus*, for *in media arma ruamus & moriamur*.

HYSTEROPHORUS. See PARTHENIUM.

HYSTRIX, in zoology, a genus of quadrupeds belonging to the order of glires, the characters of which are these: They have two fore-teeth, obliquely divided, both in the upper and under jaw, besides eight grinders; and the body is covered with quills or prickles. (See Plate CI. fig. 5.) There are four species, *viz.*

1. The cristata, or crested porcupine, has four toes on the fore-feet, five toes on the hind-feet, a crested head, a short tail, and the upper lip is divided like that of a hare. The length of the body is about two feet, and the height about two feet and a half. The porcupine is covered with prickles, some of them nine or ten inches long, and about $\frac{1}{4}$ of an inch thick. Like the hedge-hog, he rolls himself up in a globular form, in which position he is proof against the attacks of the most rapacious animals. The prickles are exceedingly sharp, and each of them has five large black and as many white rings, which succeed one another alternately from the root to the point. These quills the animal can erect or let down at pleasure; when irritated, he beats the ground with his hind feet, erects his quills, shakes his tail, and makes a considerable rattling noise with his quills.

Most authors have asserted that the porcupine, when irritated, darts his quills to a considerable distance against the enemy, and that he will kill very large animals by this means. But Mr Buffon, and some other late historians, assure that the animal possesses no such power. Mr Buffon frequently irritated the porcupine, but never saw any thing like this darting of his quills. He says indeed, that when the creature was much agitated with passion, some of the quills which adhered but slightly to the skin, would fall off, particularly from the tail; and this circumstance, he imagines, has given rise to the mistake.

The porcupine, though originally a native of Africa and the Indies, can live and multiply in the more temperate climates of Spain and Italy. Pliny, and every other natural historian since the days of Aristotle, tells us that the porcupine, like the bear, conceals itself during the winter, and that they bring forth their young in 80 days. But these circumstances remain to this day uncertain. It is remarkable, that although this animal be very common in Italy, no person has ever given us a tolerable history of it. We only know in general, that the porcupine, in a domestic state, is not a fierce or ill-natured animal; that with his foreteeth, which are strong and sharp, he can cut through a strong board; that he eats bread, fruits, roots, *&c.* that he does considerable damage when he gets into a garden; that he grows fat, like most animals, about the end of summer; and that his flesh is not bad food.

2. The prehensilis, or cuandu, has four toes on the fore-feet, five on the hind feet, and a long tail. It is considerably less than the former species, being only 17 inches long from the point of the muzzle to the origin of the tail, which is nine inches long; the legs and feet are covered with long brownish hair; the rest of the body is covered with quills interspersed with long hairs; the quills are about five inches long and about $\frac{1}{12}$ of an inch in diameter. He feeds upon birds and small animal. He sleeps in the day like the hedgehog, and searches for his food in the night. He climbs trees, and supports himself by twisting his tail round the branches. He is generally found in the high grounds of America from Brasil to Louisiana and the southern parts of Canada. His flesh is esteemed very good eating.

3. The dorsata, has four toes on the fore-feet, five on the hind-feet, and has quills only on the back, which are short, and almost hid among the long hair. He is about two feet long. He is a native of Hudson's bay. The savages eat his flesh, and make use of his skin as a fur after taking off the prickles.

4. The macroura, has five toes both on the hind and fore feet; his tail is very long, and the prickles are elevated. He is a native of Asia the East Indies.

I.

JACCA, a city and bifhop's fee of Arragon, in Spain, fixty miles north of Saragoffa: W. lon. 50′, and N. lat. 42° 50′.

JACEA. See CENTAURIA.

JACK, in mechanics, a well-known inftrument of common ufe for raifing very great weights of any kind.

The common kitchen-jack is a compound engine where the weight is the power applied to overcome the friction of the parts, and the weight with which the fpit is charged; and a fteady and uniform motion is obtained by means of the fly.

JACK-FLAG, in a fhip, that hoifted up at the fprit fail top-moft head. See FLAG.

JACK-DAW, in ornithology. See CORVUS.

JACKALL, in zoology. See CANIS.

JACOBÆA, in botany. See SENECIO.

JACOBITES, a term of reproach beftowed on the perfons, who, vindicating the doctrines of paffive obedience and non-refiftance with refpect to the arbitrary proceedings of princes, difallow of the late revolution, and affert the fuppofed rights and adhere to the interefts of the late abdicated king James and his family.

JACOBITES, in church-hiftory, a fect of Chriftians in Syria and Mefopotamia; fo called either from Jacob, a Syrian, who lived in the reign of the emperor Mauricius; or from one Jacob, a monk, who flourifhed in the year 550.

The Jacobites are of two fects, fome following the rites of the Latin church, and others continuing feparated from the church of Rome. There is alfo at prefent a divifion among the latter, who have two rival patriarchs, one of whom refides at Caramit, and the other at Derzapharan. As to their belief, they hold but one nature in Jefus Chrift; with refpect to purgatory and prayers for the dead, they are of the fame opinion as the Greeks and other eaftern Chriftians: they confecrate unleavened bread at the eucharift, and are againft confeffion, believing that it is not of divine inftitution.

JACOBUS, an ancient gold coin worth twenty-five fhillings.

JAFFA, anciently called JOPPA, is a port-town of Paleftine in Afiatic Turky, fituated thirty miles northweft of Jerufalem: E. lon. 36°, N. lat. 32° 20′.

JAFNAPATAN, a port-town at the north end of the ifland of Ceylon, in the Eaft Indies; fubject to the Dutch: E. lon. 79°, N. lat. 10°.

JAGENDORF, a city of Silefia, twelve miles northweft of Tropaw: E. lon. 17° 6′ N. lat. 50° 8′.

St JAGO, the chief of the Cape Verd iflands, in Africa, 300 miles weft of Cape Verd; fubject to Portugal: W. lon. 24°, N. lat. 15°.

St. JAGO, the capital of the ifland of Cuba, 100 miles north weft of Jamaica: W. lon. 76°, 30′, N. lat. 20°.

St. JAGO, the capital of the province of Chili, in fouth America, fituated fix miles weft of the mountains of Andes, and eighteen eaft of the Pacific ocean: W. lon. 77°, S. lat. 34°.

JAGO DE LA VEGA, or Spanifh town, the capital of Jamaica, fituated at the fouth-eaft part of the ifland, about feven miles north-weft of Port Paffage and the bay of Port Royal: E. lon. 76° 30′, N. lat. 18° 20′.

JALAP, in botany. See MIRABILIS.

JAMAICA, an ifland of America, fituated in the Atlantic ocean, between 76° and 79° of weft longitude, and between 17° and 18° odd minutes north latitude, near 5000 miles fouth-weft of England, 100 miles fouth of the ifland of Cuba, and 350 miles north of Terra Firma. The ifland lies eaft and weft, and is about 140 miles long, and 60 broad. The wind fets on the fhore almoft all the day in every part of the ifland, and off the fhore in the night; it fometimes hails, but the people there never fee froft or fnow. The produce of the ifland is chiefly fugar; but there are plantations of coffee, of the cocoa or chocolate tree, of indigo, tobacco, pepper, cotton, woods for dying, and the mahogany and machineel wood, ginger, medicinal drugs and gums. The common difeafes of the country are fevers, fluxes, and the dry gripes.

JAMANA, the chief town of a province of Arabia, alfo of the fame name: E. lon. 47° 15′, N. lat 25°.

JAMBA, a city of the hither India, and the capital of the province of the fame name, fituated 220 miles north-eaft of Delli: E. lon. 82°, N. lat. 31°.

JAMBOLIFERA, in botany, a genus of the octandria monogynia glafs. The calix has four teeth, and the corolla four funnel fhaped petals; and the ftigma is fimple. There is but one fpecies, a native of India,

IAMBUS, in ancient poetry, a fimple foot confifting of a fhort and a long fyllable, as *pios*.

JAMBY, a town on the eaft fide of the ifland of Sumatra, in the Eaft Indies, fituated in 101° E. lon. and in 1° 30′ S. lat.

JAMES, or *knights of St* JAMES, a military order in Spain, firft inftituted about the year 1170, by Ferdinand II. king of Leon and Galicia. The greateft dignity belonging to this order is grand mafter, which has been united to the crown of Spain. The knights are obliged to make proof of their defcent from families that have been noble for four generations, on both fides; they muft alfo make it appear that their faid anceftors have neither been Jews, Saracens, nor Heretics; nor have ever been called into queftion by the inquifition. The novices are obliged to ferve fix months in the galleys, and to live a month in a monaftery; they obferve the rules of St Auftin, making no vows but of poverty, obedience, and conjugal fidelity.

St JAMES's DAY, a feftival of the Chriftian church, obferved

ſerved on the 25th of July, in honour of St James the greater, ſon of Zebedee.

Epiſtle of St JAMES, a canonical book of the New Teſtament, being the firſt of the catholic or general epiſtles; which are ſo called, as not being written to one, but to ſeveral Chriſtian churches.

JAMES TOWN, once the capital of Virginia in America, and of James country, ſituated in a peninſula on the north ſide of James, or Pauhatan river, in W. lon. 76° 30′, N. lat. 37° 30′.

JANEIRO, a province of Brazil, in ſouth America, ſituated between 44° and 49° of W. lon. and between the tropic of capricorn and 22° of S. lat.

JANICAW, or JANOWITS, a town of Bohemia, ſituated forty-five miles ſouth-eaſt of Prague.

JANIZARIES, an order of the Turkiſh infantry, reputed the grand ſignior's guards, and the main ſtrength of the Ottoman army.

JANSENISTS, in church-hiſtory, a ſect of the Roman-catholics in France, who followed the opinions of Janſenius, biſhop of Ypres, and doctor of divinity of the univerſities of Louvain and Douay, in relation to grace and predeſtination.

In the year 1640, the two univerſities juſt mentioned, and particularly father Molina and father Leonard Celſus, thought fit to condemn the opinions of the Jeſuits on grace and free-will. This having ſet the controverſy on foot, Janſenius oppoſed to the doctrine of the Jeſuits the ſentiments of St Auguſtine, and wrote a treatiſe on grace, which he entitled Auguſtinus. This treatiſe was attacked by the Jeſuits, who accuſed Janſenius of maintaining dangerous and heretical opinions; and afterwards in 1642, obtained of pope Urban VIII. a formal condemnation of the treatiſe wrote by Janſenius: when the partiſans of Janſenius gave out that this bull was ſpurious, and compoſed by a perſon entirely devoted to the Jeſuits. After the death of Urban VIII. the affair of Janſeniſm began to be more warmly controverted, and gave birth to an infinite number of polemical writings concerning grace; and what occaſioned ſome mirth, was the titles which each party gave to their writings: one writer publiſhed, The torch of St Auguſtin, another found ſnuffers for St Auguſtin's torch, and father Veron formed a gag for the Janſeniſts, *&c.* In the year 1650, ſixty eight biſhops of France ſubſcribed a letter to pope innocent X. to obtain an enquiry into, and condemnation of the five following propoſitions, extracted from Janſenius's Auguſtinus: I. Some of God's commandments are impoſſible to be obſerved by the righteous, even though they endeavour with all their power to accompliſh them. II. In the ſtate of corrupted nature, we are incapable of reſiſting inward grace. III. Merit and demerit in a ſtate of corrupted nature, does not depend on a liberty which excludes neceſſity, but on a liberty which excludes conſtraint. IV. The ſemipelagians admitted the neceſſity of an inward preventing grace for the performance of each particular act, even for the beginning of faith; but they were heretics in maintaining that this grace was of ſuch a nature, that the will of man was able either to reſiſt or obey it. It is ſemipelagianiſm to ſay, that Jeſus Chriſt died, or ſhed his blood, for all mankind in general.

In the year 1652, the pope appointed a congregation for examining into the diſpute in relation to grace. In this congregation Janſenius was condemned, and the bull of condemnation, publiſhed in May 1653, filled all the pulpits in Paris with violent outcries and alarms againſt the hereſy of the Janſeniſts. In the year 1656, pope Alexander VII. iſſued out another bull, in which he condemned the five propoſitions of Janſenius. However, the Janſeniſts affirm, that theſe propoſitions are not to be found in this book; but that ſome of his enemies having cauſed them to be printed on a ſheet, inſerted them in the book, and thereby deceived the pope. At laſt Clement the XI. put an end to the diſpute by his conſtitution of July the 17. 1705; in which, after having recited the conſtitutions of his predeceſſors in relation to this affair, he declares, "That in order to pay a proper obedience to the papal conſtitutions concerning the preſent queſtion, it is neceſſary to receive them with a reſpectful ſilence." The clergy of Paris, the ſame year, approved and accepted this bull, and none dared to oppoſe it.

This is the famous bull *Unigenitus*, ſo called from its beginning with the words *Unigenitus Dei Filius*, &c. which has occaſioned ſo much confuſion in France.

JANUARY, in chronology, the firſt month of the year, ſo called from Janus, one of the ancient Roman deities painted with two faces; one whereof was ſuppoſed to look towards the new year, and the other towards the old.

JAPAN, or *iſlands of* JAPAN, are ſituated between 130° and 144° of E. lon. and between 30° and 40° N. lat.

JAPANNING, the art of varniſhing and drawing figures on wood, *&c.* in the manner as is done by the natives of Japan.

The method of preparing woods for japanning is as follows. 1. Take plaſterer's ſize, diſſolve it over the fire, and mix it with whiting finely powdered till it is of a good body, but not too thick. 2. By means of a ſtrong bruſh, lay your work over with the former mixture; and letting it dry very well, repeat this till the wood is perfectly plain, or the pores and crevices ſufficiently filled up; and when it is thoroughly dry, rub the work over with a wet rag till it is rendered as ſmooth as poſſible: this work is called water-plaining. 3. After this, waſh over the work with the thickeſt of ſeed-lac varniſh till it is very ſmooth, letting it ſtand to dry between every waſhing. 4. In a day or two's time, you may varniſh it over with black, or whatever other colour you deſign; and when it is dry, finiſh it by poliſhing. See the article VARNISH.

After the ſame manner carved figures are to be primed; alſo frames, cabinets, ſtands, tea-tables, *&c.* ſaving that theſe are not to be poliſhed, and therefore do not require ſo great a body of varniſh; but for the tops of tables, boxes, ſides of cabinets, *&c* when the wood is ordinary and rough grained, as deal, oak, *&c.* you may uſe common joiners glue diſſolved in water

water till it is fine and thin, into which put the fineſt ſaw duſt, till it is indifferently thick: then with a bruſh lay your wooden-work over with it, and when it is dry, repeat it ſo often till all the roughneſs and grain of the wood is ſufficiently hidden; and two or three days after let it be ſcraped with a ſcraper, as pear tree and olive-wood are done, to make it as ſmooth as poſſible: then varniſh it as before directed. This, if well done, might not come behind any other work either for beauty or durability; but, however, thoſe woods that are firm and cloſe-grained are chiefly to be choſen.

Method of taking off japan patterns. 1. Having laid your ground, whether black, or of any other colour, and rendered it fit for drawing; and having your draught or deſign before you on paper, either drawn or printed, do as follows. 2. Rub this draught or print all over the back ſide with whiting or fine chalk, wiping off all that whiting which lies looſe upon the paper; then laying this paper upon the table, or piece of varniſhed-work, with the whited ſide next it upon the very place where you would have that figure made, with a needle not ſharp-pointed, fixed in a wooden handle, and called a tracing-pencil, go over and trace as much of the drawing as you think proper: thus by means of the whiting, you will have the groſs form of the draught, and ſuch other lines as will be a direction to you how to perform what you would have done. 3. Having done this, if you draw in gold-ſize, uſe fine cinnabar mixed with gum-water; and with a ſmall pencil dipt into it, go over all the lines made by the chalk: this will hold it ſo as not to come off. 4. If you work your metals or colours in gum water, then trace over your deſign with gum-water mixt with gold or braſs duſt; by either of theſe ways when it is dry and finiſhed, *viz.* either in gum water or gold ſize, you may compleat and finiſh your work.

Method of japanning wood. The wood being prepared as before directed, it is japanned with black, as follows. 1. Take of the thickeſt lac-varniſh, ſix ounces; and lamp black, enough to colour it: with this waſh over your piece three times, letting it dry thoroughly between each time: again, with the ſame varniſh, waſh it over three other ſeveral times, letting it dry as before, and ruſh it ſmooth between each waſhing. 2. Then take the following: Of thickeſt ſeed-lac varniſh, ſix ounces; and venice turpentine, one ounce; waſh over your work with it ſix times, letting it ſtand twelve hours between the three firſt and the three laſt varniſhes. 3. Your work being thus far done, take the following japan-varniſh: Of the fineſt ſeed-lac varniſh, ſix ounces; of lamp black, a ſufficient quantity; mix them, and with that let your work be waſhed twelve times, ſtanding twelve hours betwixt the firſt ſix and the laſt ſix waſhings. 4 Then letting it ſtand to dry for ſix or ſeven days, poliſh it with tripoli and a rag, as before directed: but in poliſhing you muſt work at it only till it is almoſt ſmooth; and then let it ſtand by for two days: afterwards poliſh it again, almoſt enough; then let it ſtand for ſix days, after which finiſh the poliſhing of it; finally, clear it up with oil and lamp black, by which means you will have a good black japan ſcarce at all inferior to the true japan.

For a white japan. 1. Lay the ground with iſing-glaſs ſize mixed with as much whiting ſcraped into it as will make it of a proper thickneſs; with this whiten your work once over, and being thoroughly dry, do it over again; and in like manner repeat it the third time; after which let it ſtand for twelve hours, covering it from duſt; ruſh it with Dutch ruſhing as near the grain of the wood as is proper. 2. Then taking firſt iſing-glaſs ſize, and flake white, ſo much as will make the ſize of a fair body, mix them well together, and with this go over your work three ſeveral times, letting it dry between each time, and ruſh it as before. 3. Then take white ſtarch boiled in fair water, till it is ſomewhat thick, waſh over the whole work twice with it, blood-warm; letting it dry as before. 4. Letting it ſtand for a day or two, it being firſt waſhed with rectified ſpirit of wine, to clear it from the duſt, dip a pure clean pencil into the fineſt white varniſh, and do over the work ſix or ſeven times; and if this be well done, it will give a finer gloſs than if it were poliſhed: if it be not well done, poliſhing will be neceſſary, for which reaſon you muſt give it five or ſix varniſhes more. In poliſhing you muſt make uſe of the fineſt tripoli; and inſtead of lamp-black and oil, muſt uſe putty and oil, and conclude with white ſtarch mixed with oil.

Common red japan. 1. Take iſing-glaſs ſize fine vermilion, a ſufficient quantity, as much as is proper; with the former mixture do your work over four times; firſt warming it by the fire, letting it dry each time, and ruſhing it as before. 2. This being done, waſh it over eight times with ordinary ſeed lac varniſh, and let it by for twelve hours: then ruſh it again, but ſlightly, to make it look ſmooth. 3. And, laſtly, for an exquiſite outward covering, waſh it ten times with the beſt lac-ſeed varniſh; let it lie ſeven days to dry, and then poliſh it with tripoli, and clear it up with oil and lamp black.

A deeper red japan may be made by mixing fine ſanguis draconis, in powder, with the varniſh; and a pale red japan may be had by mixing ſo much white lead with it, as to make it of whatever degree of paleneſs you pleaſe.

Blue japan. 1. Take gum-water what quantity you pleaſe, and a ſufficient quantity of white lead; grind them well upon a marble; take iſing glaſs ſize what quantity you pleaſe, and the fineſt and beſt ſmalt a ſufficient quantity; mix them well together; then add to them of the white lead, ground as before, ſo much as will give it a ſufficient body; mix all together to the conſiſtence of a paint. 2. Do your work over with this mixture three or four times, till you perceive the blue to lie with a good and fair body, letting it dry thoroughly between each time: if your blue is too pale, put more ſmalt among your ſize, without any white lead, and ſo *vice verſa*. 3. Then ruſh it ſmooth, and go over it again with a ſtronger blue; and when it is dry, waſh it three times with the cleareſt iſing glaſs ſize alone, and let it ſtand for two days to dry, covering it. 4. Warm your work gently at the fire, and with a pencil varniſh it over with the fineſt white varniſh, repeating it ſeven or eight times, letting it ſtand to dry two days as before. After which repeat again the waſhes ſeven or eight times in like manner. 5 Let it now ſtand for a week, and then poliſh it as before, and clear it up with lamp black and oil.

Cheſnut-

Chefnut-coloured japan. Take indian red, grind it with ifing-glafs fize upon a porphyry-ftone, till they are as foft and as fine as butter: then mix a little white lead, which grind ftrongly; and, laftly, lamp-black, in due proportion.

A tortoife-fhell japan. Firft lay a white ground, as before directed; then with proper colours, as vermilion, auripigment, *&c.* duly mixed with turpentine-varnifh, ftreak and cloud or fhadow the white ground with any irregular fancy at pleafure, in imitation of tortoife-fhell: then let it ftand to dry. and ftriking it here and there with reddifh-yellow varnifh, mixed with a little cinnabar, cloud the work up and down, touching it up alfo with varnifh mixed with lamp or ivory black. Having done this, varnifh it five or fix times over with the fineft white varnifh, letting it dry between every wafhing.

Japanning with gold fize. The fize being laid over that part only which you intend to gild, as already directed, let it remain there till it is fo dry, that when you put your finger on it, it be glutinous and clammy, but not fo moift that the particles fhould come off with your fingers. It is in this temper that the gold is to be applied: then take a piece of wafhing leather, or the like, and wrapping it round your fore-finger, dip it in the gold duft, and rub it where your gold fize is laid; for it will ftick no where but on the fize; and if any gold-duft lies about your work, brufh it away with a fine clean varnifhing brufh. Then, with your pencil, draw that part with gold fize alfo which is defigned for your copper, and letting it dry as in the former cafe, cover it over with copper duft in the fame manner. Having done this, lay your filver-fize; and when it is dry, as before, lay on your filver-duft, as in the two former. But it is to be obferved, that the metalline colours are to be laid fucceffively one after another, letting each be covered and thoroughly dry before you enter upon a diftinct colour. After all thefe, the other colours which are not metalline are to be laid on with gum-water, referving the rock, *&c.* for the laft part of the work. Let your fize be of a due confiftence, neither too thick nor too thin, that it may run fmooth and clean. See Size.

Japanning metals with gum-water. Take gum water, put it into a muffel-fhell; with which mix fo much of your metal or colour as may give it a proper confiftence, fo that it may run fine and fmooth: having prepared and well mxed your metals and colours, lay on your defign; your gum-water being thoroughly dried, you are to run it over with fine feed-lac varnifh, and afterwards polifh and clear it.

Laying fpeckles or ftrewings on japan-work. To do this, either on outfide or infide boxes, drawers, *&c.* mix your fpeckles with ordinary lac-varnifh, fo much as may make it fit to work, but not fo thick as for colour, and mix them well with a proper brufh. Warm the work to be done gently by the fire, and with a pencil wafh it over with the former mixture; and when it is dry, repeat it again, and fo often till your fpeckles lie as thick and even as you defire. When it is thoroughly dry, go over and beautify the work three or four times with feed-lac varnifh mixt with turpentine, and fo let it dry, and the work is finifhed, except you have a mind to polifh it. But if you polifh it, you muft wafh it eight or ten times over with the beft feed-lac varnifh, letting it ftand to dry every time; and afterwards polifh it, as before directed. All forts of coloured fpeckles may be thus ufed, except thofe of filver; the laying on of which requires the beft and fineft of the lac-varnifh, or the beft white varnifh, which muft make it fit for polifhing; but if you have not a mind to pulifh it, fewer wafhes of the varnifh will be fufficient.

Japanned and laquered ware of the Eaft indies, pay duty for every 100 l. grofs value at the fale 38 l. on importation, and the drawback is 35 l. 12s. 6d. on exportation.

JASMINUM, in botany, a genus of the diandria monogynia clafs. The corolla confifts of five fegments; the berry is tricoccous; and the feed is arillated. There are fix fpecies, none of them natives of Britain.

JASPER, in natural hiftory, a genus of fcrupi, of a complex irregular ftructure, of great variety of colours, and emulating the appearance of the finer marbles, or femipellucid gems.

The great characteriftic of jafpers is, that they all readily ftrike fire with fteel, and make not the leaft effervefcence with aquafortis.

Jafpers, though commonly reckoned among the precious ftones, ought undoubtedly to be ranged among the fcrupi; being only opake cryftalline maffes, varioufly debafed with an earthy admixture: and to this laft ingredient it is that they owe all their variety of colours, as white, green, red, brown, and bluifh

The feveral kinds of nephritic ftone, and the lapus divinus or jade, are all genuine jafpers; but the hard, bright, green jafper of the Eaft Indies, feems to be the true kind. It is found in maffes of various fizes and fhapes; but the more ufual ftandard as to fize, is between four and fix inches in diameter; but there are maffes of it found of a foot or more in diameter, and others no larger than a horfe bean. It is generally fimple and unmixed; but if it be variegated at all, it is always with white; and this is difpofed not in ftreaks or veins, but in clouds. It is capable of a very fine polifh; and when the white clouds are well difpofed, is very beautiful; and, in pieces not too thick, is tolerably pellucid, when held up againft the light.

JASPONYX, in natural hiftory, the pureft horn-coloured onyx, with beautiful green zones, which are compofed of the genuine matter of the fineft jafpers. See Jasper and Onyx.

JASQUES, a port-town of Perfia, fituated on the gulph of Ormus: E. long. 58°, N. lat. 25°.

JATROPHA, the cassada plant, in botany, a genus of the monœcia monadelphia clafs. The male has no calix; the corolla confifts of one funnel-fhaped petal; and the ftamina are ten. The female has no calix; the corolla confifts of five petals; the ftyli are three, and bifid; the capfule has three cells, and contains but one feed. There are feven fpecies, none of them natives of Britain.

JAVA, an ifland of the Eaft Indies, fituated between 102° and 113° of E. longitude, and between 5° and 8°

8° of ſouth latitude; being about 700 miles long from eaſt to weſt, and one hundred broad.

JAVELIN, in antiquity, a ſort of ſpear, five feet and an half long; the ſhaft of which was of wood, with a ſteel point.

Every ſoldier, in the Roman armies, had ſeven of theſe; which were very light and ſlender.

JAUNDICE, in medicine. See MEDICINE.

JAW, in anatomy. See ANATOMY, p. 159.

JAWER, a city of Sileſia, capital of the duchy of Jawer, ſituated in 16° 12′ E. long, and 51° 8′ N. lat.

JAZY, a city of European Turky, capital of Moldavia, ſituated on the river Pruth, in E. long. 28° 40′, N. lat. 47° 15.

IBERIS, in botany, a genus of the tetradynamia ſiliculoſa claſs. The corolla is irregular, the two outmoſt petals being largeſt; and the pod is emarginated, and contains many ſeeds. There are twelve ſpecies, only one of which, *viz.* the medicaulis or rock-creſſe, is a native of Britain.

IBEX, in zoology. See CAPRA.

IBIS, in ornithology. See TANTALUS.

ICE, in phyſiology, a ſolid, traſparent, and brittle body, formed of ſome fluid, particularly water, by means of cold. See FROST and FREEZING.

The younger Lemery obſerves, that ice is only a re-eſtabliſhment of the parts of water in their natural ſtate; that the mere abſence of fire is ſufficient to account for this re-eſtabliſhment; and that the fluidity of water is a real fuſion, like that of metals expoſed to the fire; differing only in this, that a greater quantity of fire is neceſſary to the one than the other. Gallileo was the firſt that obſerved ice to be lighter than the water which compoſed it: and hence it happens, that ice floats upon water, its ſpecific gravity being to that of water as eight to nine. This rarefaction of ice is owing to the air-bubbles produced in the water by freezing; and being conſiderably large in proportion to the water frozen, render the body ſo much ſpecifically lighter: and theſe air-bubbles growing large, acquire a great expanſive power, ſo as to burſt the containing veſſels, though ever ſo ſtrong.

ICE-HOUSE, a building contrived to preſerve ice for the uſe of a family in the ſummer-ſeaſon.

Ice-houſes are more generally uſed in warm countries than with us; particularly in Italy, where the meaneſt perſon who rents a houſe, has his vault or cellar for ice.

As to the ſituation, it ought to be placed upon a dry ſpot of ground; becauſe where-ever there is moiſture, the ice will melt: therefore in all ſtrong lands which retain the wet, too much pains cannot be taken to make drains all round them. The place ſhould alſo be elevated, and as much expoſed to the ſun and air as poſſible.

As to the figure of the building, that may be according to the fancy of the owner; but a circular form is moſt proper for the well in which the ice is to be preſerved, which ſhould be of a ſize and depth proportionable to the quantity to be kept; for it is proper to have it large enough to contain ice for two years conſumption, ſo that if a mild winter ſhould happen, in which little or no ice is to be had, there may be a ſtock to ſupply the want. At the bottom of the well, there ſhould be a ſpace of about two feet deep, left to receive any moiſture that may drain from the ice; over this ſpace ſhould be placed a ſtrong wooden grate, and from thence a ſmall drain ſhould be laid under ground, to carry off the wet. The ſides of the well ſhould be built with brick or ſtone, at leaſt two bricks thick; for the thicker it is, the leſs danger there will be of the well being affected by any external cauſe. When the well is brought up within three feet of the ſurface, there ſhould be another outer-arch or wall begun, which ſhould be carried up to the height of the top of the intended arch of the well; and if there be a ſecond arch turned over this wall, it will add to the goodneſs of the houſe: the roof muſt be high enough above the inner arch to admit of a door-way to get out the ice. If the building is to be covered with ſlates or tiles, reeds ſhould be laid conſiderably thick under them, to keep out the ſun and external air; and if theſe reeds are laid the thickneſs of ſix or eight inches, and plaſtered over with lime and hair, there will be no danger of the heat getting through them. The external wall may be built in what form the proprietor pleaſes; and as theſe ice-houſes are placed in gardens, they are ſometimes ſo contrived as to have an handſome alcove-ſeat in front, with a ſmall door behind it, through which a perſon might enter to take out the ice; and a large door on the other ſide, fronting the north, with a porch wide enough for a ſmall cart to back, in order to ſhoot down the ice near the mouth of the well, which need not be more than two feet diameter, and a ſtone ſo contrived as to ſhut it up in the exacteſt manner: all the vacant ſpace above and between this and the large door ſhould be filled up with barley-ſtraw. The building thus finiſhed, ſhould have time to dry before the ice is put into it.

It is to be obſerved, that upon the wooden grate, at the bottom of the well, there ſhould be laid ſome ſmall faggots; and if upon theſe a layer of reeds is placed ſmooth for the ice to lie upon, it will be better than ſtraw, which is commonly uſed. As to the choice of the ice, the thinner it is, the eaſier it may be broken to powder; for the ſmaller it is broken, the better it will unite when put into the well. In putting it in, care muſt be taken to ram it as cloſe as poſſible; and alſo to allow a vacancy of two inches, all round, next the ſide of the well, to give paſſage to any moiſture occaſioned by the melting of ſome of the ice. When the ice is put into the well, if a little ſalt-petre be mixed with it at every ten inches or a foot in thickneſs, it will cauſe it to unite more cloſely into a ſolid maſs.

ICHNEUMON, in zoology. See VIVERRA.

ICHNEUMON is alſo the name of a genus of flies, of the hymenoptera order. It has no tongue; the antennæ have above thirty joints; the abdomen, in moſt of the ſpecies, is petiolated; and it has a ſting in the tail incloſed in a double-valved cylindrical ſheath. There are

are feventy-feven fpecies, principally diftinguifhed by their colour.

ICHNOGRAPHY, in perfpective, the view of any thing cut off by a plain parallel to the horizon, juft at the bafe of it.

Among painters, it fignifies a defcription of images, or of ancient ftatues of marble and copper, of bufts and femi-bufts, of paintings in frefco, mofaic works, and ancient pieces of miniature.

ICHOGLANS, the grand fignior's pages ferving in the feraglio.

Thofe are the children of Chriftian parents, either taken in war, purchafed, or prefents from the viceroys and governors of diftant provinces: they are the moft fprightly, beautiful and well-made that can be met with; and are always reviewed and approved of by the grand fignior himfelf, before they are admitted into the feraglios of Pera, Conftantinople, or Adrianople, being the three colleges where they are educated, or fitted for employments, according to the opinion the court entertains of them.

ICHOR, properly fignifies a thin watery humour, like ferum: but is fometimes alfo ufed for a thicker kind, flowing from ulcers, called alfo fanies.

ICHTHYOCOLLA, ISINGLASS, a preparation from the fifh known by the name of hufo. See ACCIPENSER.

This is a tough and firm fubftance, of a whitifh colour, and in fome degree tranfparent; it is light, moderately hard, very flexile, and of fcarce any fmell, and very little tafte. We ufually receive it in twifted pieces of an oblong and rounded figure, and bent in the fhape of a horfe-fhoe: this our druggifts ufually beat and pull to pieces, and fell it in thin fhreds like fkins, which eafily diffolve: befides this kind of round ifinglafs, we meet with fome in fmall thin fquare cakes, white and very tranfparent; thefe are the fineft of all. But ifinglafs, of whatever fhape, is to be chofen clean, whitifh, and pellucid.

The method of preparing the ichthyocolla is this: they cut off all the fins of the hufo, clofe to the flefh, and take out the bladder, ftomach, and inteftines; they wafh thefe very clean, and then cut them in pieces, and throwing them into a large quantity of water, they let them fteep four and twenty hours, and after this they kindle a fire under the veffel, and keep the liquor juft boiling till the greater part of the matters are diffolved; they then ftir the whole brifkly about; then ftrain it through flannels, and fet the liquor by to cool. When there is a large quantity of fat ufually formed upon it, which is carefully fkimmed off, and the clear liquor is poured off from the groffer parts which fubfide, it is put over the fire again, and gently evaporated and fkimmed afrefh all the time, till by trials they find, that on letting a fpoonful of it cool it will harden into the confiftence of glue. Great care is taken to keep the fire very gentle, to prevent burning towards the end of this evaporation. They then pour it out upon a large, fmooth, wooden table; and as it cools, form it into the maffes we meet with it in, by cutting and rolling it up.

The greateft quantity of ifinglafs is made in Ruffia. We have it principally from Holland, the Dutch contracting for the moft of it before it is made.

It is an excellent agglutinant and ftrengthener; and is often prefcribed in jellies and broth, but rarely enters any compofitions of the regular medicinal form. It is the moft efficacious as well as the moft fafe and innocent of all the ingredients ufed for cleaning wines, upon which account the wine-coopers ufe a much greater quantity of it than the apothecaries.

A very valuable glue is alfo made of this drug, which is a proper form to keep it for the wine-coopers ufe.

ICHTHYOLOGY, the fcience of fifhes, or that branch of zoology which treats of fifhes. See NATURAL HISTORY.

ICHTHYPERIA, in natural hiftory, a name given by Dr Hill to the bony palates and mouths of fifhes, ufually met with either foffile, in fingle pieces, or in fragments. They are of the fame fubftance with the bufonitæ; and are of very various figures, fome broad and fhort, others longer and flender; fome very gibbofe, and others plainly arched. They are likewife of various fizes, from the tenth of an inch to two inches in length, and an inch in breadth.

ICOSAHEDRON, in geometry, a regular folid, confifting of twenty triangular pyramids, whofe vertexes meet in the centre of a fphere, fuppofed to circumfcribe it; and therefore, have their height and bafes equal: wherefore the folidity of one of thofe pyramids multiplied by 20, the number of bafes, gives the folid content of the icofahedron.

ICOSANDRIA, in the Linnæan fyftem of botany. See BOTANY, p. 635.

IDA, a mountain in the ifland of Candia or Crete; alfo another in Natolia, or leffer Afia, celebrated by the poets for the judgment of Paris on the beauty of the three goddeffes, Minerva, Juno, and Venus, to the laft of whom he gave the preference.

IDEA, the reflex perception of objects, after the original perception or impreffion has been felt by the mind. See METAPHYSICS.

IDENTITY, denotes that by which a thing is itfelf, and not any thing elfe; in which fenfe, indentity differs from fimilitude as well as diverfity. See METAPHYSICS.

IDES, in the ancient Roman calendar, were eight days in each month; the firft of which fell on the 15th of March, May, July, and October; and on the 13th day of the other months.

They were reckoned backwards, in the manner already explained under the article CALENDS.

Thus they called the 14th day of March, May, July, and October; and the 12th of the other months, the *pridie idus*, or the day before the ides; the next preceding day, they called the *tertio idus*; and fo on, reckoning always backwards, till they come to the nones. See NONES. This method of reckoning time is ftill retained in the chancery of Rome, and in the calendar of the breviary.

IDIOM, among grammarians, properly fignifies the peculiar

culiar genius of each language, but it is often uſed in a ſynonymous ſenſe with dialect.

IDIOPATHY, in phyſic, a diſorder peculiar to a certain part of the body, and not ariſing from any preceding diſeaſe; in which ſenſe, it is oppoſed to ſympathetic. Thus, an epilepſy is idiopathic, when it happens merely through ſome fault in the brain; and ſympathetic, when it is the conſequence of ſome other diſorder.

IDIOSYNCRASY, among phyſicians, denotes a peculiar temperament of body, whereby it is redered more liable to certain diſorders than perſons of a different conſtitution uſually are.

IDIOT, a perſon that is born a natural fool.

IDOLATRY, or the worſhip of idols, may be diſtinguiſhed into two ſorts. By the firſt, men adore the works of God, the ſun, the moon, the ſtars, angels, dæmons, men and animals: by the ſecond, men worſhip the work of their own hands, as ſtatues, pictures, and the like: and to theſe may be added a third, that by which men have worſhipped the true God under ſenſible figures and repreſentations. This indeed may have been the caſe with reſpect to each of the above kinds of idolatry; and thus the Iſraelites adored God under the figure of a calf.

The ſtars were the firſt objects of idolatrous worſhip; and on account of their beauty, their influence on the productions of the earth, and the regularity of their motions, particularly the ſun and moon, which are conſidered as the moſt glorious and reſplendent images of the Deity: afterwards, as their ſentiments became more corrupted, they began to form images, and to entertain the opinion, that by virtue of conſecration, the gods were called down to inhabit or dwell in their ſtatues. Hence Arnobius takes occaſion to rally the pagans for guarding ſo carefully the ſtatues of their gods, who, if they were really preſent in their images, might ſave their worſhippers the trouble of ſecuring them from thieves and robbers.

As to the adoration which the ancient pagans paid to the ſtatues of their gods, it is certain, that the wiſer and more ſenſible heathens conſidered them only as ſimple repreſentations or figures deſigned to recal to their minds the memory of their gods. This was the opinion of Varro and Seneca: and the ſame ſentiment is clearly laid down in Plato, who mentains, that images are inanimate, and that all the honour paid to them has reſpect to the gods whom they repreſent. But as to the vulgar, they were ſtupid enough to believe the ſtatues themſelves to be gods, and to pay divine worſhip to ſtocks and ſtones.

Soon after the flood, idolatry ſeems to have been the prevailing religion of all the world; for where-ever we caſt our eyes at the time of Abraham, we ſcarcely ſee any thing but falſe worſhip and idolatry. And it appears from ſcripture, that Abraham's forefathers, and even Abraham himſelf, were for a time idolaters.

The Hebrews were indeed expreſsly forbidden to make any repreſentation of God; they were not ſo much as to look upon an idol: and from the time of the Maccabees to the deſtruction of Jeruſalem, the Jews extended this precept to the making the figure of any man: by the law of Moſes, they were obliged to deſtroy all the images they found, and were forbidden to apply any of the gold or ſilver to their own uſe, that no one might receive the leaſt profit from any thing belonging to an idol. Of this the Jews, after they had ſmarted for their idolatry, were ſo ſenſible, that they thought it unlawful to uſe any veſſel that had been employed in ſacrificing to a falſe god, to warm themſelves with the wood of a grove, after it was cut down, or to ſhelter themſelves under its ſhade.

But the preaching of the Chriſtian religion, where-ever it prevailed, entirely rooted out idolatry; as did alſo that of Mahomet, which is built on the worſhip of one God. It muſt not, however, be forgotten, that the proteſtant Chriſtians charge thoſe of the church of Rome with paying an idolatrous kind of worſhip to the pictures or images of ſaints and martyrs: before theſe, they burn lamps and wax-candles; before theſe, they burn incenſe, and kneeling offer up their vows and petitions: they, like the pagans, believe that the ſaint to whom the image is dedicated, preſides in a particular manner about its ſhrine, and works miracles by the intervention of its image; and that if the image was deſtroyed or taken away, the ſaint would no longer perform any miracle in that place.

IDYLLION, in ancient poetry, is only a diminutive of the word [*eidos*,] and properly ſignifies any poem of moderate extent, without conſidering the ſubject. But as the collection of Theocritus's poems were called idyllia, and the paſtoral pieces being by far the beſt in that collection, the term idyllion ſeems to be now appropriated to paſtoral pieces.

JEALOUSY, in general, denotes the fear of a rival; but is more eſpecially underſtood of the ſuſpicion which married people entertain of each other's fidelity and affection.

JEDBURGH, the capital of Tiviotdale or Roxburgh, in Scotland, thirty-ſix miles ſouth-eaſt of Edinburgh: W. long. 2° 15′, N. lat. 55° 25′.

JEDDO, the capital city of Japan Proper, ſituated on the eaſt ſide of the iſland: E. long. 141° N. lat. 36°.

The ſplendor of the royal palace and public buildings of this city, in the opinion of thoſe Europeans who have ſeen it, is no where to be equalled. The emperor's palace and gardens, which are in the middle of the city, are five miles in circumference. All the houſes are built upon one floor, and the rooms are only divided by folding ſcreens.

JEER, or Jeer-rope, in a ſhip, is a large rop reeved through double or treble blocks, laſhed at the maſt-head and on the yard, in order to hoiſt or lower the yards.

JEHOVAH, one of the ſcripture names of God, ſignifying the Being who is ſelf-exiſtent and gives exiſtence to others.

So great a veneration had the Jews for this name, that they left off the cuſtom of pronouncing it, whereby its true pronunciation was forgotten. They call it tetragrammaton, or the name with four letters; and believe, that whoever knows the true pronunciation of it cannot fail to be heard by God.

JEJU-

JEJUNUM, in anatomy. See ANATOMY, p. 260.

JEMPTERLAND, a province of Sweden, bounded by Angermania on the north, by Medelpadia on the eaft, by Helfingia on the fouth, and by Norway on the weft.

JENA, a city of Germany, in the circle of Upper Saxony, and the landgraviate of Thuringia: E. lon. 11° 44′, N. lat. 51°.

JENKOPING, a city of Sweden, in the province of Gothland, fituated ninety miles fouth-eaft of Gottenburg: E. long. 14° 30′, N. 57° 30′.

JEREMIAH, *The prophecy of*, a canonical book of the Old Teftament. This divine writer was of the race of the priefts, the fon of Hilkiah of Anathoth, in the tribe of Benjamin. He was called to the prophetic office when very young, about the thirteenth of Jofiah, and continued in the difcharge of it about forty years. He was not carried captive to Babylon with the other Jews, but remained in Judea to lament the defolation of his country. He was afterwards a prifoner in Egypt with his difciple Baruch, where it is fuppofed he died in a very advanced age. Some of the Chriftian fathers tell us, he was ftoned to death by the Jews, for preaching againft their idolatry; and fome fay, he was put to death by Pharaoh Hophra, becaufe of his prophecy againft him. Part of the prophecy of Jeremiah relates to the time after the captivity of Ifrael, and before that of Judah, from the firft chapter to the forty-fourth; and part of it was in the time of the latter captivity, from the forty-fourth chapter to the end. The prophet lays open the fins of Judah with great freedom and boldnefs, and reminds them of the fevere judgments, which had befallen the ten tribes for the fame offences. He paffionately laments their misfortune, and recommends a fpeedy reformation to them. Afterwards he predicts the grievous calamities that were approaching, particularly the feventy years captivity in Chaldæa. He likewife foretells their deliverance and happy return, and the recompence which Babylon, Moab, and other enemies of the Jews fhould meet with in due time. There are likewife feveral intimations in this prophecy concerning the kingdom of the Meffiah; alfo feveral remarkable vifions, and types, and hiftorical paffages relating to thofe times. The fifty-fecond chapter does not belong to the prophecy of Jeremiah, which probably was added by Ezra, and contains a narrative of the taking of Jerufalem, and of what happened during the captivity of the Jews, to the death of Jechonias. St. Jerom has obferved upon this prophet, that his ftyle is more eafy than that of Ifaiah and Hofea; that he retains fomething of the rufticity of the village where he was born; but that he is very learned and majeftic, and equal to thofe two prophets in the fenfe of his prophecy.

JERSEY, an ifland in the Englifh channel, fifteen miles weft of the coaft of Normandy, and eighty miles fouth of Portland in Dorfetfhire: W. long. 2° 20′, N. lat. 49° 20′.

New JERSEY, a province in North America, which may be bounded on the north by a line drawn from the river Delawar to Hudfon's river, which divides it from New-York; by the Atlantic Ocean, on the eaft; by the fame ocean on the fouth; and by Delawar bay and river, which feparates it from Penfilvania, on the weft. It lies between 74° and 76° of W. long. and between 39° and 41° of N. lat. and is about 140 miles in length, and 60 in breadth. It is fubject to Britain.

JERUSALEM, the capital city of Judea, or Paleftine, in Afiatic Turky, fituated thirty miles eaft of the Levant, or Mediterranean fea, and ninety miles fouth of Damafcus: E. long. 36°, N. lat. 32°.

It ftands on a high rock, with fteep afcents on every fide, except on the north; and is furrounded with a deep valley, which is again incompaffed with hills. The city is at prefent three miles in circumference, and has a little altered its fituation: for mount Calvary, which was formerly without the walls, ftands now in the middle of the city; and mount Sion, which ftood near the centre, is now without the walls.

JESI, a city of Italy, in the province of Ancona, and territory of the pope: E. long. 14° 40′, N. lat. 43° 45′.

JESSELMERE, the capital of the province of the fame name in the Eaft Indies, fubject to the Mogul: E. long. 73° 20′, N. lat. 27°.

JESSO, or YEDSO, a country of Afia, which lies north of Japan, and is faid to extend north-eaft to the continent of America: E. long. 140°, N. lat. 40°.

JESUAT, a province of India, bounded by Patan on the north, and by Bengal on the fouth; fubject to the Mogul.

JESUITES, or the fociety of Jefus, a famous religious order in the Romifh church, founded by Ignatius Loyola, a native of Guipufcoa in Spain, who in the year 1538 affembled ten of his companions at Rome, principally chofen out of the univerfity of Paris, and made a propofal to them to form a new order; when, after many deliberations, it was agreed to add to the three ordinary vows of chaftity, poverty, and obedience, a fourth; which was, to go into all countries whither the pope fhould pleafe to fend them, in order to make converts to the Romifh church. Two years after, pope Paul III. gave them a bull, by which he approved this new order, giving them a power to make fuch ftatutes as they fhould judge convenient: on which, Ignatius was created general of the order; which in a fhort time fpread over all the countries of the world, to which Ignatius fent his companions, while he ftaid at Rome, from whence he governed the whole fociety.

The entire fociety is compofed of four forts of members; novices, fcholars, fpiritual and temporal coadjutors, and profeffed members. The novices continue fo two years; after which they are admitted to make the three fimple vows, of chaftity, poverty, and obedience, in the prefence of their fuperiors: the fcholars add fome fpiritual exercifes to their ftudies. The fpiritual coadjutors affift the profeffed members, and alfo make the three fimple vows: the temporal coajutors,

or

or lay-brothers, take care of the temporal affairs of the ſociety; and the profeſſed members, which compoſe the body of the ſociety, beſides the three ſimple vows, add a ſpecial vow of obedience to the head of the church in every thing relating to miſſions among idolaters and heretics. They have profeſſed houſes for their profeſſed members and their coadjutors; colleges, in which the ſciences are taught to ſtrangers; and ſeminaries, in which the young Jeſuits go through a courſe of philoſophy and theology. They are governed by a general, who has four aſſiſtants, and who appoints rectors, ſuperiors of houſes, provincials, viſitors, and commiſſaries. The diſcipline of theſe houſes, and eſpecially of the colleges, was regulated by Ignatius himſelf. On account of the groſs doctrines and bad practices of the Jeſuits, the order, within theſe few years, has been ſuppreſſed in moſt Roman-catholic countries, the members baniſhed, and their goods confiſcated.

JET, in natural hiſtory, a ſolid, dry, opake, inflammable ſubſtance, found in large detached maſſes, of a fine and regular ſtructure, having a grain like that of wood, ſplitting more eaſily horizontally than in any other direction, very light, moderately hard, not fuſible, but readily inflammable, and burning a long time with a fine greeniſh flame.

It is of a fine deep black colour, very gloſſy and ſhining, except upon its ſurface, where it has been fouled by accident. When examined by the microſcope, it is found to be compoſed of a number of parallel plates, very thin, and laid cloſely upon one another. It is not ſoluble in, nor makes any efferveſcence with acids. It ſhould be choſen of the deepeſt black, of a moderate hardneſs, very light, and ſuch as will ſplit moſt evenly in an horizontal direction; this being its great characteriſtic, by which it is diſtinguiſhed from the cannel coal, which breaks equally eaſy any way.

Jet is of great uſe to perfumers, and is ſometimes preſcribed in medicine. Dioſcorides tells us, that it is an excellent emollient and diſcutient, and recommends a fumigation of it for diſeaſes of the womb; and among the eaſtern nations, it is ſtill in high repute as a cordial, a ſtrengthener, and prolonger of life.

Every pound of jet pays on importation a duty of $7\frac{70}{100}$d. and draws back $6\frac{75}{100}$d. on exportation.

JET D'EAU, a French term, frequently alſo uſed with us, for a fountain that caſts up water to a conſiderable height in the air.

JEWEL, any precious ſtone, or ornament beſet with them. See the articles DIAMOND, RUBY, &c.

JEWS, thoſe who profeſs obedience to the laws and religion of Moſes.

When a modern Jew builds an houſe, he muſt leave part of it unfurniſhed, in remembrance that the temple and Jeruſalem now lie deſolate. They lay great ſtreſs upon frequent waſhings. They abſtain from meats prohibited by the Levitical law; for which reaſon, whatever they eat muſt be dreſſed by Jews, and after a manner peculiar to themſelves. Every Jew is obliged to marry, and a man who lives to twenty unmarried, is accounted as actually living in ſin.

The Jews, it is ſaid, were formerly at the diſpoſal of the chief lord where they lived, and likewiſe all their goods. A Jew may be a witneſs by our law, being ſworn on the Old Teſtament, and taking the oaths to the government.

For a farther account of the Jew, ſee the articles CARAITES, CIRCUMCISION, LEVITES, PASSOVER, PHARISEES, RABBINS, SADDUCEES, SANHEDRIM, SYNAGOGUE, TALMUD, &c.

JEW'S EARS, in botany, See TREMELLA.

IGLAW, a town of Germany, in the province of Moravia, ſituated on the river Igla, on the frontiers of Bohemia; ſubject to the houſe of Auſtria: E. long. 15° 7′, N. lat. 49° 16′.

IGNAVUS, in zoology. See BRADYPUS.

IGNIS. See FIRE.

IGNIS-FATUUS. See WILL *with-a-wiſp*.

IGNITION, in chemiſtry, the heating metals red hot, without melting them.

IGNORANCE, the privation or abſence of knowledge.

The cauſes of ignorance, according to Locke, are chiefly theſe three. 1. Want of ideas. 2. Want of a diſcoverable connection between the ideas we have. 3. Want of tracing and examining our ideas. See METAPHYSICS.

IGUANA, in zoology. See LACERTA.

IHOR, the capital of the province of Ihor, in Malacca, near the ſouth cape of the further peninſula of India, ſubject to the Dutch: E. lon. 103°, N. lat. 3°.

ILCHESTER, a borough-town of Somerſetſhire, fourteen miles ſouth of Wells. It ſends two members to parliament.

ILEX, the HOLM-OAK, or EVER-GREEN OAK, in botany, a genus of the tetrandria tetragynia claſs. The calix has four teeth; the corolla is rotated; it has no ſtylus; and the berry contains four ſeeds. There are five ſpecies, none of them natives of Britain. The kermes of the ſhops adheres and is gathered off the branches of the ilex aquifolium. The kermes is a round grain about the bulk of a pea. Theſe grains appear full of ſmall reddiſh ovula, or animalcules, of which they are the nidus. The kermes is a grateful mild reſtringent and corroborant.

ILHEOS, or RIO DE ILHEOS, a province of Brazil in ſouth America, ſubject to Portugal. It is bounded by the bay of All-ſaints on the north, and by the Atlantic ocean on the eaſt.

ILIAC PASSION, in medicine. See MEDICINE.

ILIACUS MUSCULUS, in anatomy. See ANATOMY, p. 204.

ILIAD, the name of an ancient epic poem, the firſt and fineſt of thoſe compoſed by Homer.

The poet's deſign in the iliad was to ſhew the Greeks, who were divided into ſeveral little ſtates, how much it was their intereſt to preſerve a harmony and good underſtanding among themſelves: for which end, he ſets before them the calamities that befel their anceſtors from the wrath of Achilles, and his miſunder-

ſtanding with Agamemnon; and the advantages that afterwards accrued to them from their union. The Iliad is divided into twenty-four books, or rhapſodies, which are marked with the letters of the alphabet.

ILIUM, in anatomy. See ANAT. p. 260.

ILLENOIS, the inhabitants of a country contiguous to the illenois-lake, in Canada, in north America, which is ſituated between 88° and 93° of W. lon. and between 41° and 46° of N. lat.

ILLER, a river of Germany, which riſing in the mountains of Tyrol, runs north through Swabia, and falls into the Danube at Ulm.

ILMEN, a lake in the province of Great Novogrod, in Ruſſia, in 34° E. lon. and 58° N. lat.

ILMINSTER, a market-town of Somerſetſhire, twenty-four miles ſouth-weſt of Wells.

IMAGE, in a religious ſenſe, is an artificial repreſentation or ſimilitude of ſome perſon or thing, uſed either by way of decoration and ornament, or as an object of religious worſhip and veneration; in which laſt ſenſe, it is uſed indifferently with the word idol.

IMAGINATION, a power or faculty of the mind, whereby it conceives and forms ideas of things communicated to it by the outward organs of ſenſe. See METAPHYSICS.

IMAN, a name applied by the Mahometans to him who is head of the congregations in their moſques; and, by way of eminence, to him who has the ſupreme authority both in reſpect to ſpirituals and temporals.

IMBECILLITY, a languid, infirm ſtate of body; which, being greatly impaired, is not able to perform its uſual exerciſes and functions.

IMBIBING, the action of a dry porous body, that abſorbs or takes up a moiſt or fluid one: thus, ſugar imbibes water; a ſpunge, the moiſture of the air, *&c.*

IMBRICATED, among botaniſts. See BOTANY, p. 641.

IMENSTAT, a town of Germany, in the circle of Swabia; ſituated in E. lon. 10° 8′. N. lat. 47° 26′.

IMITATION, the acts of doing or ſtriving to copy after, or become like to, another perſon or thing.

Du Bos obſerves, that the principal merit of poems and pictures conſiſts in the imitation of ſuch objects as would have excited real paſſions; and that the paſſions which theſe imitations give riſe to, are only ſuperficial, and not ſo ſtrong as that of the object imitated, and are therefore ſoon effaced. He alſo maintains, that the imitation of tragic objects in poems and pictures, afford moſt pleaſure: we liſten, therefore, with pleaſure to thoſe unhappy men who make a recital of their misfortunes by means of a painter's pencil, or of a poet's verſes; but, as Diogenes Laertius obſerves, it would afflict us extremely, were we to hear them bewailing their ſad diſaſters in perſon.

IMMACULATE, ſomething without ſtain, chiefly applied to the conception of the holy virgin.

IMMATERIAL, ſomething devoid of matter, or that is pure ſpirit: thus God, angels, and the human ſoul, are immaterial beings.

IMMEDIATE, whatever is capable of producing an effect without the intervention of external means; thus we ſay, an immediate cauſe, in oppoſition to a mediate or remote one.

IMMENSITY, an unlimited extenſion, or which no finite and determinate ſpace, repeated ever ſo often, can equal.

IMMERSION, that act by which any thing is plunged into water or other fluid.

It is uſed in chemiſtry for a ſpecies of calcination, when any body is immerſed in a fluid to be corroded; or it is a ſpecies of lotion, as when a ſubſtance is plunged into any fluid in order to deprive it of a bad quality, or communicate to it a good one.

IMMERSION, in aſtronomy, is when a ſtar or planet is ſo near the ſun with regard to our obſervations, that we cannot ſee it; being, as it were, inveloped and hid in the rays of that luminary. It alſo denotes the beginning of an eclipſe of the moon, or that moment when the moon begins to be darkened, and to enter into the ſhadow of the earth.

IMMORTAL, that which will laſt to all eternity, as having in it no principle of alteration or corruption: thus God and the human ſoul are immortal.

IMMUNITY, a privilege or exemption from ſome office, duty, or impoſition, as an exemption from tolls, *&c.*

Immunity is more particularly underſtood of the liberties granted to cities and communities.

IMPALED, in heraldry; when the coats of a man and his wife who is not an heireſs are borne in the ſame eſcutcheon, they muſt be marſhalled in pale; the huſband's on the right ſide, and the wife's on the left: and this the heralds call baron and feme, two coats impalled.

If a man has had two wives, he may impale his coat in the middle between theirs; and if he has had more than two, they are to be marſhalled on each ſide of his in their proper order.

IMPALPABLE, that whoſe parts are ſo extremely minute that they cannot be diſtinguiſhed by the ſenſes, particularly by that of feeling.

IMPANATION, a term uſed by divines, to ſignify the opinion of the Lutherans with regard to the euchariſt, who believe that the ſpecies of bread and wine remain together with the body of our Saviour after conſecration.

IMPANNELLING, in law, ſignifies the writing down or entering into a parchment, liſt or ſchedule, the names of a jury ſummoned by the ſheriff to appear for ſuch public ſervices as juries are employed in.

IMPARLANCE, in law, a petition in court for a day to conſider or adviſe what anſwer the defendant ſhall make to the plaintiff's action; and is the continuance of the cauſe till another day, or a longer time given by the court.

IMPASTATION, the mixtion of various materials of different colours and conſiſtencies, baked or bound together with ſome cement, and hardened either by the air or by fire.

IMPATIENS, in botany, a genus of the ſyngeneſia monogynia claſs. The calix conſiſts of two leaves, and the

the corolla of five irregular petals; and the capsule has five valves. There are seven species, only one of which, *viz.* the noli-me-tangere, or touch-me-not, is a native of Britain.

IMPEACHMENT, an accusation and prosecution for treason and other crimes and misdemeanors.

IMPENETRABILITY, in philosophy, that property of body, whereby it cannot be pierced by another: thus, a body, which so fills a space as to exclude all others, is said to be impenetrable.

IMPERATIVE, one of the moods of a verb, used when we would command, intreat, or advise: thus, *go*, *read*, *take pity*, *be advised*, are imperatives in our language.

IMPERATOR, in Roman antiquity, a title of honour conferred on victorious generals, by their armies, and afterwards confirmed by the senate.

IMPERATORIA, MASTER-WORT, in botany, a genus of the pentandria digynia class. The fruit is roundish, compressed, and gibbous in the middle. There is but one species, a native of Switzerland. The root of this plant, though an excellent aromatic, has only place in the plague-water of the Edinburgh pharmacopœia.

IMPERFECT, something that is defective, or that wants some of the properties found in other beings of the same kind.

IMPERIAL, something belonging to an emperor or empire, as imperial crown, imperial chamber, imperial cities, imperial diet, *&c.*

IMPERSONAL VERB, in grammar, a verb to which the nominative of any certain person cannot be prefixed; or, as others define it, a verb destitute of the two first and primary persons, as *decet*, *oportet*, &c.

IMPERVIOUS, a thing not to be pervaded nor passed thro', either by reason of the closeness of its pores, or the particular configuration of its parts.

IMPETUS, in mechanics, the force with which one body impels or strikes another. See MECHANICS.

IMPLICATION, in law, is where something is implied, that is not expressed by the parties themselves in their deeds, contracts, and agreements.

IMPORTATION, in commerce, the bringing merchandize into a kingdom from foreign countries; in contradistinction to exportation. See EXPORTATION.

We shall here give some of the principal laws relating to the importation of goods into this kingdom. Goods imported without entry, or paying customs, are forfeited; and the lord-treasurer, the barons of the exchequer, or chief magistrates of the place where the offence was committed, or next adjoining to it, may grant a warrant to any person, who, with the assistance of a constable, may break open doors, chests, *&c.* and take thence any prohibited or unaccustomed goods; but this is to be done within one month after the offence was committed. But if false information is given, the person wrongfully accused, may recover costs and damages.

No ship or vessel arriving from beyond sea is to be above three days in sailing from Gravesend to the place of discharge on the river Thames, unless hindered by contrary winds or other impediment. And no ship bound for the port of London is to touch or stay at any place adjoining to any shore, between Gravesend and Chester-quay. True entries are to be made of all such ships lading, upon oath of the master or purser for that voyage; also where she took in her lading, where she was built, how manned, who were the owners, and who the master during the voyage. In all out-ports, ships are to come directly to the place of unlading, and make true entries as aforesaid, upon penalty of the forfeiture of 100 l.

After any ship is cleared, and the watchmen and tidesmen discharged from their attendance, if there be found on board any concealed goods that have not paid the duty inwards, the master, or other person taking charge of the ship, shall forfeit 100 l.

Porters, carmen, watermen, *&c.* assisting in landing unaccustomed goods, shall, on conviction, for the first offence, be committed to the next jail till they find security for their good behaviour; and for their second offence, they are to be committed to prison for two months, without bail or mainprize, or till they are discharged by the court of exchequer, or each of them pay 5 l. to the sheriff of the county.

No merchant-denizen shall cover a stranger's goods, but shall, by himself or agent, sign one of his bills of every entry, with the mark, number, and contents of every parcel of goods, without which no entry shall pass. And no children of aliens under the age of twenty one years, shall have entry made in their names, nor be permitted to trade.

Merchants, trading into the port of London, shall have free liberty to lade and unlade their goods at any of the lawful quays between the Tower and London-bridge, from sun-rising to sun-setting, from September 10, to March 10; and between six o' clock in the morning and six in the evening, from March 10, to September 10; giving notice thereof to the respective officers, appointed to attend the lading and unlading of goods. And such officers as shall refuse to be present shall forfeit 5 l. for every default.

To prevent combination between importers, and seizers of goods unlawfully imported or exported, none shall seize them but the officers of the customs, or such as shall be authorised so to do by the lord treasurer, under-treasurer, or a special commission from his majesty, under the great privy seal.

If any seizer of prohibited or unaccustomed goods does not make due prosecution thereof, it is lawful for the custom-house officers, or others deputed thereto, to make seizure of such goods, and they shall be, in law, adjudged the first true informers and seizers, and have the benefit thereof, notwithstanding any law and statute to the contrary.

All foreign goods permitted to be landed by bills at sight, bills at view, or suffrance, shall be landed at the most convenient quays and wharfs, as the officers of the customs shall direct; and there, or at the king's storehouse of the respective ports, shall be measured, weighed, numbered, *&c.* by the officers appointed, who shall perfect the entry, and subscribe their names to it, and the next day make their report to the customer, collector,

or comptroller; or in default thereof, ſhall forfeit 100 l.

Any merchant who ſhall import goods, ſhall have liberty to break bulk in any lawful port or quay, the maſter or purſer firſt making oath of the true contents of the ſhip's lading. No Engliſh merchant ſhall put on ſhore in Scotland or Ireland, any merchandize of the growth or produce of any of his majeſty's plantations, unleſs the ſame have been firſt landed in England, Wales, or Berwick, and paid the duties with which they are chargeable, under the penalty of forfeiting the ſhip and goods, three fourths to the king, and one fourth to the informer, or he that ſhall ſue for the ſame: but if a ſhip be diſabled, or driven into any port of Ireland, and unable to proceed on her voyage, her goods may be put on ſhore, under the hands of the principal officers of the cuſtoms there reſiding, till the goods can be put on board ſome other veſſel, to be tranſported to ſome part of England or Wales.

Natives of England or Ireland may import into England, directly from Ireland, any hemp, flax, thread, yarn and linen, of the growth and manufacture of Ireland, cuſtom-free; the chief officer ſo importing bringing a certificate from the chief office in Ireland, expreſſing the particulars of the goods, with the names and places of abode of the exporters thence, and of ſuch as have ſworn that the ſaid goods are, bona fide, of the growth and manufacture of that kingdom, and who they are conſigned to in England; and the chief officer ſhall make oath, that the ſaid goods are the ſame that are on board, by virtue of that certificate.

IMPOST, in law, ſignifies in general a tribute or cuſtom, but is more particularly applied to ſignify that tax which the crown receives for merchandizes imported into any port or haven.

IMPOSTS, in architecture, the capitals of pillars, or pilaſters, which ſupport arches.

IMPOSTHUME, in ſurgery, *&c.* See ABSCESS.

IMPOTENCE, or IMPOTENCY, in general, denotes want of ſtrength, power, or means to perform any thing.

Divines and philoſophers diſtinguiſh two ſorts of impotency; natural, and moral. The firſt is a want of ſome phyſical principle, neceſſary to an action; or where a being is abſolutely defective, or not free and at liberty to act: the ſecond only imports a great difficulty, as a ſtrong habit to the contrary, a violent paſſion, or the like.

Impotency is, more particularly, uſed for a natural inability to coition. Impotence with reſpect to men, is the ſame as ſterility in women; that is, an inability of propagating the ſpecies. There are many cauſes of impotence; as, a natural defect in the organs of generation, which ſeldom admits of a cure: accidents, or diſeaſes; and in ſuch caſes the impotence may, or may not be remedied, according as theſe are curable or otherwiſe.

IMPREGNATION, the getting a female with-child. See PREGNANCY.

The term impregnation is alſo uſed, in pharmacy, for communicating the virtues of one medicine to another, whether by mixture, coction, digeſtion, *&c.*

IMPRESSION is applied to the ſpecies of objects, which are ſuppoſed to make ſome mark or impreſſion on the ſenſes, the mind, and the memory.

The peripatetics aſſert, that bodies emit ſpecies reſembling them, which are conveyed to the common ſenſorium, and they are rendered intelligible by the active intellect; and when thus ſpiritualized, are called expreſſions, or expreſs ſpecies, as being expreſſed from the others.

IMPRESSION alſo denotes the edition of a book, regarding the mechanical part only; whereas edition, beſides this, takes in the care of the editor, who corrected or augmented the copy, adding notes, *&c.* to render the work more uſeful.

IMPROBATION, in Scots law, the name of that action brought for ſetting any deed or writing aſide upon the head of forgery. See LAW, tit. 33.

IMPROPRIATION, a parſonage or eccleſiaſtical living, the profits of which are in the hands of a layman; in which ſenſe, it ſtands diſtinguiſhed from appropriation, which is where the profits of a benefice are in the hands of a biſhop, college, *&c.* though theſe terms are now often uſed promiſcuouſly.

IMPULSE, in machanics. See MECHANICS.

IMPURITY, in the law of Moſes, is any legal defilement. Of theſe there were ſeveral ſorts; ſome were voluntary, as the touching a dead body, or any animal that died of itſelf, or any creature that was eſteemed unclean; or the touching things holy, by one who was not clean, or was not a prieſt; the touching one who had a leproſy, one who had a gonorrhœa, or who was polluted by a dead carcaſe, *&c.* Sometimes theſe impurities were involuntary, as when any one inadvertently touched bones, or a ſepulchre, or any thing polluted; or fell into ſuch diſeaſes as pollute, as the leproſy, *&c.*

IMPUTATION, in general, the charging ſomething to the account of one, which belonged to another: thus, the aſſertors of original ſin maintain, that Adam's ſin is imputed to all his poſterity.

In the ſame ſenſe, the righteouſneſs and merits of Chriſt are imputed to true believers.

INACCESSIBLE, ſomething that cannot be come at, or approached, by reaſon of intervening obſtacles, as a river, rock, *&c.* It is chiefly uſed in ſpeaking of heights and diſtances. See GEOMETRY.

INALIENABLE, that which cannot be legally alienated or made over to another: thus the dominions of the king, the revenues of the church, the eſtates of a minor, *&c.* are inalienable, otherwiſe than with a reſerve of the right of redemption.

INANIMATE, a body that has either loſt its ſoul, or that is not of a nature capable of having any.

INANITION, among phyſicians, denotes the ſtate of the ſtomach when empty, in oppoſition to repletion.

INARCHING, in gardening, is a method of grafting, commonly called grafting by approach, and is uſed when the ſtock intended to graft on, and the tree from which the graft is to be taken, ſtand ſo near, or

can

can be brought ſo near, that they may be joined together.

INAUGURATION, the coronation of an emperor or king, or the conſecration of a prelate: ſo called from the ceremonies uſed by the Romans, when they were received into the college of augurs.

INCA, or YNCA, a name given by the natives of Peru to their kings and the princes of the blood. Pedro de Cieça, in his Chronicle of Peru, gives the origin of the incas, and ſays, that that country was, for a long time, the theatre of all manner of crimes, of war, diſſention, and the moſt dreadful diſorders, till at laſt two brothers appeared, one of whom was called Mangocapa; of this perſon, the Peruvians relate many wonderful ſtories. He built the city of Cuſco, made laws, eſtabliſhed order and harmony by his wiſe regulations; and he and his deſcendents took the name of inca, which ſignifies king or great lord. Theſe incas became ſo powerful, that they rendered themſelves maſters of all the country from Paſto to Chili, and from the river Maule on the ſouth, to the river Augaſmago on the north; theſe two rivers forming the bounds of their empire, which extended above thirteen hundred leagues in length. This they enjoyed till the diviſions between inca Guaſcar and Atabalipa; which the Spaniards laying hold of, made themſelves maſters of the country, and deſtroyed the empire of the incas.

INCAMERATION, a term uſed in the chancery of Rome, for the uniting of lands, revenues, or other rights, to the pope's domain.

INCANTATION, denotes certain ceremonies, accompanied with a formula of words, and ſuppoſed to be capable of raiſing devils, ſpirits, *&c.* See CHARM, *&c.*

INCAPACITY, in the canon-law, is of two kinds: 1. The want of a diſpenſation for age in a minor, for legitimation in a baſtard, and the like: this renders the proviſion of a benefice void in its original. 2. Crimes and heinous offences, which annul proviſions at firſt valid.

INCARNATION, in theology, the act whereby the ſecond perſon of the holy Trinity aſſumed the human nature, *viz.* a true body and reaſonable ſoul, in order to accompliſh the redemption of fallen mankind.

INCARNATIVES, in ſurgery, medicines which aſſiſt nature in filling up wounds or ulcers with fleſh; or rather remove the obſtructions thereto.

INCENSE, or FRANK-INCENSE, in the materia medica, *&c.* a dry reſinous ſubſtance, known among authors by the names thus and olibanum.

Incenſe is a rich perfume, with which the ancient pagans, and the Roman Catholics ſtill, perfume their temples, altars, *&c.*

The burning of incenſe made part of the daily ſervice of the ancient Jewiſh church. The prieſts drew lots to know who ſhould offer it; the deſtined perſon took a large ſilver diſh, in which was a cenſer full of incenſe; and being accompanied by another prieſt, carrying ſome live coals from the altar, went into the temple. There, in order to give notice to the people, they ſtruck upon an inſtrument of braſs placed between the temple and the altar; and being returned to the altar, he who brought the fire left it there, and went away. Then the offerer of incenſe having ſaid a prayer or two, waited the ſignal, which was the burning of the holocauſt; immediately upon which he ſet fire to the incenſe, the whole multitude continuing all the time in prayer. The quantity of incenſe offered each day, was half a pound in the morning, and as much at night.

One reaſon of this continual burning of incenſe might be, that the multitude of victims that were continually offered up, would have made the temple ſmell like a ſlaughter-houſe, and conſequently have inſpired the comers rather with diſguſt and averſion, than awe and and reverence, had it not been overpowered by the agreeable fragrance of thoſe perfumes.

INCEST, the crime of venereal commerce between perſons who are related in a degree wherein marriage is prohibited by the law of the country.

INCH, a well known meaſure of length; being the twelfth part of a foot, and equal to three barley-corns in length.

INCIDENCE, denotes the direction in which one body ſtrikes on another. See OPTICS and MECHANICS.

INCIDENT DILIGENCE, in Scots law, a warrant granted by a lord ordinary in the court of ſeſſion, for citing witneſſes for proving any point, or for production of any writing neceſſary for preparing the cauſe for a final determination, or before it goes to a general proof.

INCISIVE, an appellation given to whatever cuts or divides: thus, the fore-teeth are called dentes inciſivi, or cutters; and medicines of an attenuating nature, incidents, or inciſive medicines.

INCLE, a kind of tape made of linen yarn.

INCLINATION, is a word frequently uſed by mathematicians, and ſignifies the mutual approach, tendency, or leaning of two lines or two planes towards each other, ſo as to make an angle.

INCLINED PLANE, in mechanics, one that makes an oblique angle with the horizon. See MECHANICS.

INCLOSURE, in huſbandry, the fence or hedge made to incloſe lands.

INCOGNITO, or INCOG, is applied to a perſon that is in any place where he would not be known: but it is more particularly applied to princes, or great men, who enter towns, or walk the ſtreets, without their ordinary train or the uſual marks of their diſtinction and quality.

INCOMBUSTIBLE, ſomething that cannot be burnt, or conſumed by fire. See ASBESTUS.

INCOMMENSURABLE, a term in geometry, uſed where two lines, when compared to each other, have no common meaſure, how ſmall ſoever, that will exactly meaſure them both. And in general, two quantities are ſaid to be incommenſurable, when no third quantity can be found that is an aliquot part of both.

INCOMMENSURABLE NUMBERS are ſuch as have no common diviſor that will divide them both equally.

INCOMPATIBLE, that which cannot ſubſiſt with another, without deſtroying it: thus cold and heat are incom-

incompatible in the fame fubject, the ftrongeft overcoming and expelling the weakeft.

INCORPORATION, in pharmacy, is much the fame as impaftation, being a reduction of dry fubftances to the confiftence of a pafte, by the admixture of fome fluid; thus pills, boles, troches, and plafters are made by incorporation. Another incorporation is, when things of different confiftences, are by digeftion reduced to one common confiftence.

INCORPOREAL, a thing, or fubftance, which has no body; as God, angels, and the foul of man.

INCORRUPTIBLE, that which cannot be corrupted.

INCRASSATING, in pharmacy, *&c.* the rendering fluids thicker by the mixture of other fubftances lefs fluid, or by the evaporation of the thinner parts.

INCUBATION, the action of a hen, or other fowl brooding on her eggs.

INCUBUS, or NIGHT-MARE, in medicine. See MEDICINE.

INCUMBENT, a clerk, or minifter who is refident on his benefice: he is called incumbent, becaufe he does, or at leaft ought, to bend his whole ftudy to difcharge the cure of his church.

INCURVATION *of the rays of light*, their bending out of a rectilinear ftraight courfe, occafioned by refraction. See OPTICS.

INCUS, in anatomy. See ANATOMY, p. 296.

INDEFINITE, that which has no certain bounds, or to which the human mind cannot affix any.

INDEFINITE, in grammar, is underftood of nouns, pronouns, verbs, participles, articles, *&c.* which are left in an uncertain indeterminate fenfe, and not fixed to any particular time, thing, or other circumftance.

INDELIBLE, fomething that cannot be cancelled, or effaced.

INDEMNITY, in law, the faving harmlefs; or, a writing to fecure one from all damage and danger that may enfue from any act.

INDENTED, in heraldry, is when the out-line of an ordinary is notched like the teeth of a faw. See Plate CII. fig. 1.

INDEPENDENTS, a fect of Proteftants in Britain and Holland, fo called from their independency on other churches, and their maintaining that each church or congregation has fufficient power to act and perform every thing relating to religious government within itfelf, and is no way fubject or accountable to other churches or their deputies.

They therefore difallow parochial and provincial fubordination, and form all their congregations upon a fcheme of co-ordinancy. But though they do not think it neceffary to affemble fynods; yet if any be held, they look on their refolutions as prudential councils, but not as decifions to which they are obliged to conform.

INDETERMINATE, in general, an appellation given to whatever is not certain, fixed, and limited; in which fenfe, it is the fame with indefinite.

INDEX, in arithmetic and algebra, fhews to what power any quantity is involved, and is otherwife called exponent.

INDIA PROPER, or HITHER INDIA, a large peninfula in Afia, bounded on the north by Ufbec Tartary, and Thibet; on the eaft, by another part of Thibet, the kingdom of Afem, Ava, and Pegu; on the fouth, by the bay of Bengal, and the Indian ocean; and by the fame ocean and Perfia on the weft: fituated between 66° and 92° of eaft longitude, and between 7° and 40° of north latitude; being about 2000 miles in length from north to fouth, and 1500 miles in breadth from eaft to weft where broadeft; though the fouthern part of the peninfula is not 300 miles broad. All the country within thefe limits is either fubject or tributary to the great Mogul. It is frequently called Indoftan, a name fuppofed to be derived from the river Indus, on its weftern frontiers: it is alfo called the Mogulftan, from the imperial family now upon the throne, who trace their pedigree from Tamerlane a Mogul Tartar.

The produce of this country, and what the Europeans import from thence, is chiefly chints, callicoes, muflins, fome filk, pepper, and diamonds, which are purchafed by moft nations with filver; but the Dutch frequently barter fpices for them, which makes the India trade doubly advantageous to them.

INDIA, beyond the Ganges, is a country bounded by Thibet and Boutan on the north; by China, Tonquin, and Cochin-China on the eaft; by the Indian ocean on the fouth; and by the hither India, the bay of Bengal, and the ftraits of Malacca, on the weft: it is fituated between 92° and 104° of eaft longitude, and between the equator and 30 degrees of north latitude: being near 2000 miles in length from north to fouth, but of a very unequal breadth; in which limits are comprehended the kingdoms of Afem, Ava, Pegu, Laos, Siam, Cambodia, and Malacca, governed by as many Indian princes; only the Dutch have ufurped the dominion of Malacca. In this country there are a vaft number of elephants, and confequently a great deal of ivory; our merchants alfo meet with gold and precious ftones, canes, opium, and fuch other articles as are ufually found within the tropics.

INDIAN BERRY. See COCCULUS.

INDICATION, in phyfic, whatever ferves to direct the phyfician how to act.

INDICATIVE, in grammar, the firft mood, or manner, of conjugating a verb, by which we fimply affirm, deny, or afk fomething; as, *amant*, they love; *non amant*, they do not love; *amantne*, do they love?

INDICTION, in chronology, a cycle of fifteen years.

INDICTMENT, in Scots law, the name of the fummons or libel upon which criminals are cited before the court of Jufticiary to ftand trial.

INDIES, Eaft and Weft. See INDIA and AMERICA.

INDIGESTION, in medicine, a crudity, or want of due coction, either in the food, an humour of the body, or an excrement.

INDIGETES, a name which the ancients gave to fome of their gods.

INDIGO, in botany. See INDIGOFERA.

INDIGOFERA, in botany, a genus of the diadelphia decandria clafs. The calix is plain; the fuperior mar-

gins

gins of the alæ are connivent, and of the ſame ſhape with the vexillum; and the pod is ſtrait. There are ſix ſpecies, all of them natives of the Indies. The tinctoria, anil, or indigo, grows about two feet high, with roundiſh leaves.

As to the indigo blue, it is a fecular, or ſettling, made by means of water and oil-olive out of the leaves of the anil, or indigo plant; there is a difference between that made by the leaves only, and that which is made of the leaves and ſmall branches. The choiceſt of the former ſort is that which bears the ſurname of Serquiſſe, from a village of that name ſome leagues from Surat in the Eaſt-Indies. It is made alſo about Biana and Coſſa near Agra; and alſo in the kingdom of Golconda. In making the feculæ of anil, in order to make indigo of it, they cut the herb with a ſickle, when the leaves begin to fall upon touching them; and after they have ſtripped them from the branches, they put them into a ſufficient quantity of water in a veſſel called the ſteeping vat; and let them infuſe there thirty or thirty-five hours; after which they turn the cock, in order to let the water run off, which is become of a green colour inclining towards blue, into a veſſel of the nature of a churn, where it is worked by means of a roller or turner of wood, the ends of which are pointed and faced with iron: this they work till the water abounds with a lather; then they caſt into it a little oil of olive, that is, one pound into ſuch a quantity of the liquor as will yield ſeventy pounds of indigo, ſuch as is ſaleable; and as ſoon as the ſaid oil is thrown in, the lather ſeparates into two parts, ſo that you may obſerve a quantity curdled as milk is when ready to break; then they ceaſe working, and let it ſtand to ſettle; which when it has done ſome time, they open the pipe or cock of the veſſel, in order to let the water clear off, that the feculæ which is ſubſided may remain behind at the bottom of the veſſel like the lees of wine. Then taking it out, they put it into ſtraining bags of cloth, to ſeparate what water was left; after which they convey it into cheſts or boxes that are ſhallow, to dry it; and being dried, it is what we call indigo.

Chuſe the indigo of Serquiſſe in flat cakes, of a moderate thickneſs, neither too ſoft nor too hard, of a deep violet colour, light, and ſuch as ſwims on water, and when broken has no white ſpots in it; and laſtly, ſuch as is copperiſh or reddiſh on being rubbed with one's nail, and has the leaſt duſt and broken pieces in it.

The other ſort of indigo is alſo the feculæ made from the anil; and differs nothing from the former, but as it is made of the whole plant, ſtalk and leaf; the beſt of which kind is that which bears the name Guatimala, that comes from the Weſt Indies. In chuſing this indigo, it ſhould be as near the other kind as can be; but the ſureſt proof of its goodneſs is its burning upon the fire like wax, and leaving only a little aſhes behind. The ſecond ſort of indigo is that of St Domingo, differing nothing from the Guatimala, only that it is not of ſo lively a colour; the third is the Jamaica indigo; the fourth is that of the Leeward iſlands; all which are better or worſe, according as they are more or leſs neat and pure.

The uſe of the indigo is for the the dyer and landreſſes, ſerving the laſt to put among their linen. The painters uſe it to grind with white for painting in blue; for if it is uſed alone and neat, it turns black; ground with yellow, it makes a green: ſome confectioners and apothecaries prepoſterouſly uſe this to colour ſugars with which to make conſerves and ſyrup of violets, by adding ſome orice.

INDIVIDUAL, in logic, a particular being of any ſpecies, or that which cannot be divided into two or more beings equal or alike.

The uſual diviſion in logic is made unto genera or genus's, thoſe genera into ſpecies, and thoſe ſpecies into individuals.

INDIVISIBLE, among metaphyſicians. A thing is ſaid to be abſolutely indiviſible, that is a ſimple being, and conſiſts of no parts into which it may be divided. Thus God is indiviſible in all reſpects, as is alſo the human mind, not having extenſion or other properties of body.

INDIVISIBLES, in geometry, the elements or principles into which any body or figure may be ultimately reſolved; which elements are ſuppoſed infinitely ſmall: thus a line may be ſaid to conſiſt of points, a ſurface of parallel lines, and a ſolid of parallel and ſimilar ſurfaces.

INDORSEMENT, in law, any thing written on the back of a deed, as a receipt for money received.

There is likewiſe an indorſement, by way of aſſignment, on bills of exchange and notes of hand; which is done by writing a perſon's name on the back thereof. See BILL.

INDUCTION, in law, is putting a clerk or clergyman in poſſeſſion of a benefice or living to which he is collated, or preſented.

INDULGENCES, in the Romiſh church, are a remiſſion of the puniſhment due to ſins, granted by the church, and ſuppoſed to ſave the ſinner from Purgatory. Clement VI. in his decretal, which is generally received by the church of Rome, declares, that our Saviour has left an infinite treaſure of merits, ariſing from his own ſufferings, beſides thoſe of the bleſſed virgin and the ſaints; and that the paſtors and guides of the church, and more eſpecially the popes, who are the ſovereign diſpoſers of this treaſure, have authority to apply it to the living by virtue of the keys, and to the dead by way of ſuffrage, to diſcharge them from their reſpective proportions of puniſhment, by taking juſt ſo much merit out of this general treaſure as they conceive the debt requires, and offering it to God.

The power of granting indulgences has been greatly abuſed in the church of Rome. It was one of the chief things which the council of Conſtance laid to the charge of John XXIII. in 1415, that he impowered his legates to abſolve penitents from all ſorts of crimes, upon the payment of ſums proportionable to their guilt. Pope Leo X. in order to carry on the magnificent ſtructure of St. Peter's at Rome, publiſhed indulgences, and a plenary remiſſion to all ſuch as ſhould contribute money

money towards it. Finding the project take, he gave his ſiſter, the princeſs of Cibo, the benefit of the indulgences of Saxony and the neighbouring parts, and farmed out thoſe of other countries to the higheſt bidders, who, to make the beſt of their bargains, procured the ableſt preachers to cry up the value of the ware. "Happy times for ſinners! ſays a modern writer, "their crimes were rated, and the remiſſion of them "ſet up by auction. The apoſtolic chancery taxed "ſins at a pretty reaſonable rate. It coſt but ninety "livres and a few ducats, for crimes which people on "this ſide the Alps puniſhed with death."

It was this great abuſe of indulgences that contributed not a little to the firſt reformation of religion in Germany, where Martin Luther began firſt to declaim againſt the preachers of indulgences, and afterwards againſt indulgences themſelves: but ſince that time the popes have been more ſparing in the exerciſe of this power: however, they ſtill carry on a great trade with them to the Indies, where they are purchaſed at two rials a-piece, and ſometimes more.

The pope likewiſe grants indulgences to perſons at the point of death; that is, he grants them, by a brief, power to chuſe what confeſſor they pleaſe, who is authorized thereby to abſolve them from all their ſins in general.

INDULT, in the church of Rome, the power of preſenting to benefices granted to certain perſons by the pope. Of this kind is the indult of kings and ſovereign princes in the Romiſh communion, and that of the parliament of Paris granted by ſeveral popes. By the concordat for the abolition of the pragmatic ſanction, made between Francis I. and Leo X. in 1516, the French king has the power of nominating to biſhoprics, and other conſiſtorial benefices, within his realm. At the ſame time, by a particular bull, the pope granted him the privilege of nominating to the churches of Britany and Provence. In 1648 pope Alexander VIII. and in 1668 Clement IX. granted the king an indult for the biſhoprics of Metz, Toul, and Verdun, which had been yielded to him by the treaty of Munſter; and in 1668 the ſame pope Clement IX. granted him an indult for the benefices in the counties of Rouſillon, Artois, and the Netherlands. The cardinals likewiſe have an indult granted them by agreement between pope Paul IV. and the ſacred college in 1555, which is always confirmed by the popes at the time of their election. By this treaty the cardinals have the free diſpoſal of all the benefices depending on them, and are impowered likewiſe to beſtow a benefice in commendam.

INDULTO, a duty, tax, or cuſtom, paid to the king of Spain for all ſuch commodities as are imported from the Weſt Indies in the galleons.

INDUS, a large river of Aſia, which riſes in the mountains which ſeparate Tartary from India, and diſcharges itſelf into the India ocean.

INERTIA *of matter*, in philoſophy, is defined by Sir Iſaac Newton to be a paſſive principle by which bodies perſiſt in their motion or reſt, receive motion in proportion to the force impreſſing it, and reſiſt as much as they are reſiſted. It is alſo defined by the ſame author to be a power implanted in all matter, whereby it reſiſts any change endeavoured to be made in its ſtate. See MECHANICS.

INFALLIBLE, ſomething that cannot err, or be deceived.

One of the great controverſies between the Proteſtants and Papiſts, is the infallibility which the latter attribute to the pope; though, in fact, they themſelves are not agreed on that head, ſome placing this pretended infallibility in the pope and a general council.

INFAMY, in law, is a term which extends to forgery, perjury, groſs cheats, *&c.* by which a perſon is rendered incapable of being a witneſs or juror, even tho' he is pardoned for his crimes.

INFANT, denotes a young child. See MIDWIFERY, and MEDICINE.

INFANTE, and INFANTA, all the ſons and daughters of the kings of Spain and Portugal, except the eldeſt; the princes being called infantes, and the princeſſes infantas.

INFANTRY, in military affairs, denotes the whole body of foot-ſoldiers.

INFECTION, among phyſicians. See CONTAGION.

INFEFTMENT, in Scots law, the ſolemnity of the delivery of an heretable ſubject to the purchaſer. See LAW, tit. 10.

INFINITE, that which has neither beginning nor end: in which ſenſe God alone is infinite.

Infinite is alſo uſed to ſignify that which has had a beginning, but will have no end, as angels and human ſouls. This makes what the ſchoolmen call *infinitum a parte poſt*; as, on the contrary, by *infinitum a parte ante*, they mean that which has an end but had no beginning.

INFINITE QUANTITIES. The very idea of magnitudes infinitely great, or ſuch as exceed any aſſignable quantities, does include a negation of limits: yet if we nearly examine this notion, we ſhall find that ſuch magnitudes are not equal among themſelves, but that there are really, beſides infinite length and infinite area, three ſeveral ſort of infinite ſolidity; all of which are *quantitates ſui generis*, and that thoſe of each ſpecies are in given proportions.

Infinite length, or a line infinitely long, is to be conſidered either as beginning at a point, and ſo infinitely extended one way, or elſe both ways from the ſame point; in which caſe the one, which is a beginning infinity, is the one half of the whole, which is the ſum of the beginning and ceaſing infinity; or, as may be ſaid, of infinity *a parte ante* and *a parte poſt*, which is analogous to eternity in time and duration, in which there is always as much to follow as is paſt, from any point or moment of time; nor doth the addition or ſubduction of finite length, or ſpace of time, alter the caſe either in infinity or eternity, ſince both the one or the other cannot be any part of the whole.

INFINITESIMALS, among mathematicians, are defined to be infinitely ſmall quantities.

In

In the method of infinitefimals, the element, by which any quantity increafes or decreafes, is fuppofed to be infinitely fmall, and is generally expreffed by two or more terms, fome of which are infinitely lefs than the reft, which being neglected as of no importance, the remaining terms form what is called the difference of the propofed quantity. The terms that are neglected in this manner, as infinitely lefs than the other terms of the element, are the very fame which arife in confequence of the acceleration, or retardation, of the generating motion, during the infinitely fmall time in which the element is generated; fo that the remaining terms exprefs the elements that would have been produced in that time, if the generating motion had continued uniform: therefore thofe differences are accurately in the fame ratio to each other as the generating motions or fluxions. And hence, though in this method infinitefimal parts of the elements are neglected, the conclufions are accurately true without even an infinitely fmall error, and agree precifely with thofe that are deduced by the method by fluxions. See FLUXIONS.

INFIRMARY, a kind of hofpital, where the weak and fickly are properly taken care of.

INFLAMMABILITY, that property of bodies which difpofes them to kindle, or catch fire. See FIRE.

INFLAMMATION. See MEDICINE and SURGERY.

INFLECTION, or *Point of* INFLECTION, in the higher geometry, is a point where a curve begins to bend a contrary way.

INFLECTION, in grammar, the variation of nouns and verbs, by declenfion and conjugation.

INFLUENCE, a quality fuppofed to flow from the heavenly bodies, either with their light or heat; to which aftrologers idly afcribe all fublunary events.

INFORMATION, in law, is nearly the fame in the crown-office, as what in other courts is called a declaration. It is fometimes brought by the king, or his attorney general, or the clerk of the crown-office; and at other times by a private perfon, who informs or fues, as well for the king as himfelf, upon the breach of fome popular ftatute, in which a penalty is given to the party that will fue for it.

INFRACTION, a term chiefly ufed to fignify the violation of a treaty.

INFRA-SCAPULARIS, in anatomy. See ANATOMY, p. 196.

INFRA-SPINATUS, in anatomy. See ANATOMY, p. 195.

INFULA, in antiquity, a broad kind of fillet, made of white wool, which the priefts ufed to tie round their heads.

INFUNDIBULIFORM, in botany, an appellation given to fuch monopetalous or one-leaved flowers, as refemble a funnel in fhape, or which have a narrow tube at one end, and gradually widen towards the limb or mouth.

INFUSION, in pharmacy, a method of obtaining the virtues of plants, roots, *&c.* by fteeping them in a hot or cold liquid.

Hot infufions are made by pouring boiling water, or any other menftruum, on the drugs whofe virtues we would extract: thus, in order to obtain the common infufion of fena, take the leaves of fena, an ounce and a half; of cryftals of tartar, three drams; of the leffer cardamom-feeds hufked, two drams: boil the cryftals of tartar in a pint of water, till they are diffolved; then pour the water, while boiling hot, upon the fena and the reft; and when the liquor is cold, ftrain it off.

INGELSHEIM, a town of Germany, in the palatinate of the Rhine, eight miles fouth-weft of Mentz, E. long. 7° 40′, N. lat. 50°.

INGLUVIES, the crop or craw of graniverous birds, ferving for the immediate reception of the food, where it is macerated for fome time, before it is tranfmitted to the true ftomach.

INGOLSTAT, a town of Germany, in the circle of Bavaria, fituated on the river Danube, thirty miles weft of Ratifbon: E. long. 11° 30′, and N. lat. 48° 45′.

INGOT, a mafs of gold or filver, melted down and caft in a mould, but not coined or wrought.

INGRAFTING, in gardening. See GARDENING.

INGRESS, in aftronomy, fignifies the fun's entering the firft fcruple of one of the four cardinal figns, efpecially Aries.

INGRIA, a province of Ruffia, bounded by the lake Ladoga, the river Nieva, and the gulph of Finland on the north, by Novogorod on the eaft and fouth, and by Livonia on the weft.

INGROSSER, one who buys up great quantities of any commodity, before it comes to market, in order to raife the price.

INGUEN, in anatomy, the fame with what is otherwife called groin, or pubes.

INHERITANCE, a perpetual right or intereft in lands, invefted in a perfon and his heirs.

INHIBITION, in Scots law, a diligence obtained at the fuit of a creditor againft his debtor, prohibiting him from felling or contracting debts upon his eftate to the creditor's prejudice. See LAW, tit. 18.

INHUMATION, in chemiftry, a method of digefting fubftances by burying the veffel in which they are contained in horfe-dung or earth.

INJECTION, the forcibly throwing certain liquid medicines into the body, by means of a fyringe, tube, clyfter-pipe, or the like.

Anatomical INJECTION, the filling the veffels with fome coloured fubftance, in order to make their figures and ramifications vifible.

For this purpofe, a fine red injection is prepared thus: pour a pint of oil of turpentine on three ounces of vermilion, ftir them well together, and then ftrain all through a fine linen-cloth. If a green injection is wanted, diftilled verdigreafe may be ufed inftead of the vermilion.

A coarfe injection may be made of one pound of tallow, five ounces of white-wax, three ounces of oil of olives, melted together, and adding two ounces of venice-turpentine; and when this is diffolved, three ounces of vermilion or verdigreafe are to be throughly mixed with the other ingredients, and the whole ftrained through a linen cloth.

INJURY, any wrong done to a man's perſon, reputation, or goods.

INK, a black liquor generally made of an infuſion of galls, copperas, and a little gum arabic.

To make a very good ink for writing: take three ounces of good galls, reduced to powder; which infuſe in three pints of river or rain-water, ſetting it in the ſun or a gentle heat, for two days; then take common copperas, or green vitriol, three ounces; powder it, put it into the infuſion, and ſet it in the ſun for two days more; laſtly, ſhake it well, and add an ounce of good gum arabic.

To make the London powder-ink: take ten ounces of the cleareſt nut-galls, which reduce to a fine powder; then add two ounces of white copperas, four ounces of Roman vitriol, and of gum arabic or ſandarach an ounce; pound and ſift them very fine. This powder, though whitiſh itſelf, will, when put into water, turn it to a good black ink: an ounce of the powder ſerves to make a pint of ink.

To make a ſhining ink: take gum arabic and Roman vitriol, of each an ounce; galls well bruiſed, a pound; put them into rape-vinegar, or vinegar made of clear ſmall beer; ſet them in a warm place, ſtir them often till the liquor becomes black, and then add to a gallon of this preparation an ounce of ivory-black, and a quarter of a pint of ſeed-lac varniſh.

To make a ſhining Japan or China ink: take an ounce of lamp-black, and clarify it in an earthen pipkin to take out the droſs; two drams of indigo; half a dram of peach black; one dram of black endive, burnt; reduce them to a very fine powder, and then take a moiety of fig-leaf water, another part of milk, and a very little gum arabic; and mixing all the ingredients well together, make them up for uſe.

Printing INK is made by boiling or burning linſeed-oil till it is pretty thick, adding a little roſin to it while hot, and then mixing this varniſh with lamp-black.

INK is alſo an appellation given to any coloured liquor, uſed in the ſame manner as the atramentum or black ink; as red, green, blue, yellow, *&c.* inks.

Red ink is made thus: take wine-vinegar a pint; raſpings of brazil, one ounce; alum, half an ounce; boil them gently, and add five drams of gum arabic: diſſolve the gum, ſtrain the ingredients, and keep the liquid for uſe.

Green ink is made by boiling verdigreaſe with argol in fair water, and adding a little gum arabic.

Blue ink is made by grinding indigo with honey and the white of eggs, and making it fluid with water.

Yellow ink is made by an infuſion of ſaffron in water, with a little alum and gum arabic.

Sympathetic INK, a liquor with which a perſon may write, without the letters appearing, till ſome means be taken to render them legible.

Of this kind are the glutinous juices of plants, or any other thick and viſcid fluids, provided they have no remarkable colours themſelves; for being written on white paper, nothing will appear, till ſome fine powder of any coloured earth is thrown over the paper, whereby the letters become legible: the reaſon of this is evident, as the powder ſticks only to the letters formed by the inviſible but viſcid liquor.

Another ſort of ſympathetic inks are made of infuſions, the matter of which eaſily burns to a charcoal: thus if a ſcruple of ſal armoniac be diſſolved in two ounces of fair water, letters written therewith will be inviſible till held before the fire; for the ſal armoniac being burnt to a charcoal, by a heat not ſtrong enough to ſcorch the paper, the letters are thereby rendered viſible,

Another ſort of ſympathetic ink is made of a ſolution of lead in vinegar, and a lixivium of lime and orpiment; for if a letter be written with the former, nothing will appear: but to conceal the affair ſtill more, ſome different ſubject may be written above it, with a black ink made of burnt cork and gum-water; then, if a pice of cotton, wetted with the ſaid lixivium, be rubbed over the paper, the ſentence that was viſible will diſappear, and the inviſible one before written with the ſolution of lead will be ſeen in its place very black and ſtrong.

INN, a place appointed for the entertainment and relief of travellers.

INNS *of Court*, are colleges in London, for the ſtudy of the laws of England, with all conveniencies for the lodging and entertainment of the profeſſors and ſtudents.

The four principal inns of court are the Inner-temple, Middle-temple, Lincoln's inn, and Gray's inn; the other inns are the two ſerjeant's inns; and the others, which are leſs conſiderable, are Clifford's inn, Symond's inn, Clement's inn, Lion's inn, Furnival's inn, Staple's inn, Thavie's inn, Barnard's inn, and New-inn. Theſe are moſtly taken up by attorneys, ſolicitors, *&c.* but they belong to the inns of court, who ſend yearly ſome of their barriſters to read to them.

INN, in geography, a large river which riſes in a mountain of the Alps, in the country of the Griſons, runs north-eaſt through Tyrol and Bavaria, and diſcharges itſelf into the Danube.

INNATE IDEAS, thoſe ſuppoſed to be ſtamped on the mind from the firſt moment of its exiſtence, and which it conſtantly brings into the world with it: a doctrine, which Mr. Locke has abundantly refuted.

INNERKEITHING, a port town of Scotland, in the county of Fife, ſituated on the north ſhore of the frith of Forth, ten miles north-weſt of Edinburgh.

INNISKILLING, a ſtrong town of Ireland, in the province of Ulſter, and county of Fermanagh: W. long. 7° 50′, and N. lat. 54° 20′.

INNOCENTS DAY, a feſtival of the Chriſtian church, obſerved on December 28, in memory of the maſſacre of the innocent children by the command of Herod king of Judea; who being alarmed at hearing that an infant was born king of the Jews, and imagining that his own kingdom was in danger, ſent orders to have all the children ſlain that were in Bethlehem and the adjacent country.

The Greek church in their calendar, and the Abyſſinians of Ethiopia in their offices, commemorate fourteen thouſand infants on this occaſion.

INNOMINATA ossa, in anatomy. See Anatomy, p. 171.

INOCULATION, in medicine, the art of transplanting a distemper from one subject to another, by incision, particularly used for engrafting the small pox. See Medicine.

INOSCULATION, in anatomy. See Anastomasis.

INQUEST, in Scots law, the same with jury.

INQUISITION, in the church of Rome, a tribunal in several Roman catholic countries, erected by the popes for the examination and punishment of heretics.

This court was founded in the twelfth century by father Dominic and his followers, who were sent by pope Innocent III. with orders to excite the catholic princes and people to extirpate heretics, to search into their number and quality, and to transmit a faithful account thereof to Rome. Hence they were called inquisitors; and this gave birth to the formidable tribunal of the inquisition, which was received in all Italy, and the dominions of Spain, except the kingdom of Naples and the Low Countries.

This diabolical tribunal takes cognizance of heresy, Judaism, Mahometanism, Sodomy, and polygamy; and the people stand in so much fear of it, that parents deliver up their children, husbands their wives, and masters their servants, to its officers, without daring in the least to murmur. The prisoners are kept for a long time, till they themselves turn their own accusers, and declare the cause of their imprisonment; for they are neither told their crime, nor confronted with witnesses. As soon as they are imprisoned, their friends go into mourning, and speak of them as dead, not daring to solicit their pardon, lest they should be brought in as accomplices. When there is no shadow of proof against the pretended criminal, he is discharged, after suffering the most cruel tortures, a tedious and dreadful imprisonment, and the loss of the greatest part of his effects. The sentence against the prisoners is pronounced publicly, and with extraordinary solemnity. In Portugal they erect a theatre capable of holding three thousand persons, in which they place a rich altar, and raise seats on each side in the form of an amphitheatre. There the prisoners are placed, and over-against them is a high chair, whither they are called, one by one, to hear their doom, from one of the inquisitors.

These unhappy people know what they are to suffer, by the cloaths they wear that day. Those who appear in their own cloaths, are discharged upon payment of a fine: those who have a santo benito, or strait yellow coat without sleeves, charged with St. Andrew's cross, have their lives, but forfeit all their effects: those who have the resemblance of flames, made of red serge, sewed upon their santo benito, without any cross, are pardoned, but threatened to be burnt if ever they relapse: but those who, besides these flames, have on their santo benito their own picture, surrounded with figures of devils, are condemned to expire in the flames. The inquisitors, who are ecclesiastics, do not pronounce the sentence of death; but form and read an act, in which they say, that the criminal being convicted of such a crime, by his own confession, is with much reluctance delivered to the secular power to be punished according to his demerits: and this writing they give to the seven judges, who attend at the right side of the altar, who immediately pass sentence. For the conclusion of this horrid scene, see Act *of faith*.

INSCRIBED, in geometry. A figure is said to be inscribed in another, when all its angles touch the side or planes of the other figure.

INSCRIPTION, a title or writing carved, engraved, or affixed to any thing, to give a more distinct knowledge of it, or to transmit some important truth to posterity.

The inscriptions mentioned by Herodotus and Diodorus Siculus, sufficiently shew that this was the first method of conveying instruction to mankind, and transmitting the knowledge of history and sciences to posterity: thus the ancients engraved upon pillars both the principles of sciences, and the history of the world. Pisistratus carved precepts of husbandry on pillars of stone; and the treaties of confederacy between the Romans and Jews, were engraved on plates of brass. Hence, antiquarians have been very curious in examining the inscriptions on ancient ruins, coins, medals, *&c.*

INSECTS, in zoology, a numerous class of animals. See Natural History.

INSERTION, in anatomy, the close conjunction of the vessels, tendons, fibres, and membranes of the body with some other parts.

INSIPID, an appellation given to things without taste.

INSOLATION, in chemistry, the suffering matters to stand and digest in the heat of the sun, instead of that of a furnace.

INSOLVENT, a term applied to persons unable to pay their debts.

INSPIRATION, among divines, implies the conveying of certain extraordinary and supernatural notices or motions into the soul.

INSPISSATING, in pharmacy, an operation whereby a liquor is brought to a thicker consistence, by evaporating the thicker parts.

INSPRUCK, a city of Germany, in the circle of Austria, capital of the county of Tyrol, situated on the river Inn, in E. long. 11° 26′, N. lat. 47° 12′.

INSTALLMENT, the instating or establishing a person in some dignity.

INSTANT, such a part of duration wherein we perceive no succession; or it is that which takes up the time only of one idea in our minds.

INSTAURATION, the re establishment or restauration of a religion, a church, or the like, to its former state.

INSTEP, in the manege, is that part of a horse's hind leg which reaches from the ham to the pastern-joint.

INSTINCT, an appellation given to the sagacity and natural inclinations of brutes, which supplies the place of reason in mankind.

INSTITUTES, in literary hiftory, a book containing the elements of the Roman law, and conftitutes the laft part of the civil-law.

The Inftitutes are divided into four books, and contain an abridgment of the whole body of the civil law; being defigned for the ufe of ftudents.

INSTITUTE, in Scots law. When by difpofition, or deed of entail, a number of perfons are called to the fucceffion of an eftate one after another, the perfon firft named is called the inftitute, and the others fubftitutes. See LAW, tit. 27.

INSTITUTION, in general, fignifies the eftablifhing or founding fomething.

In the canon and common law, it fignifies the inverting a clerk with the fpiritualities of a rectory, *&c.* which is done by the bifhop, who ufes the formula, "I inftitute you rector of fuch a church, with cure of "fouls, and receive your care and mine."

INSTRUMENT, in general, whatever is fubfervient to a caufe in producing any effect.

A common cafe of mathematical inftruments contains feveral compaffes, a fector, fcale, drawing-pen, and protractor.

Notorial INSTRUMENT, in Scots law, any fact certified in writing, under the hand of a notary-public. See LAW, tit 21.

INSULATED, in architecture, an appellation given to fuch columns as ftand alone, or free from any contiguous wall, *&c.* like an ifland in the fea; whence the name.

INSURANCE, in law and commerce, a contract or agreement whereby one or more perfons, called infurers, affurers, *&c.* oblige themfelves to anfwer for the lofs of a fhip, houfe, goods, *&c.* in confideration of a premium paid by the proprietors of the things infured.

Infurances are of various kinds, as on fhips or parts of fhips, on merchandize fingly, and on fhips and goods jointly: and thefe are again branched out to run either for a time ftipulated, or to one fingle port, or out and home, with liberty to touch at the different places mentioned in the policy. Infurances may likewife be made on goods fent by land, or by hoys, *&c.* on rivers; and this is frequently done, more efpecially on jewels, and other things of great value.

The principal offices for the infurance of fhips and merchandize in London, are the Royal-exchange affurance, and the London affurance, both of which are eftablifhed by act of parliament. Thefe offices alfo infure houfes and other buildings, goods, wares, and merchandize, from lofs or damage by fire; and the former of them alfo affure lives.

The Royal-exchange infurance, on a brick or ftone building, infures any fum not exceeding 200 l. at 5s. *per ann.* and any larger fum not exceeding 1000 l. after the rate of 2 s. 6 d. *per cent. per ann.* Above 1000 l. and not exceeding 2000 l. at 3 s. *per cent.* Above 2000 l. and not exceeding 3000 l. at 4 s. *per cent.* On goods and merchandize, the property of the affured, within any brick or ftone building, or on the goods and building together, this office infures any fum not exceeding 300 l. for 7 s 6 d. *per ann.* and larger fums after the rates above-mentioned: but timber or plafter-buildings, or goods or merchandize therein, pay 8 s. *per ann.* for 200 l. and after the rate of 4 s. *per cent.* for any greater fum not exceeding 1000 l. and 5 s. *per cent.* for all infurances above 1000 l. and not exceeding 2000 l. On a timber or plafter-building with goods and merchandize together, any fum, not exceeding 300 l. may be infured for 12 s. *per ann.* and larger fums at the above rates. The goods belonging to hazardous trades, as diftillers, chemifts, apothecaries, colour-men, tallow-chandlers, oilmen, innholders, *&c.* depofited in brick houfes, pay 8 s. *per ann.* for infuring 200 l. and after the rate of 4 s. *per cent.* for any greater fum not exceeding 1000 l; and above 1000 l. and not exceeding 2000 l. 5 s. *per cent.* but when the houfes and goods are put together, the price of infurance is 4 s. *per cent. per ann.* without any other charge except the policies.

The Friendly Society infurance, has fome very extraordinary regulations; the principal of which is, that every one of the affured becomes a member of the fociety; and when any lofs happens, contributes in proportion to the fum he has infured, to make good the damage; on which account he pays only 1s. 4d. *per cent. per ann.* premium, and 6 s. 8d. *per cent.* as a caution; but what is unexpended of the 6 s. 8 d. is returned to the party infured at the end of feven years.

We have alfo infurances for lives, in virtue of which, when the perfon infured dies, a fum of money becomes payable to the perfon on whofe behalf the policy of infurance was granted. The principal infurance-office of this kind, is that of the Amicable Society for a perpetual affurance, kept in Serjeant's inn, Fleet-ftreet, London.

In this office, after paying the charges of the policy, and 10s. entrance-money, each perfon pays 5 l. *per annum*, by quarterly payments; and from thefe payments the dividends, which ufually amount to 100 l. and upwards, are to arife. All perfons admitted are to be between the ages of twelve and forty-five, and in a good ftate of health. Any perfon is allowed to have two or three infurances or numbers on the fame life, whereby fuch perfon will be intitled to a claim on each number fo infured; and every claimant is impowered to put in a new life, in the room of one deceafed, within twelve kalendar months next after the end of the current year. By becoming members of this fociety, clergymen, phyficians, lawyers, tradefmen, and all whofe income ceafes at the time of their death, may, in all probability, leave to their families a claim of not lefs than 100 l. for every 5 l. anually paid in.

INTAGLIOS, precious ftones on which are engraved the heads of great men, infcriptions, and the like; fuch as we frequently fee fet in rings, feals, *&c.*

INTEGER, in arithmetick, a whole number, in contradiftinction to a fraction.

INTERCALARY, an appellation given to the odd day inferted in leap-year; which was fo called from *calo, calare*, to proclaim, it being proclaimed by the priefts with a loud voice.

INTER-

INTERCOLUMNIATION, in architecture, denotes the ſpace between two columns, which is always to be proportioned to the height and bulk of the columns. See ARCHITECTURE.

INTERCOSTAL, in anatomy, an appellation given to ſuch muſcles, nerves, arteries and veins as lie between the ribs. See ANATOMY, Part II.

INTERDICT, an eccleſiaſtical cenſure, by which the church of Rome forbids the performance of divine ſervice in a kingdom, province, town, *&c.*

INTERDICTION, in Scots law, a legal reſtraint laid upon weak or profuſe perſons from ſigning any deed to their own prejudice, without the conſent of curators or interdictors. See SCOTS LAW, tit. 7.

INTEREST, is the premium or money paid for the loan or uſe of money; and is diſtinguiſhed into two kinds, ſimple and compound.

Simple intereſt is that which is paid for the principal, or ſum lent, at a certain rate or allowance made by law, or agreement of parties, whereby ſo much as 5 l. or 6 l. or any other ſum, is paid for 100 l. lent out for one year; and more or leſs proportionally for greater or leſſer ſums, and for more or leſs time. For example, if it is 5 l. to 100 l for one year, it is 2 l. 10 s. for half a year, and 10 l. for two years: alſo 10 l. for one year of 200 l. and 5 l. for half a year; and ſo on, for other ſums and times. Thus, as the law, or agreement of parties, fixes a certain ratio, or, as we call it, rate of intereſt, which is ſo much on the 100 l. for one year; from this we can eaſily find the proportional intereſt on 1 l. for one year, being plainly the $\frac{1}{100}$ part of the intereſt of 100 l ſo if this is 5 l. that is .05 l. if this is 6 l. that is .06 l and if this is 5 l. 10 s. or 5 5 l. that is .055 l. Wherefore, if we underſtand the rate of intereſt to be the intereſt of 1 l. for one year, the more common queſtions about ſimple intereſt will relate to theſe four things, *viz.* any principal ſum, its intereſt, the time in which it gives that intereſt, and the rate, or intereſt of 1 l. for one year; according to which, that principal, intereſt, and time, are adjuſted to one another

From which we have four problems; in the rules whereof we ſuppoſe the principal and intereſt expreſſed in the denomination of pounds, by reducing what is leſs than 1 l. to a decimal of 1 l. and the time to be expreſſed in years, and decimal parts of one year.

Prob I. Having any principal, ſum, and time, with the rates of intereſt given, to find the intereſt of that ſum for that time and rate.

Rule: Multiply the principal rate, and time, continually into one another; the product is the intereſt ſought.

Obſerve, if we expreſs the principal by p, the intereſt by n, the time by t, and the rate by r, then this rule is thus repreſented, $n=tpr$.

Example: The rate of intereſt being .05 l. what is the intereſt of 85 l. for 4 years and 3 quarters, or 4.75 years?

Anſwer. 20 l. 3 s. 9 d. $=20.1875$ l. $=85\times4.75\times.05$.

Which is thus performed:

$$\begin{array}{r} 85=p \\ 4.75=t \\ \hline 425 \\ 595 \\ 340 \\ \hline 403.75 \\ .05=r \\ \hline 20.1875 \end{array}$$

20.1875 pounds.

Which decimal is reduced by multiplying it by 20, 12, and 4: thus,

$$\begin{array}{r} .1875 \\ 20 \\ \hline 3.7500 \\ 12 \\ \hline 15000 \\ 7500 \\ \hline 9.0000 \end{array}$$

3.7500 ſhillings; 9.0000 pence

Prob. II. Having the rate, principal and intereſt, to find the time.

Rule: Divide the intereſt by the product of the rate and principal, the quote is the time: thus, $t=\frac{n}{rp}$.

Example: The rate .05 l. principal 85 l. intereſt 20 l. 3 s. 9 d. or 20.1875 l. the time is 4.75 years, or 4 ¾ years. Thus, $4.75=\frac{20.1875}{85\times.05}$, or $\frac{20.1875}{4.25}$.

Demonſtration: This rule is deduced from the former; thus, ſince $n=trp$, then dividing both ſides by rp, it is $\frac{n}{rp}=t$.

Prob. III. Having the principal, intereſt, and time, to find the rate.

Rule: Divide the intereſt by the product of principal and time, the quote is the rate: thus, $\frac{n}{tp}=r$.

Example: $n=20.1875$ l. $t=4.75$ years, $p=85$ l. then is $r=.05$ l. $=\frac{20.1875}{4.75\times85}$, or $\frac{20.1875}{403.75}$.

Demonſtration: Since $n=trp$, divide both by tp; it is $\frac{n}{tp}=r$.

Prob. IV. Having the rate, time and intereſt, to find the principal.

Rule: Divide the intereſt by the product of rate and time, the quote is the principal; thus, $\frac{n}{tr}=p$.

Example: $n=20.1875$ l. $t=4.75$ years, $r=.05$ l. then is $p=85$ l. $=\frac{20.1875}{4.75\times05}$, or $\frac{20.1875}{.2375}$.

Demonſtration: Since $n=trp$, divide both ſides by tr, the quote is $\frac{n}{tr}=p$.

Scholium: If the intereſt of any ſum for any time is added to the principal, this total or ſum is called the amount, (*viz.* of the principal and its intereſt for that time.) And then from theſe four things, *viz.* the amount, which we call a, the principal, the time, and

and rate, arise four problems; for having any three of these, the fourth may always be found. Thus,

Prob. V. Having the principal, time, and rate, to find the amount.

Rule: Find the interest by prob. I. add it to the principal, the sum is the amount.

Thus, by prob. I. the interest is ptr: therefore the amount is $a=ptr+p$. The reason is evident.

Note: Because $ptr=rt\times p$, and $p=1\times p$; therefore $rtp+p=\overline{rt+1}\times p=a$. And so the rule may be expressed thus; To the product of the rate and time add unity, and multiply the sum by the principal, the product is the amount.

Example: What is the amount of 246l. principal in 2 years and $\frac{1}{2}$, or 2.5 years, the rate of interest being .05 l? Answer 246l.+30.75 l.=276l. 15s. for the interest is$=246\times.05\times2.5=30.75$l. Or thus; $.05\times2.5=.125$l. to which add 1, it is $1+.125$ l. which multiplied by 276, produces 276.75 l.

Prob. VI. Given the principal, amount, and time, to find the rate.

Rule: Take the difference betwixt the principal and amount, and divide it by the product of the time and principal, the quote is the rate: thus, $r=\frac{a-p}{tp}$.

Example: Suppose $a=276.75$ l. $p.=246$, $t=2.5$ years; then is $r=.05$ l.$=\frac{276.75-246}{2.5\times246}=\frac{30.75}{615}$.

Demonstration: Since by prob. V. $a=trp+p$, take p from both sides, it is $a-p=trp$; then divide both by tp, it is $\frac{a-p}{tp}=r$.

Prob. VII. Given the amount, principal, and rate, to find the time.

Rule: Take the difference of the amount and principal, and divide it by the product of the principal and rate, the quote is the time: thus $t=\frac{a-p}{rp}$.

Example: Suppose $a=276.75$ l. $p=246$ l. $r=.05$; then is $t=2.5$ years$=\frac{276.75\text{ l.}-246}{246\times.05}=\frac{30.75}{12.3}$.

Demonstration: In the last problem, $a-p$ was equal to trp; and dividing both by rp, it is $\frac{a-p}{rp}=t$.

Prob. VIII. Given the amount, rate, and time, to find the principal.

Rule: Add 1 to the product of the rate and time, and by that sum divide the amount, the quote is the principal: thus, $p=\frac{a}{rt+1}$.

Example. $a=276.75$ l. $r=.05$ l. $t=2.5$ years; then is $p=246=\frac{276.75}{2.5\times.05+1}=\frac{276.75}{1.125}$.

Demonstration: By prob. V. it is $a=\overline{rt+1}\times p$; therefore dividing both sides by $\overline{rt+1}$, it is $\frac{a}{rt+1}=p$.

Compound Interest, is that which is paid for any principal sum, and the simple interest due upon it for any time, accumulated into one principal sum. Example: if 100l. is lent out for one year at 6 l. and if at the end of that year the 6l. due of interest be added to the principal, and the sum 106 l. be considered as a new principal bearing interest for the next year (or whatever less time it remains unpaid) this is called compound interest, because there is interest upon interest, which may go on by adding this second year's interest of 106 l. to the principal 106 l. and making the whole a principal for the next year.

Now, although it be not lawful to let out money at compound interest, yet in purchasing of annuities or pensions, *&c.* and taking leases in reversion, it is very usual to allow compound interest to the purchaser for his ready money; and therefore, it is very necessary to understand it.

Let therefore, as before, p=the principal put to interest; t=the time of its continuance; a=the amount of the principal and interest; R=the amount of 1 l. and its interest for one year, at any given rate, which may be thus found.

Viz. 100: 106:: 1: 1,06=the amount of 1 l. at 6 *per cent.* Or 100: 105:: 1: 1,05=the amount of 1 l. at 5 *per cent.* And so on, for any other assigned rate of interest.

Then if

R =amount of 1l. for 1 year, at any rate.
R^2=amount of 1l. for 2 years.
R^3=amount of 1l. for 3 years.
R^4=amount of 1l. for 4 years.
R^5=amount of 1l. for 5 years.

Here $t=5$. For 1 : R :: R : RR :: RR : RRR :: RRR :: R^4 : R^4: : R^5 : *&c.* in a geometrical progression continued; that is, as 1 l.: is to the amount of 1 l. at 1 years's end: : so is that amount: to the amount of 1 l. at 2 years end, *&c.* Whence it is plain, that compound interest is grounded upon a series of terms, increasing in geometrical proportion continued; wherein t (*viz.* the number of years) does always assign the index of the last and highest term, *viz.* the power of R, which is R^t.

Again, as $1 : R^t :: p : pR^t=a$ the amount of p for the time, that R^t=the amount of 1 l. That is, as 1 l.: is to the amount of 1 l. for any given time:: so is any proposed principal, or sum: to its amount for the same time.

From what has been said, we presume, the reason of the followings theorems will be very easily understood.

Theorem I. $pR^t=a$, as above.

From hence the two following theorems are easily deduced.

Theorem II. $\frac{a}{R^t}=p$.

Theorem III. $\frac{a}{p}=R^t$.

By these three theorems, all questions about compound interest may be truly resolved by the pen only, *viz.* without tables: though not so readily as by the help of tables calculated on purpose.

Example

Example I. What will 256l. 10 s. amount to in 7 years, at 5 *per cent. per annum*, compound intereſt?

Here is given $p=256.5$, $t=7$, and $R=1.05$, which being involved until its index $=t$ (*viz.* 7) will become $R^7=1.40710$. Then $1.40710\times256.5=360.92115$ $=a=$ 360 l. 18 s. 5 d. which is the anſwer required.

Example II. What principal or ſum of money muſt be put out to raiſe a ſtock of 360l. 18 s. 5 d. in ſeven years, at 5 *per cent. per annum*, compound intereſt.

Here is given $a=360.92115$, $R=5.07$ and $t=7$ to find p by theorem II. Thus $R^t=1.40710$ (360.92115 $=a$) $256.5=p$. That is, $p=$ 256l. 10 s. which is the ſum or principal required.

Example III. In what time will 256l. 10 s. raiſe a ſtock of (or amount to) 360l. 18 s. 5d. allowing 5 *per cent. per annum*, compound intereſt?

Here is given $p=256.5$, $a=360.92115$, $R=1.05$. To find t by theorem III. $R^t=\frac{a}{p}=\frac{360.92115}{256}=$ 1.40710. which being continually divided by $R=1.05$ until nothing remain, the number of thoſe diviſions will be $=7=t$.

Thus 1.05) 1.40710 (1,3400, and 1.05) (1.3400) 1.2762, and 1.05(1.2762) 1.2155, and ſo on until it becomes 1.05) 1.05 (1. which will be at the ſeventh diviſion.

Therefore it will be $t=7$, the number of years required by the queſtion.

INTERJECTION, in grammar, an indeclinable part of ſpeech, ſignifying ſome paſſion or emotion of the mind. See GRAMMAR.

INTERIM, a name given to a formulary, or kind of confeſſion of the articles of faith, obtruded upon the Proteſtants after Luther's death by the emperor Charles V. when he had defeated their forces; ſo called becauſe it was only to take place in the interim (mean time) till a general council ſhould have decided all points in diſpute between the Proteſtants and Romaniſts. It retained moſt of the doctrines and ceremonies of the Romaniſts, excepting that of marriage, which was allowed to prieſts, and communion to the laity under both kinds. Moſt of the Proteſtants rejected it. There were two other interims, one of Leipſic, the other of Franconia.

INTERLOCUTOR, in Scots law. The ſentence or judgment of a court of law, is commonly called an interlocutor before decree is extacted.

INTERLOPERS, are properly thoſe who, without due authority, hinder the trade of a company or corporation lawfully eſtabliſhed, by dealing in the ſame way.

INTERLUDE, an entertainment exhibited on the theatre between the acts of a play, to amuſe the ſpectators while the actors take breath and ſhift their dreſs, or to give time of changing the ſcenes and decorations.

INTERMITTENT, or INTERMITTING FEVERS, ſuch fevers as go off and ſoon return again, in oppoſition to thoſe which are continual. See MEDICINE.

INTEROSSEUS, in anatomy. See ANATOMY, p. 202.

INTERPOLATION, among critics, denotes a ſpurious paſſage inſerted into the writings of ſome ancient author.

INTERREGNUM, the time during which the throne is vacant in elective kingdoms; for in ſuch as are hereditary, like ours, there is no ſuch thing as an interregnum.

INTERREX, the magiſtrate who governs during an interregnum.

INTERMENT. See BURIAL.

INTERROGATION, or *Point of* INTERROGATION, in grammar, a character of this form (?) ſerving to denote a queſtion.

INTERVAL, in muſic, the difference between two ſounds, in reſpect of acute and grave; or, that imaginary ſpace terminated by two ſounds, differing in acuteneſs or gravity.

INTESTATE, in law, a perſon that dies without making a will.

INTESTINES, in anatomy. See ANATOMY, p. 259.

INTESTINAL, ſomething belonging to or ſeated in the inteſtines.

INTRIGUE, or INTREAGUE, an aſſemblage of events or circumſtances, occurring in an affair, and perplexing the perſons concerned in it.

In this ſenſe, it is uſed to ſignify the nodus or plot of a play or romance; or that point wherein the principal characters are moſt embarraſſed, through the artifice and oppoſition of certain perſons, or the unfortunate falling out of certain accidents and circumſtances.

INTRINSIC, a term applied to the inner, real, and genuine values, properties, *&c.* of any thing, in oppoſition to their extrinſic or apparent values, *&c.*

INTRUSION, in Scots law. See EJECTION.

INTUITION, among logicians, the act whereby the mind perceives the agreement or diſagreement of two ideas, immediately by themſelves, without the intervention of any other; in which caſe, the mind perceives the truth as the eye doth the light, only by being directed towards it.

INVECTED, in heraldry, denotes a thing fluted or furrowed.

Invected is juſt the reverſe of ingrailed, in which the points are turned outward to the field; whereas in invected they are turned inward to the ordinary, and the ſmall ſemicircles outward to the field. See Plate CII fig. 2.

INVECTIVE, in rhetoric, differs from reproof, as the latter proceeds from a friend, and is intended for the good of the perſon reproved; whereas the invective is the work of an enemy, and entirely deſigned to vex and give uneaſineſs to the perſon againſt whom it is directed.

INVENTION, denotes the act of finding any thing new, or even the thing thus found.

INVERARY, a parliament town of Scotland, in the county of Argyle, of which it is the capital, ſituated in Lochfin, forty five miles north-weſt of Glaſgow: W. long. 5°, N. lat 36° 28′.

INVERNESS, a parliament and port-town of Scotland, the capital of the county of Inverneſs, ſituated at the mouth of the river Neſs: W. long. 4° N. lat. 57° 46′.

INVERSE,

INVERSE, is applied to a manner of working the rule of three. See ARITHMETICK, p. 383.

INVERURY, a parliament town of Scotland, in the county of Aberdeen, fituated on the river Don, ten miles weft of Aberdeen.

INVESTIGATION, properly denotes the fearching or finding any thing out by the tracts or prints of the feet; whence mathematicians, fchoolmen, and grammarians, come to ufe the term in their refpective refearches.

INVESTITURE, in Scots law, the writings which conftitute a proper feudal right. See LAW, tit. 10.

INULA, in botany, a genus of the fyngenefia polygamia fuperflua clafs. The receptacle is naked; the pappus is fimple; and the antheræ terminate at the bafe in two briftles. There are 22 fpecies, 4 of them natives of Britain, *viz.* the helenium, or elecampane; the dyfenterica, or middle flea-bane; the pulicaria, or fmall flea-bane; and the erithmoides, or golden fampire. The root of the elecampane is faid to excite urine, and loofen the belly.

INVOCATION, in theology, the act of adoring God, and efpecially of addreffing him in prayer for his affiftance and protection.

INVOICE, an account in writing of the particulars of merchandife, with their value, cuftom, charges, *&c.* tranfmitted by one merchant to another in a diftant country. See BOOK-KEEPING, p 618.

INVOLUCRUM, among botanifts. See BOTANY, p. 637.

INVOLUTION, in algebra See ALGEBRA, p 84.

JOACHIMITES, in church-hiftory, the difciples of Joachim a ciftertian monk, who was an abbot of Flora in Calabria, and a great pretender to infpiration.

The Joachimites were particularly fond of certain ternaries: the Father, they faid, operated from the beginning till the coming of the Son; the Son, from that time to theirs, which was the year 1260; and from that time the Holy Spirit was to operate in his turn. They alfo divided every thing relating to men, to doctrine, and the manner of living, into three claffes, according to the three perfons in the Trinity.

JOANNA, one of the iflands of Comoro, fituated between the north-weft part of Madagafcar and Zanguebar, in Africa: E. long. 45°, S. lat. 12°.

JOB, or *Book of* JOB, a canonical book of the Old Teftament, containing a narrative of a feries of misfortunes which happened to a man whofe name was Job, as a trial of his virtue and patience; together with the conferences he had with his cruel friends, on the fubject of his misfortunes, and the manner in which he was reftored to eafe and happinefs. This book is filled with thofe noble, bold, and figurative expreffions, which conftitute the very foul of poetry.

Many of the Jewifh rabbins pretend that this relation is altogether a fiction: others think it a fimple narrative of a matter of fact, juft as it happened: while a third fort of critics acknowledge, that the groundwork of the ftory is true, but that it is wrote in a poetical ftrain, and decorated with peculiar circumftances, to render the narration more profitable and entertaining.

The time is not fet down in which Job lived. Some have thought that he was much ancienter than Mofes, becaufe the law is never cited by Job or his friends, and becaufe it is related that Job himfelf offered facrifices. Some imagine that this book was wrote by himfelf; others fay, that Job wrote it originally in Syriac or Arabic, and that Mofes tranflated it into Hebrew: but the rabbins generally pronounce Mofes to be the author of it, and many Chriftian writers are of the fame opinion.

JOBBER, in law, a perfon that buys and fells cattle for others. Hence ftock jobbers are perfons who buy and fell ftocks for other perfons.

IOGUIS, among the Eaft-Indians, a kind of hermits, who generally ftand under trees, or near their pagods. Some of them go ftark naked, holding their arms acrofs over their heads, and continue in that pofture all their lives: others lie on the ground, with one leg higher than the other, and their arms raifed above their head: and thefe wretched penitents infenfibly lofe the ufe of their arms and legs: fome confine themfelves in cages, fet on the top of a thick ftake, fixed in the ground; and thefe cages are fo fmall, that they put the penitent to prodigious torture: fome holding a fabre in one hand, and a kind of fhield in the other, go up a kind of crane, where hooking themfelves to an iron, which runs a confiderable way into their backs, they fpring forward into the air, flourifhing their fabres, and launching out into extravagant praifes of their idols: and others plunge into the Ganges, in hopes of being devoured by a crocodile, fancying that by this means they fhall obtain the happinefs of the next life.

Thefe miferable wretches are confidered by the Indians as perfect models of piety and holinefs: they are followed by perfons of both fexes, who make a vow of devoting themfelves to their fervice, and are wholely employed in foothing their voluntary fufferings by offering them alms and refrefhments. They call the pious to their devotions by ringing a little bell; and when they hold their fpiritual converfations, they fit clofe in a ring, and fet up a banner, made of feveral pieces of ftuff, faftened at the end of a ftick.

JOHN, or *Gofpel of St.* JOHN, a canonical book of the New Teftament, containing a recital of the life, actions, doctrine, and death of our Saviour Jefus Chrift, written by St John the apoftle and evangelift.

St. John wrote his Gofpel at Ephefus, after his return from the ifle of Patmos, at the defire of the Chriftians of Afia. St Jerom fays, he would not undertake it, but on condition they fhall appoint a public faft, to implore the affiftance of God; and that the faft being ended, St. John, filled with the Holy Ghoft, broke out into thefe words, "In the beginning was "the word," *&c.* The ancients affign two reafons for this undertaking: the firft is, becaufe, in the other three gofpels, there was wanting the hiftory of the beginning of Jefus Chrift's preaching, till the imprifonment of John the Baptift; which, therefore, he applied himfelf particularly to relate. The fecond reafon was, in order to remove the errors of the Cerinthians, Ebionites, and other fects.

St

St. John's day, the name of two Chriſtian feſtivals, one obſerved on June 24, kept in commemoration of the wonderful circumſtances attending the birth of St. John the Baptiſt; and the other on Dec. 27, in honour of St. John the Evangeliſt.

St. John's wort. See Hypericum.

St. John's, in geography, one of the Philippine iſlands, ſituated in 126° E. lon. and 7° N. lat.

St. John's, is alſo an iſland in the bay of St. Lawrence, ſituated north of New Scotland: W. lon. 65°, N. lat. 47°.

JOINERY, the art of working in wood, or of fitting various pieces of timber together.

It is called by the French *menuiſerié*, *q. d.* ſmall work, to diſtinguiſh it from carpentry, which is employed about large and leſs curious works.

JOINT, in general, denotes the juncture of two or more things.

The joints of the human body are called by anatomiſts articulations. See Anatomy, p. 148.

JOINTURE, in law, generally ſignifies a ſettlement of lands and tenements, made on a woman in conſideration of marriage.

JOINVILLE, a town of Champaign, in France, ſituated on the river Marne: E. lon. 5° 15′, and N. lat. 48° 27′.

JOISTS, or Joysts, in architecture, thoſe pieces of timber framed into the girders and ſummers, on which the boards of the floor are laid.

JONAH, or *Prophecy of* Jonah, a canonical book of the Old Teſtament; in which it is related, that Jonah was ordered to go and prophecy the deſtruction of the Ninevites; but that diſobediently attempting a voyage another way, he was diſcovered by the riſing of a ſudden tempeſt, and caſt into the ſea; where he was ſwallowed up by a whale, which, having lodged him three days and three nights in his belly, diſgorged him upon the ſhore; whereupon being ſenſible of his paſt danger and ſurpriſing deliverance, he betook himſelf to the journey and embaſſy to which he was appointed; and arriving at Nineveh, the metropolis of Aſſyria, he, according to his commiſſion, boldly laid open to the inhabitants their ſins and miſcarriages, and proclaimed their ſudden overthrow; upon which the whole city, by prayer and faſting, and a ſpeedy repentance, happily averted the divine vengeance, and eſcaped the threatened ruin.

IONIA, anciently was a province of the Leſſer Aſia, or Natolia, bounded by Etolia on the north, Lydia on the eaſt, Caria on the ſouth, and the Archipelago on the weſt.

IONIC order. See Architecture, p. 352.

Ionic dialect, in grammar, a manner of ſpeaking peculiar to the people of Ionia.

Ionic sect was the firſt of the ancient ſects of philoſophers; the others were the Italic and Eleatic. The founder of this ſect was Thales, who, being a native of Miletus in Ionia, occaſioned his followers to aſſume the appellation of Ionic: Thales was ſucceeded by Anaximander, and he by Anaximenes, both of Miletus; Anaxagoras Clazomenius ſucceeded them, and removed his ſchool from Aſia to Athens, where Socrates was his ſcholar. It was the diſtinguiſhing tenet of this ſect, that water was the principle of all natural things.

JONK, or Jonque, in naval affairs, is a kind of ſmall ſhip, very common in the Eaſt Indies: theſe veſſels are about the bigneſs of our fly-boats; and differ in the form of their building, according to the different methods of naval architecture uſed by the nations to which they belong. Their ſails are frequently made of mats, and their anchors are made of wood.

JOSHUA, a canonical book of the Old Teſtament, containing a hiſtory of the wars and tranſactions of the perſon whoſe name it bears. This book may be divided into three parts; the firſt of which is a hiſtory of the conqueſt of the land of Canaan; the ſecond, which begins at the twelfth chapter, is a deſcription of that country, and the diviſion of it among the tribes; and the third, compriſed in the two laſt chapters, contains the renewal of the covenant he cauſed the Iſraelites to make, and the death of their victorious leader and governor. The whole comprehends a term of ſeventeen, or, according to others, of twenty-ſeven years.

JOURNAL, or Day-book. See Book keeping, p. 583.

Journal, at ſea. See Navigation.

Journal is alſo a name common for weekly eſſays, news-papers, *&c.* as the Gray's Inn Journal, the Weſtminſter Journal, the Edinburgh Weekly Journal, *&c.*

JOURNEYMAN, properly one who works by the day only; but it is now uſed for any one who works under a maſter, either by the day, the year, or the piece.

IPECACUANHA, in the materia medica, a Weſt-indian root, of which there are two kinds, diſtinguiſhed by their colour, and brought from different places, but both poſſeſſing the ſame virtues, though in a different degree. The one is grey, and brought from Peru; the other is brown, and is brought from the Brazils: and theſe are indifferently ſent into Europe under the general name of ipecacuanha.

Theſe two ſorts have been by ſome ſuppoſed to be the roots of two different plants: but this is a miſtake; the only difference is, that one grows in a different place, and in a richer and moiſter ſoil, and is better ſupplied with juices than the other.

Ipecacuanha is an excellent, mild, and ſafe emetic; it is alſo a noble reſtringent; and, given in doſes too ſmall to vomit, is the greateſt of all remedies for a dyſentery. Small doſes of ipecacuanha, are an excellent remedy in diarrhœas of a more ſimple kind; and in the fluor albus we hardly know a better medicine.

IPOMÆA, in botany, a genus of the pentandria monogynia claſs. The corolla is funnel ſhaped; the ſtylus is globular; and the capſule has three cells. There are eighteen ſpecies, none of them natives of Britain.

IPSWICH, a borough and port town of Suffolk, ſituated on the river Orwel, twenty-four miles ſouth eaſt of Bury.

It ſends two members to parliament.

IRELAND, an iſland of the Atlantic ocean, ſubject to Great Britain, ſituated between 5° an 10° W. long. and between 51° and 56° N. lat. being bounded by the Northern ocean on the north, by St. George's channel, which divides it from Great Britain, on the eaſt, and by the Atlantic and Weſtern ocean on the the ſouth and weſt. This country is two hundred and fifty miles long, and one hundred and fifty broad; diſtant from Holyhead in north Wales fifty miles, and from Galloway in Scotland fifteen miles. It is divided into four large provinces, *viz.* Ulſter on the north, Leinſter on the eaſt, Munſter on the ſouth, and Connaught on the weſt.

IRIS, the RAINBOW. See OPTICS.

IRIS, in anatomy. See ANATOMY, p. 289.

IRIS, the FLOWER-DE LUCE, in botany, a genus of the triandria monogynia claſs. The corolla conſiſts of ſix diviſions, alternately reflected: the ſtigmata have the appearance of petals. There are twenty-two ſpecies, only two of which are natives of Britain, *viz.* the pſeudacorus, or yellow flower-de-luce; and the fœtidiſſima, or ſtinking gladdon. The root is cathartic, and recommended in dropſies.

IRON. See CHEMISTRY, p. 82.

IRON-SICK, in the ſea-language, is ſaid of a ſhip or boat, when her bolts or nails are ſo eaten with ruſt, and ſo worn away, that they occaſion hollows in the planks, whereby the veſſel is rendered leaky.

IRON-WORT, in botany. See SIDERITIS.

IRONY, in rhetoric, is when a perſon ſpeaks contrary to his thoughts, in order to add force to his diſcourſe; whence Quintilian calls it diverſiloquium.

IROQUOIS, the name of five nations in North America, in alliance with the Britiſh colonies. They are bounded by Canada on the north, by the Britiſh plantations of New-York and Penſilvania on the eaſt and ſouth, and by the lake Ontario on the weſt.

IRRADIATION, the act of emitting ſubtile effluvia, like the rays of the ſun, every way.

IRTIS, a great river, which runs from north to ſouth through Ruſſia, falls into the river Oby, and makes part of the boundary between Aſia and Europe.

IRWIN, a port-town of Scotland, in the bailiwic of Cunningham, ſituated at the mouth of the river Irwin, on the frith of Clyde: W. long. 4° 40′, N. lat. 55° 35′.

ISABELLA, a fortreſs of the Auſtrian Netherlands, ſituated on the weſt ſide of the river Schield, oppoſite to Antwerp: in E. long. 4° 10′, N. lat. 51° 15′.

ISAIAH, or *Prophecy of* ISAIAH, a canonical book of the Old Teſtament. Iſaiah is the firſt of the four greater prophets, the other three being Jeremiah, Ezekiel, and Daniel. This prophet was of royal blood, his father Amos being brother to Azariah king of Judah. The ſtyle of this prophet is noble, ſublime and florid. Grotius calls him the Demoſthenes of the Hebrews. He had the advantage, above the other prophets, of improving his diction by converſing with men of the greateſt parts and elocution; and this added a ſublimity, force, and majeſty to what he ſaid. He impartially reproved the vices of the age in which he lived, and openly diſplayed the judgments of God that were hanging over the Jewiſh nation; at the ſame time denouncing vengeance on the Aſſyrians, Egyptians, Ethiopians, Moabites, Edomites, Syrians, and Arabians, who were inſtrumental in inflicting thoſe judgments. He foretold the deliverance of the Jews from their captivity in Babylon, by the hands of Cyrus king of Perſia, an hundred years before it came to paſs; but the moſt remarkable of his predictions are thoſe concerning the Meſſiah, in which he not only foretold his coming in the fleſh, but all the great and memorable circumſtances of his life and death.

ISATIS, in botany, a genus of the tetradynamia ſiliquoſa claſs. The pod is lanceolated, has two valves, and contains but one ſeed. There are four ſpecies, only one of which, *viz.* the tinctoria, or woad, is a native of Britain. It is uſed by the dyers. See BOTANY, p. 634.

ISCHÆMUM, SCHOENANTH, in botany, a genus of the polygamia monœcia claſs. The calix of the hermaphrodite is a glume containing two flowers; the corolla conſiſts of two valves; it has three ſtamina, two ſtyli, and one ſeed. The calix, *&c.* of the male are the ſame with thoſe of the hermaphrodite. There are two ſpecies, both natives of the Eaſt Indies.

ISCHIUM, in anatomy. See ANAT. p. 172.

ISCHURY, in medicine, a diſeaſe conſiſting in an entire ſuppreſſion of urine. See MEDICINE.

ISENACH, a town of Germany in the circle of Upper Saxony, ſituated in E. long. 10° 12′, N. lat. 51°.

ISENARTS, a town of Germany, in the circle of Auſtria, and dukedom of Stiria, ſituated thirty-five miles north-weſt of Gratz.

ISERNIA, a town of Naples, in the province of Moliſe, ſituated in E. long. 15° 15′, N. lat. 41° 36′.

ISH, in Scots law, ſignifies *expiry*: thus we ſay, The iſh of a leaſe. It ſignifies alſo *to go out*: thus we ſay, Free iſh and entry from and to any place.

ISIA, feaſts and ſacrifices anciently ſolemniſed in honour of the goddeſs Iſis.

The Iſia were full of abominable impurities, and for that reaſon thoſe who were initiated were obliged to take an oath of ſecrecy: they held for nine days ſucceſſively; but were ſo abominable, that the ſenate aboliſhed them at Rome, under the conſulſhip of Piſo and Gabinius.

ISINGLASS. See ICHTHYOCOLLA.

ISLAND, a tract of dry land, encompaſſed with water; in which ſenſe it ſtands contradiſtinguiſhed from continent, or terra firma.

ISLE DE DIEU, an iſland in the bay of Biſcay, on the coaſt of France, ſituated fourteen miles weſt of the coaſt of Poitou.

ISLE *of France*, a province of that kingdom, in which the capital city of Paris is ſituated, being bounded by Picardy on the north, by Champain on the eaſt, by Orleans on the ſouth, and by Normandy on the weſt.

ISNARDIA, in botany, a genus of the tetrandria monogynia claſs. It has no corolla; the calix conſiſts of four diviſions; and the capſul has four cells. There is but one ſpecies, a native of France.

ISNY, a free imperial city of Germany, in the circle of Swabia, ſituated in E. long. 10°, N. lat. 47° 36′.

ISOCHRONAL, is applied to ſuch vibrations of a pendulum, as are performed in the ſame ſpace of time as all the vibrations or ſwings of the ſame pendulum are, whether the arches it deſcribes be longer or ſhorter.

ISOCHRONAL LINE, that in which a heavy body is ſuppoſed to deſcend without any acceleration.

ISOLA, a port town and biſhop's ſee of the hither Calabria, fifteen miles ſouth of St Severino.

ISOPERIMETRICAL FIGURES, in geometry, are ſuch as have equal perimeters or circumferences.

ISOPYRUM, in botany, a genus of the polyandria polygynia claſs. It has no calix; the petals are five or more; the nectarium is bilabiated, and tubular; and the capſule contains many ſeeds. There are three ſpecies, none of them natives of Britain.

ISOCELES TRIANGLE, in geometry, one that has two equal ſides.

ISPAHAN, or SPAHAWN, the capital city of Eyrac Agem, and of all Perſia: it is of an oval form, and twelve miles in circumference: E. lon. 50°, N. lat. 32° 30′.

ISPIDA, in ornithology. See ALCEDO.

ISSUES, in ſurgery, are little ulcers made deſignedly by the ſurgeon in various parts of the body, and kept open by the patient, for the preſervation or recovery of his health. See SURGERY.

ISTHMIA, or ISTHMIAN GAMES, one of the four ſolemn games which were celebrated every fifth year in Greece; ſo called from the Corinthian iſthmus, where they were kept.

ISTHMUS, in geography, a narrow neck of land, that joins two continents, or joins a peninſula to the terra firma, and ſeparates two ſeas,

ISTRIA, a peninſula in the north-part of the gulph of Venice, bounded by Carniola on the north; and on the ſouth, eaſt, and weſt, by the ſea.

ITALIAN, the language ſpoken in Italy.

ITALY, a country ſituated between ſeven and nineteen degrees eaſt long. and between thirty-eight and forty-ſeven degrees north latitude, bounded by Switzerland, and the Alps, which ſeparate it from Germany, on the north; by the gulph of Venice, on the eaſt; by the Mediterranean ſea, on the ſouth; and by the ſame ſea and the Alps, which ſeparate it from France, on the weſt; and if we include Savoy, which lies indeed on the weſt ſide of the Alps, between Italy and France, we muſt extend it a degree farther weſt: this is uſually deſcribed, however, with Italy, as it is contiguous to Piedmont, and has the ſame ſovereign, being a province of the king of Sardinia's dominions. Italy is ſaid to reſemble a boot, and is in length from north-weſt to ſouth-eaſt 600 miles; the breadth is very unequal; in the north, which may be called the top of the boot, it is about 400 miles broad from eaſt to weſt; in the calf of the leg, or middle, it is about 120 miles broad; and towards the ſouth, about the inſtep, eighty miles broad; and comprehends the following countries or ſubdiviſions. 1. In the north are the duchies of Savoy, Piedmont, and Montferrat; the territories of Genoa; the duchies of Milan, Mantua, Parma, Modena, and the territories of Venice. 2. In the middle of Italy, are the duchy of Tuſcany, the pope's dominions, and the ſtate of Lucca. 3. And in the ſouth is the kingdom of Naples.

ITCH, a cutaneous diſeaſe, ariſing from a corruption of a ſerous lymphatic matter, ſometimes attended with mild, ſometimes with more obſtinate and dangerous ſymptoms. See MEDICINE.

JUBILEE, a time of public and ſolemn feſtivity among the ancient Hebrews.

This was kept every fiftieth year: it began about autumnal equinox, and was proclaimed by the ſound of trumpet throughout all the country. At this time all ſlaves were releaſed, all debts annihilated, and all lands, houſes, wives, and children, however alienated, were reſtored to their firſt owners. During this whole year all kind of agriculture was forbidden, and the poor had the benefit of the harveſt, vintage, and other productions of the earth, in the ſame manner as in the ſabbatic or ſeventh year. As this was deſigned to put the Iſraelites in mind of their Egyptian ſervitude, and to prevent their impoſing the like upon their brethren, it was not obſerved by the Gentile proſelytes.

The Chriſtians, in imitation of the Jews, have likewiſe eſtabliſhed jubilees, which began in the time of pope Boniface VIII. in the year 1300, and are now practiſed every twenty-five years; but theſe relate only to the pretended forgiveneſs of ſins, and the indulgences granted by the church of Rome; together with the privilege of performing a thouſand frolics in maſquerade.

JUCATAN, or YUCATAN, a peninſula of Mexico, ſituated between 89° and 94° W. long. and between 16° and 21° N. lat.

JUDAISM, the religious doctrines and rites of the Jews. See JEWS.

JUDE, or *the general epiſtle of* JUDE, a canonical book of the New Teſtament, written againſt the heretics, who, by their diſorderly lives and impious doctrines, corrupted the faith and good morals of the Chriſtians. St. Jude draws them in lively colours, as men given up to their paſſions, full of vanity, conducting themſelves by worldly wiſdom, and not by the ſpirit of God.

JUDEA. See PALESTINE.

JUDENBURGH, a city of Stiria, in Germany: E. long 15°, N lat. 47° 22′.

JUDGE, a chief magiſtrate of the law, appointed to hear cauſes, to explain the laws, and to paſs ſentence.

Book of JUDGES, a canonical book of the Old Teſtament, ſo called from its relating the ſtate of the Iſraelites under the adminiſtration of many illuſtrious perſons who were called judges, from their being both the civil and military governors of the people, and who were raiſed up by God upon ſpecial occaſions, after the death of Joſhua, till the time of their making a king. In the time of this peculiar polity, there were ſeveral remarkable occurrences, which are recorded in this book. It acquaints us with the groſs impiety of a new generation which ſprung up after the death of Joſhua,

ſhua, and gives us a ſhort view of the diſpenſations of heaven towards this people, ſometimes relieving and delivering them, and at others ſeverely chaſtiſing them by the hands of their enemies.

JUDGMENT, among logicians, a faculty or rather act of the human ſoul, whereby it compares its ideas, and perceives their agreement or diſagreement.

JUDGEMENT, in law, the ſentence of the judges upon a ſuit, *&c.*

JUDOIGNE, a town of the Auſtrian Netherlands, in the province of Brabant, ſituated on the river Gheet, thirteen miles ſouth-eaſt of Louvain, and ſixteen north of Namur.

IVES, or St. IVES, a borough and port-town of Cornwal, ſituated on the Iriſh channel: it ſends two members to parliament: W. long. 6°, N. lat. 50° 18′.

JUGERUM, in Roman antiquity, a ſquare of 120 Roman feet; its proportion to the Engliſh acre being as 10000 to 16097.

JUGULAR, in anatomy, an appellation given to two veins of the neck, which ariſe from the ſubclavians. See ANATOMY, part IV.

IVICA, or YVICA, the capital of an iſland of the ſame name, fifty miles eaſt of Valencia in Spain: E. long. 1°, N. lat. 39°.

JUICE, denotes the ſap of vegetables, or the liquors of animals.

JUJUBES, in the materia medica, the name of a fruit of the pulpy kind, produced on a tree which Linnæus makes a ſpecies of rhamnus. See RHAMNUS.

The jujubes have been made a general ingredient in pectoral decoctions; but they are now ſeldom uſed on theſe occaſions, and are ſcarce at all heard of in preſcription, or to be met with in our ſhops.

JULEP, in pharmacy, a medicine compoſed of ſome proper liquor, and a ſyrup or ſugar of extemporaneous preparation, without decoction, deſigned for the concoction or alteration of the humours, or reſtoring the ſtrength.

JULIAN, or St. JULIAN, a harbour on the coaſt of Patagonia, in South America, where ſhips bound to the ſouth ſeas uſually touch: W. long. 74°, N. lat. 48° 15′.

JULIAN PERIOD, in chronology. See ASTRONOMY, p. 489.

JULIERS, the capital of the duchy of the ſame name, ſituated on the river Roer, twenty miles weſt of Cologn, and as many eaſt of Maeſtricht: E. long. 6°, N. lat. 50° 55′

JULPHA, or *Old* JULPHA, once the capital of Armenia, but now in ruins, the inhabitants being tranſplanted to a town within a mile of Iſpahan, called New Julpha, and there they carry on a foreign trade with all countries in Aſia. The ſituation of Old Julpha was in E. long. 46°, N. lat. 39°.

JULY, in chronology, the ſeventh month of the year, ſo called in honour of Julius Cæſar; before whoſe time it was known by the name of quintilis, as being the fifth month of the old Roman year.

JUNCUS, the RUSH, in botany, a genus of the hexandria monogynia claſs. The calix has ſix leaves; it has no corolla; and the berry is dry, and contains but one ſeed. There are 19 ſpecies, twelve of them natives of Britain.

JUNGERMANNIA, a genus of the cryptogamia algæ claſs. Of which there are 29 ſpecies, all natives of Britain.

JUNIPERUS, in botany, a genus of the diœcia monadelphia claſs. The male has no corolla, but has three ſtamina; the calix of the female conſiſts of three parts; it has three petals, and three ſtyli; and the berry contains three ſeeds. There are nine ſpecies, only one of which, *viz.* the communis or common juniper, is a native of Britain. The berries are uſed as carminatives and ſtomachics.

JUNK, in the ſea-language, old cables cut into ſhort pieces, and given to boatſwains for making ſwabs, plats, and nippers; as alſo to the ſhip-carpenters, and to poor people, to be picked into oakam, for caulking ſhips, *&c.*

JUNTO, in matters of government, denotes a ſelect council for taking cognizance of affairs of great conſequence, which require ſecrecy.

In Spain and Portugal, it ſignifies much the ſame with convention, aſſembly, or board among us: thus we meet with the junto of the three eſtates, of commerce, of tobacco, *&c.* See BOARD, *&c.*

IVORY, in natural hiſtory, *&c.* a hard, ſolid and firm ſubſtance, of a white colour, and capable of a very good poliſh. It is the tuſk of the elephant, (See ELEPHAS,) and is hollow from the baſe to a certain height, the cavity being filled up with a compact medullary ſubſtance, ſeeming to have a great number of glands in it. It is obſerved, that the Ceylon ivory, and that of the iſland of Achem, do not become yellow in the wearing, as all other ivory does; for this reaſon the teeth of theſe places bear a larger price than thoſe of the coaſt of Guinea.

JUPITER, in aſtronomy. See ASTRONOMY, p. 441.

JUREA, or JURA, a ſtrong city in Italy, in the province of Piedmont, ſituated on the river Doria, ſubject to the king of Sardinia: E. long. 7°, 36′; N. lat. 45°, 22′.

JURISPRUDENCE, the ſcience of what is juſt or unjuſt; or the knowledge of laws, rights, cuſtoms, ſtatutes, *&c.* neceſſary for the adminiſtration of juſtice.

JURY-MAST, whatever is ſet up in room of a maſt that has been loſt in a ſtorm or in an engagement, and to which a leſſer yard, ropes, and ſails, are fixed.

JUS DELIBERANDI, in Scots law, that right which an heir has, by law, of deliberating for a certain time whether he will repreſent his predeceſſor. See LAW, tit 27.

JUS DEVOLUTUM, in Scots law, the right of the church, of preſenting a miniſter to a vacant pariſh, in caſe the patron ſhall neglect to uſe that right within the time limited by law. See LAW, tit. 5.

JUS MARITI, in Scots law, the right the huſband acquires to his wife's moveable eſtate, in virtue of the marriage. See LAW, tit. 6.

JUS RELICTÆ, in Scots law, the right the wife has in the

the goods in communion, in caſe of the previous deceaſe of the huſband. See LAW, tit. 28.

JUS PREVENTIONIS, in Scots law, the preferable right of juriſdiction acquired by a court, in any cauſe to which other courts are equally competent, by having exerciſed the firſt act of juriſdiction. See LAW, tit. 2.

JUST, a ſportive combat on horſeback, man againſt man, armed with lances.

The difference between juſts and tournaments, according to Du Cange, conſiſts in this, that the latter is a genus of which the former is only a ſpecies. Tournaments included all kinds of military ſports and engagements, which were made out of gallantry and diverſion. Juſts were thoſe particular combats, where the parties were near each other, and engaged with lance and ſword.

JUSTICE, in a moral ſenſe, is one of the four cardinal virtues, which gives every perſon his due.

JUSTICE, in a legal ſenſe, a perſon deputed by the king to adminiſter juſtice to his ſubjects, whoſe authority ariſes from his deputation, and not by right of magiſtracy.

JUSTICE-SEAT, is the higheſt foreſt-court, always held before the lord chief juſtice in eyre of the foreſt; in which court fines are ſet for offences, and judgments given.

JUSTICIA, in botany, a genus of the diandria monogynia claſs. The corolla is ringent; and the capſule has two cells. There are 19 ſpecies, none of them natives of Britain.

JUSTICIAR, in the old Engliſh laws, an officer inſtituted by William the Conqueror, as the chief officer of ſtate, who principally determined in all caſes civil and criminal. He was called in Latin *Capitalis Juſticiarius totius Angliæ.*—For JUSTICIAR *in Scotland*, ſee LAW, tit. 3. § 13.

JUSTICIARY, or *Court of* JUSTICIARY, in Scotland. See LAW, tit. 3. § 10.

JUTES, the ancient inhabitants of Jutland, in Denmark.

JUTLAND, a peninſula of Denmark, anciently called the Cimbrian Cherſoneſe, ſituated between 8° and 11° of E. long. and between 55° and 58° of N. lat. bounded by the Categate ſea, which ſeparates it from Norway, on the north; by the ſame ſea, which divides it from the Daniſh iſlands and Sweden, on the eaſt; by Holſtein, on the ſouth; and by the German ocean, on the weſt. It is divided into north and ſouth Jutland; the ſouth being uſually called Sleſwic. The whole is about 180 miles in length, and 90 in breadth.

IVY, in botany. See HEDERA.

IXIA, in botany, a genus of the triandria monogynia claſs. The corolla conſiſts of ſix open equal petals; and it has three erect ſtigmata. There are ten ſpecies, none of them natives of Britain.

IXORA, in botany, a genus of the tetrandria monogynia claſs. The corolla conſiſts of one long funnel-ſhaped petal; and the berry contains four ſeeds. There are three ſpecies, none of them natives of Britain.

K.

KÆMPFERIA, in botany, a genus of the monandria monogynia claſs. The corolla conſiſts of ſix ſegments, three of them being large and open. There are two ſpecies, both natives of India. The root of this plant is the galangal, which was formerly uſed in bitter infuſions, but is now neglected in practice.

KAKENHAUSEN, a city of Livonia, ſubject to Ruſſia: E. long. 26°, N. lat. 57°.

KALI, in botany. See SALSOLA.

KALLO, a town of upper Hungary, ſituated in a lake twenty miles ſouth eaſt of Tockay.

KAOLIN, one of the ſubſtances whereof china-ware is made; being no other than a kind of talc reduced to powder, and made into a paſte with water.

KAUSBEUREN, an imperial city of Germany, thirty-two miles ſouth of Augſburg: E. long. 10° 45′, N. lat. 47° 50′.

KEBLA, an appellation given by the Mahometans to that part of the world where the temple of Mecca is ſituated, towards which they are obliged to turn themſelves when they pray.

KEDGING, in the ſea-language, is when a ſhip is brought up or down in a narrow river by means of the tide, the wind being contrary. To do this, they uſe to ſet their fore-courſe, or fore-top ſail and mizzen, that ſo they may flat her about; and if ſhe happens to come too near the ſhore, they let fall a kedge-anchor, with a hawſer faſtened to it from the ſhip, in order to turn her head about; which work is called kedging.

KEEL, the loweſt piece of timber in a ſhip, running her whole length from the lower part of her ſtem to the lower part of her ſtern-poſt. Into it are all the lower futtocks faſtened; and under part of it, a falſe keel is often uſed.

KEELSON, a principal timber in a ſhip, fayed withinſide croſs all the floor timbers; and being adjuſted to the keel with ſuitable ſcarfs, it ſerves to ſtrengthen the bottom of the ſhip.

KEEPER *of the great ſeal*, is a lord by his office, is ſtyled lord keeper of the great ſeal of Great-Britain, and is always one of the privy-council. All grants, charters and commiſſions of the king under the great ſeal, paſs through the hands of the lord-keeper; for without that ſeal, many of thoſe grants, *&c.* would be

be of no force; the king being, in the interpretation of the law, a corporation, and therefore paſſes nothing but by the great ſeal, which is alſo ſaid to be the public faith of the kingdom, being in the higheſt eſteem and reputation.

Whenever there is a lord-keeper, he is inveſted with the ſame place, authority, preheminence, juriſdiction, or execution of laws, as the lord chancellor of Great-Britain is veſted with.

The lord-keeper is conſtituted by the delivery of the great ſeal, *&c.*

KEEPER *of the privy ſeal*, is alſo a lord by his office, through whoſe hands all grants, pardons, *&c.* paſs before they come to the great ſeal, and even ſome things paſs this officer's hands which do not paſs the great ſeal at all. This officer is alſo one of the privy council, yet was anciently called clerk of the privy ſeal. His duty is to put the ſeal to no grant, *&c.* without a proper warrant; nor with warrant where it is againſt law, or inconvenient, but ſhall firſt acquaint the king therewith.

KEISERWAERT, a ſtrong town of Germany in the circle of Weſtphalia and duchy of Berg, ſituated on the Rhine, twenty-five miles north of Cologne, E. lon. 6° 8′, N. lat. 51° 20′.

KELLINGTON, a borough-town of Cornwall, thirteen miles ſouth of Launceſton, which ſends two members to parliament.

KELP, a fixed ſalt, or particular ſpecies of pot-aſh, procured by burning a ſpecies of ſalicoſa. See SALICOSA.

KELSO, a town of Scotland, in the ſhire of Mers, or Roxburgh, ſituated on the north ſide the Tweed, twenty miles ſouth-weſt of Berwick.

KEMPTEN, a city of Germany, in the circle of Swabia, ſituated on the river Iſer: E. lon. 10° 7′, N. lat. 47° 38′.

KENDAL, a market-town of Weſtmoreland, twenty-two miles ſouth-weſt of Appleby.

KENKS, in the ſea language, doublings in a rope or cable, when handed in and out, ſo that it does not run eaſy; or when any rope makes turns or twiſts, and does not run free in the block, then it is ſaid to make kenks.

KENNING *to a* TERCE, in Scots law, the dividing or ſetting off that part of the huſband's eſtate to his relict which ſhe is entitled to liferent after his death. See TERCE.

KENSINGTON, a pleaſant village in the county of Middleſex, two miles weſt of London; where is a royal palace, with large and fine gardens.

KENT, a county bounded by the river Thames on the north, by the ocean on the eaſt, by Suſſex and the Straits of Dover on the ſouth, and by Surrey on the weſt.

KERMAN, the capital of the province of Kerman, or Carimania, in Perſia: E. lon. 56° 30′, N. lat. 30°.

KERMES, in botany. See ILEX.

KERMES MINERAL. See CHEMISTRY, p. 140.

KERRY, a county of Ireland, in the province of Munſter, bounded by the river Shannon, which divides it from Clare, on the north; by Limeric and Cork, on the eaſt; by another part of Cork, on the ſouth; and by the Atlantic Ocean, on the weſt.

KESSEL, a town of Upper Guelderland, in the quarter of Roermonde, ſituated on the river Meuſe: E. lon. 6°, N. lat. 51° 25′.

KESTRIL, in ornithology. See FALCO.

KETMIA, in botany. See HIBISCUS.

KETTERING, a market-town of Northamptonſhire, ten miles north-eaſt of Northampton.

KETCH, in naval architecture, a veſſel with two maſts. See SHIP.

KEVEL, in ſhip-building, a piece of plank ſayed againſt the quickwork on the quarter-deck, in the ſhape of a ſemicircle; about which the running rigging is belaid.

KEXHOLME, the capital of the province of the ſame name in Finland, ſituated on the lake Ladoga, eighty miles north of Peterſburgh: E. lon. 30°, N. lat. 61° 30′.

KEY, a well known inſtrument for opening and ſhutting the locks of doors, cheſts, buroes, and the like.

KEY, in muſic, a certain fundamental note, or tone, to which the whole piece, be it in concerto, ſonata, cantata, *&c.* is accommodated, and with which it uſually begins, but always ends.

KEY-STONE of an arch, or vault, that placed at the top or vertex of an arch, to bind the two ſweeps together.

KIAM, a great river of China, which, taking its riſe near the weſt frontier, croſſes the whole kingdom eaſtward, and falls into the bay or gulph of Nanking, a little below that city.

KIAMSI, a province of China, bounded by that of Nanking on the north, and by that of Canton on the ſouth.

KIDDERMINSTER, a market-town twelve miles north of Worceſter.

KIDNEYS, in anatomy. See ANATOMY, p. 268.

KIGGELARIA, in botany, a genus of the dioecia decandria claſs. The calix of both male and female conſiſts of five ſegments, and the corolla of five petals; the antheræ of the male are perforated at the apex: The female has five ſtyli; the capſule has five valves, one cell, and many ſeeds. There is but one ſpecies, a native of Ethiopia.

KIDDARE, the capital of a county of the ſame name, in Ireland, twenty-ſeven miles ſouth-weſt of Dublin.

KILDERKIN, a liquid meaſure, containing two firkins.

KILKENNY, a county of Ireland, in the province of Leinſter, bounded by Queen's County, on the north; by the county of Wexford, on the eaſt; by Waterford, on the ſouth; and by the county of Tipperary, on the weſt. It is alſo the name of the capital of that county; and is ſituated in W. lon. 7° 15′, N. lat. 52° 30′.

KIMBOLTON, a market-town of Huntingtonſhire, nine miles ſouth-weſt of Huntington.

KING, in the general acceptation of the word, is a perſon who has a ſupreme authority, with the power of levying taxes, making laws, and enforcing an obedience to them: but in Britain, which is a limited monarchy,

monarchy, the power of the king is greatly reftrained; which is fo far from diminifhing his honour, that it adds a glory to his crown; for while other kings are abfolute monarchs over innumerable multitudes of flaves, the king of England has the diftinguifhed glory of governing a free people, the leaft of whom is protected by the laws: he has great prerogatives, and a boundlefs power in doing good; and is at the fame time only reftrained from acting inconfiftently with his own happinefs, and that of his people. He has all the enfigns of royalty, and all the marks of fovereignty; but while he has the power of making treaties, of fending and receiving ambaffadors, of conferring titles of honour, creating privy counfellors, officers of ftate, and judges, and may raife men and arms both for fea and land, he cannot force his fubjects to maintain them, or raife one tax by his fole authority: he has the privilege of coining money, but he cannot force the meaneft fubject to part with his property: he can pardon a criminal; but he cannot put a fubject to death, till he is condemned by his peers: he may at his pleafure call, continue, prorogue, and diffolve parliaments, and without his royal affent no bill in parliament can pafs into a law; yet he can neither act contrary to law, nor make new laws by his fole authority; on the contrary, he may even be fued and caft in his own courts.

At his coronation, he takes an oath to govern his people according to the ftatutes agreed on in parliament, to caufe law and juftice in mercy to be executed in all his judgments; to maintain, as much as in him lies, the laws of God, the true profeffion of the gofpel, and the proteftant reformed religion by law eftablifhed. But tho' he may mitigate the rigour of the law, and forgive offenders, he cannot pardon murder, where an appeal is brought by the fubject; nor any other crime, when the offender is impeached by the houfe of commons. He may lay an embargo on fhipping; but then it ought to be for the public good, and not for the private advantage of any particular traders. Writs, proceffes, commiffions, *&c.* are in his name; and he has a power not only to make courts, but to create univerfities, colleges, and boroughs; to incorporate a city or town, and to grant franchifes to fuch corporations; but they muft not, under colour thereof, fet up a monopoly. He is efteemed the head of the church in that part of his dominions called England. But notwithftanding thefe and other prerogatives, the king can take what he has a right to only by due courfe of law. In fhort, he has a principal fhare in the legiflative power, and the whole executive power is lodged in him; he is fuppofed prefent in all his courts, he can do no wrong, and, according to the laws of England, he never dies.

KING's BENCH, a court in which the king was formerly accuftomed to fit in perfon, and on that account was moved with the king's houfhold. This was originally the only court in Weftminfter-hall, and from this it is thought that the courts of common pleas and exchequer were derived. As the king in perfon is ftill prefumed in law to fit in this court, though only reprefented by his judges, it is faid to have fupreme authority; and the proceedings in it are fuppofed to be coram nobis, that is, before the king. This court confifts of a lord chief juftice and three other juftices or judges, who are invefted with a fovereign jurifdiction over all matters, whether of a criminal or public nature. All crimes againft the public good, though they do not injure any particular perfon, are under the cognizance of this court; and no private fubject can fuffer any unlawful violence or injury againft his perfon, liberty, or poffeffions, but a proper remedy is afforded him here; not only for fatisfaction of damages fuftained, but for the punifhment of the offender: and wherever this court meets with an offence contrary to the firft principles of juftice, it may punifh it. It frequently proceeds on indictments found before other courts, and removed by certiorari into this. Perfons illegally committed to prifon, though by the king and counfel, or either of the houfes of parliament, may be bailed in it; and in fome cafes, even upon legal commitments. Writs of mandamus are iffued by this court, for the reftoring of officers in corporations, *&c.* unjuftly turned out, and freemen wrongfully disfranchifed.

The court of king's bench is now divided into a crown-fide and plea-fide, the one determining criminal, and the other civil caufes: in the firft it determines criminal matters of all kinds, where the king is plaintiff; fuch as treafons, felonies, murders, rapes, robberies, riots, breaches of the peace, and all other caufes that are profecuted by indictment, information, *&c.* On the plea-fide, it determines all perfonal actions commenced by bill or writ; as actions of debt, upon the cafe, detinue, trover, ejectment, trefpafs, wafte, *&c.* againft any perfon in the cuftody of the marfhal of the court, as every perfon fued here is fuppofed to be by law.

The officers of this court on the crown-fide are the clerk and fecondary of the crown; and on the fide of the pleas there are two chief clerks or prothonotaries, and their fecondary and deputy, the cuftos brevium, two clerks of the papers, the clerk of the declarations, the figner and fealer of bills, the clerk of the rules, clerk of the errrors, and clerk of the bails; to which may be added the filazers, the marfhal of the court, and the crier.

Books of KINGS, two canonical books of the Old Teftament, fo called becaufe they contain the hiftory of the kings of Ifrael and Judah, from the beginning of the reign of Solomon, down to the Babylonifh captivity, for the fpace of near fix hundred years.

It is probable that thefe books were compofed by Ezra, who extracted them out of the public records, which were kept of what paffed in that nation.

KING's COUNTY, a county of Ireland, in the province of Leinfter, bounded by Weft-meath on the north, by the county of Kildare on the eaft, by Queen's county and Tipperary on the fouth, and by the river Shannon, which feparates it from Galway, on the weft.

KING's EVIL. See MEDICINE.

KING's FISHER, in ornithology. See ALCEDO.

KINGHORN, a town of Scotland, on the coaft of Fife, nine miles north of Edinburgh.

KINGSTON,

KINGSTON, a market-town of Surry, ſituated on the river Thames, twelve miles weſt of London.

KINGSTON, a port-town of Jamaica, ſituated on the north ſide of the bay of Port royal: W. long. 77°, N. lat. 17° 32′.

KINROSS, a town of Scotland, in the ſhire of Fife, ſituated on the lake of Loch-Leven, twenty miles north of Edinburgh.

KINSALE, a port-town of Ireland, in the county of Cork and province of Munſter, ſituated on the river Bandon, fourteen miles ſouth of the city of Cork: W. long. 8° 20′, and N. lat. 51° 32′.

KIOF, or KIOW, the capital of the Ruſſian Ukraine, on the frontiers of Poland: E. long. 30° 30′, and N. lat. 51°.

KIRK, a Saxon term, ſignifying the ſame with church.

KIRK OSWALD, a market town of Cumberland, twelve miles ſouth of Carliſle.

KIRK-SESSIONS, an inferior church judicatory in Scotland, conſiſting of the miniſters, elders, and deacons of a pariſh.

It regulates matters relating to public worſhip, catechiſing, viſitations, *&c.* and judges in caſes of fornication and leſſer ſcandals.

KIRKALDY, a town of Fifeſhire, in Scotland, ten miles north of Edinburgh.

KIRKHAM, a market-town of Lancaſhire, ſixteen miles ſouth of Lancaſter.

KIRKUDBRIGHT, a parliament-town of Scotland, which ranks with Dumfries, Annan, *&c.* ſituated on a bay of the Iriſh ſea, ſixty miles weſt of Carliſle: W. long. 4° 5′, and N. lat. 54° 38′.

KIRKWALL, the capital of the Orkney-iſlands, and ſituated in that of Pomona, is a parliament-town, which claſſes with Dingwall, Tain, *&c.* W. long. 25°, and N. lat. 59° 45′.

KITCHEN-GARDEN, a piece of ground laid out for the cultivation of fruit, herbs, pulſe, and other vegetables uſed in the kitchen. See GARDENING.

KITE. See FALCO.

KNARESBOROUGH, a borough-town in the north riding of Yorkſhire, fifteen miles north of York. It ſends two members to parliament.

KNAVE, in old law-books, an appellation given to a man-ſervant, or even to a male child.

KNAVESHIP, in Scots law, one of the names of the ſmall-duties payable in thirlage to the miller's ſervants, called ſequels. See SCOTS LAW, tit. 16.

KNAUTIA, in botany, a genus of the tetrandria monogynia claſs. The common calix is oblong, ſimple, and contains five flowers; the proper calix is ſimple, and above the fruit; the corollulæ are irregular; and the receptacle is naked. There are two ſpecies, none of them natives of Britain.

KNEE, in anatomy, the articulation of the thigh and leg-bones. See ANATOMY, part I. *&c.*

KNEE, in a ſhip, a crooked piece of timber, bent like a knee, uſed to bind the beams and futtocks together, by being bolted faſt into them both. Theſe are uſed about all the decks.

Carling-KNEES, in a ſhip, thoſe timbers which extend from the ſides to the hatch-way, and bear up the deck on both ſides.

KNIFE, a well-known inſtrument, made for cutting.

All ſorts of knives are prohibited to be imported.

KNIGHT, among the Romans, a perſon of the ſecond degree of nobility, following immediately that of the ſenators.

Part of the ceremony whereby this honour was conferred, was the giving of an horſe; for each had an horſe at the public charge, and received the ſtipend of a horſeman, to ſerve in the wars.

When the knights were taken in among the ſenators, they reſigned the privilege of having an horſe kept for them at the charge of the public: then it become neceſſary, in order to be a knight, that they ſhould have a certain revenue, that their poverty might not diſgrace the order; and when they failed of the preſcribed revenue, they were expunged out of the liſt of knights, and thruſt down among the Plebeians. Ten thouſand crowns is computed to have been the revenue required.

The knights at length grew ſo very powerful, that they became a balance between the power of the ſenate and people: they neglected the exerciſes of war, and betook themſelves principally to civil employments in Rome.

KNIGHT, in a modern ſenſe, properly ſignifies a perſon, who, for his virtue and martial proweſs, is by the king raiſed above the rank of gentlemen, into an higher claſs of dignity and honour.

Knighthood was formerly the firſt degree of honour in the army, and uſually conferred with a great deal of ceremony on thoſe who had diſtinguiſhed themſelves by ſome notable exploit in arms: the ceremonies at their creation have been various; the principal was a box on the ear, and a ſtroke with a ſword on the ſhoulder; they put on him a ſhoulder-belt, and a gilt ſword, ſpurs, and other military accoutrements; after which being armed as a knight, he was led to the church in great pomp. Camden deſcribes the manner of making a knight-batchelor among us, which is the loweſt, though the moſt ancient order of knighthood, to be thus: the perſon kneeling, was gently ſtruck on the ſhoulder by the prince, and accoſted in theſe words, "Riſe, or be a knight, in the name of God."

KNIGHT is alſo underſtood of a perſon admitted into any order, either purely military, or military and religious, inſtituted by ſome king or prince, with certain marks and tokens of honour and diſtinction, as the knights of the garter, knights of the thiſtle, knights of Malta, the knights of the Holy Ghoſt, *&c.*

KNIGHTS ERRANT, a pretended order of chivalry, much talked of in old romances, being a kind of heroes that travelled the world in ſearch of adventures, redreſſing wrongs, reſcuing damſels, and taking all occaſions of ſignalizing their proweſs. This romantic bravery of the old knights was heretofore the chimera of the Spaniards.

KNIGHTS *of the ſhire*, or KNIGHTS *of parliament*, in the

the British polity, are knights or gentlemen of estate, who are elected, on the king's writ, by the freeholders of every county, to represent them in parliament.

The qualifications of a knight of the shire in England, is to be possessed of 600 l. *per. ann.* in a freehold estate; and in Scotland 400 l. Scots valued rent, or 40 shillings of old extent. Their expences during their sitting, were, by a statute of Hen. VIII. to be defrayed by the county; but this is now scarce ever required.

KNIGHT-MARSHAL, an officer in the king's household, who has jurisdiction and cognizance of any transgression within the king's household and verge; as also of contracts made there, whereof one of the house is party.

KNIGHTS, in a ship, two thick short pieces of wood, commonly carved like a man's head, having four shivers in each, three for the halyards, and one for the top-ropes to run in: one of them stands fast bolted on the beams abaft the foremast, and is therefore called the fore-knight; and the other, standing abaft the main mast, is called the main knight.

KNOWLEDGE, is defined, by Mr Locke, to be the perception of the connection and agreement, or disagreement and repugnancy, of our ideas.

KONIGSBURG, a city of Poland, the capital of ducal Prussia, and of the king of Prussia's Polish dominions, situated on the river Pregel, near a bay of the Baltic sea, seventy miles north-east of Dantzick: E. long. 21°, and N. lat. 54° 40′.

KORAN, or ALCORAN. See MAHOMETANISM.

KOS, in Jewish antiquity, a measure of capacity, containing about four cubic inches: this was the cup of blessing, out of which they drank when they gave thanks after solemn meals, like that of the passover.

KUR, the ancient Cyrus, a river of Persia, which rises in the mountains of Georgia, and running south-east by Teflis, unites it streams with the river Arras (the ancient Arraxes) and falls into the Caspian sea, south of Baku.

KUTUCHTA, among the Calmuc Tartars, the name of their high-priest, or sovereign pontiff; formerly only the deputy of the delai-lama, or high-priest of the Tartars, but at present independent on him.

L.

LA, in music, the syllable by which Guido denotes the last sound of each hexachord: if it begins in C, it answers to our A; if in G, to E; and if in F, to D.

LABARUM, in Roman antiquity, the standard borne before the Roman emperors; being a rich purple streamer, supported by a spear.

LABDANUM, or LADANUM, a resin of the softer kind, though of too firm a consistence to be ranked among the fluid ones.

There are two kinds of it kept in the shops; one usually imported in bladders, to preserve it in its genuine soft consistence, and to prevent the evaporation of its finer parts; another in rolls, much inferior to the former in purity and virtue.

Labdanum should be chosen soft and moist, of a strong smell, pure, very inflammable, and diffusing a fragrant smell while burning. It is a resinous juice which exsudes from a tree of the cistus-kind.

In medicine it is used externally, to attenuate and discuss tumours; internally, it is more rarely used, but it is greatly extolled by some against catarrhs, and in dysenteries.

LABEL, in heraldry, a fillet usually placed in the middle along the chief of the coat, without touching its extremities. Its breadth ought to be a ninth part of the chief. It is adorned with pendants; and when there are above three of these, the number must be specified in blazoning.

This is a kind of addition to the arms of a second brother, to distinguish him from the first, and is esteemed the most honourable of all differences. See Plate CII.

LABIAL LETTERS, those pronounced chiefly by means of the lips.

LABIATED FLOWERS, monopetalous flowers, consisting of a narrow tube, with a wide mouth, divided into two or more.

LABIAU, a port-town of Prussia, situated on a bay of the Baltic sea, twenty miles north-east of Koningsburg: E. long. 22° 15′, N. lat. 55°.

LABORATORY or ELABORATORY, the chemists work-house, or the place where they perform their operations; where the furnaces are built, their vessels kept, *&c.* and in general, the term laboratory, is applied to any place where physical experiments in pharmacy, chemistry, pyrotechny, *&c.* are performed. See CHEMISTRY, p. 108, *&c.*

LABOUR, in general, denotes a close application to work or business. Among seamen a ship is said to be in labour, when she rolls and tumbles very much, either a hull, under sail, or at anchor.—It is also spoke of a woman in travail or child birth. See MIDWIFERY.

LABOURER, generally signifies one that does the most slavish and less artful part of a laborious work, as that of husbandry, masonry, *&c.*

LABRADOR, also called New-Britain, and Eskimaux, is a country in North America, bounded by Hudson's Straits and the Atlantic Ocean, on the north; by the same ocean, on the east; by the river of St. Lawrence and

and Canada, on the fouth; and by Hudfon's bay, on the weft: fituated between 59° and 79° of W. long. and between 50° and 64° of N. lat.

LABRUS, in ichthyology, a genus of fifhes belonging to the order of thoracici, the characters of which are thefe. The teeth are fharp, and the lips are fimple and very thick; there are fix bony rays in the membrane of the gills, and the opercula are fcaly. The rays of the back fin are furnifhed with a thread-like ramentum behind; the breaft fins are fharp-pointed; and the lateral line is ftraight. There are forty-one fpecies of labrus, diftinguifhed by the fhape of the tail, fins, colour, *&c.*

LABURNUM, in botany. See CYTISUS.

LABYRINTH, in anatomy. See ANATOMY, p. 297.

LAC, MILK, among phyficians, *&c.* See MILK.

LACCA, or LAC, in natural hiftory, improperly called gum-lac, a fort of wax of a red colour, collected in the Eaft-Indies by certain infects, and depofited on fticks faftened for that purpofe in the earth. It is brought over, either adhering to the fticks, or in fmall tranfparent grains, or in femi-tranfparent flat cakes: the firft is called ftick lac, the fecond feed lac, and the third fhell lac. On breaking a piece of ftick lac, it appears compofed of regular cells like the honey-comb, with fmall corpufcles of a deep red colour lodged in them: thefe are the young infects, and to thefe the lac owes its tincture, for when freed from them its colour is very dilute. The fhell and feed lacs, which do not exhibit any infects or cellular appearance upon breaking, are fuppofed to be artificial preparations of the other: the feed fort is faid to be the ftick lac bruifed and robbed of its more foluble parts; and the fhell to be the feed lac, melted and formed into cakes. The ftick lac therefore is the genuine fort, and ought alone to be employed for medicinal purpofes. This concrete is of great efteem in Germany and other countries, for laxity and fponginefs of the gums, proceeding from cold, or a fcorbutic habit: for this ufe the lac is boiled in water, with the addition of a little alum, which promotes its folution: or a tincture is made from it with rectified fpirit. This tincture is recommended alfo internally in the fluor albus, and in rheumatic and fcorbutic diforders: it has a grateful fmell, and a not unpleafant, bitterifh, aftringent tafte: in the Edinburgh pharmacopœia, a tincture is directed to be made with fpirit of fcurvy grafs. The principal ufe of lac among us is in certain mechanic arts as a colouring drug, and for making fealing wax.

LACE, in commerce, a work compofed of many threads of gold, filver or filk, interwoven the one with the other, and worked upon a pillow with fpindles, according to the pattern defigned. The open work being formed with pins, which are placed and difplaced as the fpindles are moved.

The importation of gold and filver lace is prohibited.

Bone LACE, a lace made of fine linen thread or filk, much in the fame manner as that of gold and filver. The pattern of the lace is fixed upon a large round pillow, and pins being ftuck into the holes or openings in the pattern, the threads are interwoven by means of a number of bobbins made of bone or ivory, each of which contains a fmall quantity of fine thread, in fuch a manner as to make the lace exactly refemble the pattern. There are feveral towns in England, and particularly in Buckinghamfhire, that carry on this manufacture; but vaft quantities of the fineft laces have been imported from Flanders.

LACEDEMON, the ancient name of Mifithra. See MISITHRA.

LACERTA, the lizard, in zoology, a genus of amphibious animals belonging to the order of reptilia, the characters of which are thefe: The body is naked, with four feet, and a tail. There are 49 fpecies, *viz.*

1. The crocodylus, or crocodile, has a compreffed jagged tail, five toes on the fore-feet, and four on the hind-feet. This is the largeft animal of the lizard kind. One that was diffected at Siam, an account of which was fent to the Royal Academy at Paris, was eighteen feet and a half long, of which the tail was no lefs than five feet and a half, and the head and neck above two and a half. He was four feet and nine inches in circumference where thickeft.

The hinder legs, including the thigh and the paw, were two feet and two inches long; the paws, from the joint to the extremity of the longeft claws, were above nine inches. They were divided into four toes; of which three were armed with large claws, the longeft of which was an inch and a half, and feven lines and a half broad at the root. The fourth toe was without a nail, and of a conical figure; but was covered with a thick fkin like fhagreen leather. Thefe toes were united with membranes like thofe of ducks, but much thicker.

The fore-legs had the fame parts and conformation as the arms of a man, both within and without; but they were fomewhat fhorter than thofe behind. The hands had five fingers, the two laft of which had no nails, and were of a conical figure, like the fourth toe on the hind paws. The head was long, and had a little rifing at the top; but the reft was flat, and efpecially towards the extremity of the jaws. It was covered with a fkin, which adhered firmly to the fkull and to the jaws. The fkull was rough and unequal in feveral places; and about the middle of the forehead there were two bony crefts, about two inches high. They were not quite parallel, but feparated from each other in proportion as they mounted upwards.

The eye was very fmall in proportion to the reft of the body, and was fo placed within its orbit, that the outward part, when fhut, was only a little above an inch in length, and run parallel to the opening of the jaws.

The nofe was placed in the middle of the upper jaw, near an inch from its extremity, and was perfectly round and flat, being two inches in diameter, of a black, foft, fpungy fubftance, not unlike the nofe of a dog. The noftrils were in the form of a Greek capital Σ, and there were two caruncles which filled and clofed them very exactly, and which opened as often as he breathed through the nofe. The jaws feemed to fhut one within another by means of feveral apophyfes, which

Fig. 4. LACERTA CROCODYLUS *or* CROCODYLE

Fig. 5. LACERTA CHAMÆLEON

Fig. 1. INDENTED

Fig. 6. LACERTA BASILISCUS

Fig. 2. INVECTED

Fig. 3. LABEL

A. Bell Sculpt.

which proceeded from above downwards, and from below upwards, there being cavities in the oppofite jaw to receive them. They had twenty-feven dog-teeth in the upper jaw, and fifteen in the lower, with feveral void fpaces between them. They were thick at the bottom, and fharp at the point; being all of different fizes, except ten large hooked ones, fix of which were in the lower jaw, and four in the upper. The mouth was fifteen inches in length, and eight and a half in breadth where broadeft; and the diftance of the two jaws, when opened as wide as they could be, was fifteen inches and a half. The fkull, between the two crefts, was proof againft a mufket ball, for it only rendered the part a little white that it ftruck againft.

The colour of the body was of a dark brown on the upper part, and of a whitifh citron below, with large fpots of both colours on the fides. From the fhoulders to the extremity of the tail he was covered with large fcales of a fquare form, difpofed like parallel girdles, and were fifty-two in number; but thofe near the tail were not fo thick as the reft. In the middle of each girdle there were four protuberances, which became higher as they aproached the end of the tail, and compofed four rows, of which the two in the middle were lower than the remaining two, forming three channels, which grew deeper the nearer they came to the tail, and were confounded with each other about two feet from its extremity.

The fkin was defended with a fort of armour, which, however, was not proof againft a mufket ball, contrary to what has been commonly faid. However, it muft be acknowledged, that the attitude in which it was placed might contribute not a little thereto; for probably, if the ball had ftruck obliquely againft the fhell, it would have flown off. Thofe parts of the girdles underneath the belly were of a whitifh colour, and were made up of fcales of divers fhapes. They were about one fixth of an inch in thicknefs, and were not fo hard as thofe on the back.

This creature lays eggs of the fize of thofe of a goofe, to the number of fixty; which fhe covers over with fand, and leaves to be hatched by the heat of the fun. They are to be met with in the rivers Nile, Niger, and Ganges, befides moft other large rivers in the fouthern parts of Afia, Africa, and America.

The crocodile is very deftructive to the lower people of Upper Egypt, often devouring women who come to the river to fetch water, and children playing on the fhore or fwimming in the river.

2. The caudiverbera, has a depreffed pinnatifid tail, and palmated feet. It is larger than the common green lizard, is found in Peru, and has got its name from its beating the ground with its tail. 3. The dracæra, has a long tail dentated above, a fmooth body, and equal toes. It is a native of America. 4. The fuperciliofa, has a carinated tail, and the fcales on the back and eye-brows are ciliated. It is a native of the Indies. 5. The fcutata, has a fubcompreffed tail, and a dentated future on the back. It is a native of Afia. 6. The monitor, has a carinated tail, and white eye-like fpots on the body. It is a native of the Indies. 7. The principalis, has a carinated tail, a creft on the throat, and a fmooth back. It is found in fouth America. 8. The bicarinata, has a compreffed tail with a double carina, and a quadruple carina on the back. It is a native of the Indies. 9. The cordylus has a fhort verticillated tail, and dentated fcales. It is found in Africa and Afia. 10. The ftellio, has a verticillated tail, and dentated fcales. It is a native of Africa. 11. The mauritanica, has a fhort verticillated tail fmooth at the apex. It is found in Mauritania. 12. The azurea, has a fhort verticillated tail, and fharp pointed fcales. It is a native of Africa. 13. The turcica, has a verticillated tail, and a rough grey body. It is a native of the Eaft Indies. 14. The ameiva, has a long verticillated tail, 30 fcutæ on the belly, and a plaited collar. It is a native of America. 15. The agilis, has a pretty long verticillated tail, with fharp fcales, and a collar formed by fcales. This is the common green lizard, and is a native both of Europe and India. 16. The algira, has a pretty long verticillated tail, and a yellow line on each fide of the body. It is found in Mauritania. 17. The feps has a long verticillated tail, with a reflected lateral future, and fquare fcales. It is a native of warm climates. 18. The fex-lineata, has a long verticillated tail, and fix white lines on the back. It is a native of Carolina. 19. The angulata, has a long hexagonal tail, and fharp carinated fcales. It is a native of America.

20. The chamæleon, has a crooked cylindrical tail.

The head of a large chamæleon is almoft two inches long, and from thence to the beginning of the tail it is four inches and a half. The tail is five inches long, and the feet two and a half. The thicknefs of the body is different at different feafons; for fometimes from the back to the belly it is two inches, and fometimes but one; for he can blow himfelf up and contract himfelf at pleafure. This fwelling and contraction is not only of the back and belly, but of the legs and tail.

Thefe different motions are not like thofe of other animals, which proceed from a dilatation of the breaft in breathing, and which rifes and falls fucceffively; but they are very irregular, as in tortoifes, and frogs. The chamæleon has continued as it were blown up for two hours together, and then he would grow lefs and lefs infenfibly; for the dilatation was always more quick and vifible than the contraction. In this laft ftate he appeared extremely lean, and the fpine of the back was fharp, and all his ribs might be told; likewife the tendons of the arms and legs might be feen very diftinctly.

The fkin is very cold to the touch; and, notwithftanding he feems fo lean, there is no feeling the beating of the heart. The furface of the fkin is unequal, and has a grain not unlike fhagreen, but very foft, becaufe each eminence is as fmooth as if it was polifhed. Some of thefe are as large as a middling pin's head on the arms, legs, belly, and tail, but on the fhoulders and head they are of an oval figure, and a little larger. Thofe under the throat are ranged in the form of a chaplet.

let, from the lower lip to the breaſt. Some on the head and back are amaſſed together in cluſters, with ſpaces between them, on which are almoſt imperceptible ſpots of a pale red and yellow colour; as well as the ground of the ſkin itſelf; which plainly appears between theſe cluſters. This ground changes colour when the animal is dead, becoming of a greyiſh brown, and the ſmall ſpots are whitiſh.

The colour of all theſe eminences, when the chamæleon is at reſt in a ſhady place, is of a bluiſh grey, except on the claws, where it is white with a little yellow; and the ſpaces between the cluſters is of a pale red and yellow, as was before obſerved. But when he is in the ſun, all parts of the body which are affected with the light, become of a greyiſh brown, or rather of a tawny. That part of the ſkin which the ſun does not ſhine on, changes into ſeveral brighter colours, which form ſpots of the ſize of half one's finger. Some of theſe deſcend from the ſpine half way on the back; and others appear on the ſides arms, and tail. They are all of an iſabella colour, from a mixture of a pale yellow and of a bright red, which is the colour of the ground of the ſkin.

The head of a chameleon is not unlike that of a fiſh, it being joined to the breaſt by a very ſhort neck, covered on each ſide with cartilaginous membranes reſembling the gills of fiſhes. There is a creſt directly on the top of the head, and two others on each ſide above the eyes, and between theſe there are two cavities near the top of the head. The muzzle is blunt, and not much unlike that of a frog; at the end there is a hole on each ſide for the noſtrils, but there are no ears, nor any ſign of any.

The jaws are furniſhed with teeth, or rather with a bone in the form of teeth, which he makes little or no uſe of, becauſe he lives upon ſwallowing flies and other inſects, without chewing them. The form, ſtructure, and motion of the eyes, have ſomething very particular; for they are very large, being almoſt half an inch in diameter. They are of a globous figure: which may be eaſily ſeen, becauſe they ſtand out of the head. They have a ſingle eye-lid like a cap, with a hole in the middle, through which the ſight of the eye appears, which is of a ſhining brown, and round it there is a little circle of a gold colour. This eye-lid has a grain like ſhagreen, as well as the other parts of the ſkin; and when the reſt of the body changes colour, and aſſumes ſpots of different ſhapes, thoſe on the lid always keep the ſame form, though they are tinctured with the ſame colour as the ſkin. But the moſt extraordinary thing relating to the eyes is, that this animal often moves one when the other is entirely at reſt; nay, ſometimes one eye will ſeem to look directly forward, and the other backward; and one will look up to the ſky when the other regards the earth.

That part of the body which is called the trunk, and comprehends the thorax and the belly, in a chamæleon is almoſt all thorax with little or no belly. The four feet are all of a length; and the only difference between them is, that thoſe before are turned backwards, and thoſe behind forwards. There are five toes on each paw, which have a greater reſemblance to hands than feet. They are all divided into two, which gives the appearance of two hands to each arm, and two feet to each leg; and though one of theſe parts have three toes, and the other but two, yet they ſeem to be all of the ſame ſize. Theſe toes lie together under the ſame ſkin as in a mitten; however, their ſhape might be ſeen through the ſkin. With theſe paws the chamæleon can lay hold of the ſmall branches of trees in the ſame manner as a parrot. When he is about to perch, he parts his toes different from birds, becauſe he puts two behind and two before. The claws are little, crooked, very ſharp, and of a pale yellow, proceeding but half way out of the ſkin, while the other half is hid beneath it. His walk is ſlower than that of a tortoiſe, and he ſeems to move along with an affectation of gravity. He ſeems to ſeek for a proper place to ſet his feet upon; and when he climbs up trees, he does not truſt to his feet like ſquirrels, but endeavours to find out clefts in the bark, that he may get a ſurer hold.

His tail is like that of a viper when it is puffed up and round; for otherwiſe the bones may be ſeen in the ſame manner as on the back. He always wraps his tail round the branches of trees, and it ſerves him as it were inſtead of a fifth hand.

He is a native of Africa and Aſia.

21. The gecko, has a cylindrical tail, concave ears, and a warty body. It is the Indian ſalamander of Bontius. "This animal is very frequent in Cairo, (ſays Haſſelquiſt) both in the houſes and without them. The poiſon of this animal is very ſingular, as it exhales from the lobuli of the toes. The animal ſeeks all places and things impregnated with ſea ſalt, and paſſing over them ſeveral times leaves this very noxious poiſon behind it. In July 1750, I ſaw two women and a girl, in Cairo, at the point of death, from eating cheeſe new ſalted, bought in the market, and on which this animal had dropt its poiſon. Once at Cairo, I had an opportunity of obſerving how acrid the exhalations of the toes of this animal are, as it ran over the hand of a man who endeavoured to catch it; there immediately roſe little puſtules over all thoſe parts the animal had touched; theſe were red, inflamed, and ſmarted a little, greatly reſembling thoſe occaſioned by the ſtinging of nettles. It emits an odd ſound, eſpecially in the night, from its throat, not unlike that of a frog." 22. The ſcincus, has a cylindrical tail, compreſſed at the point, and blunt marginated toes. This animal is found in Arabia Petræa near the Red Sea, and in Upper Egypt near the Nile. It is much uſed by the inhabitants of the Eaſt as an aphrodiſiacum, but not at this time by the Europeans. The fleſh of the animal is given in powder, with ſome ſtimulating vehicle; broth made of the recent fleſh, is likewiſe uſed by the Arabs. It is brought from Upper Egypt and Arabia to Alexandria, whence it is carried to Venice and Marſeilles, and from thence to all the apothecaries ſhops of Europe. It has been an error, common to almoſt all authors, to imagine the ſcincus to be a fiſh. 23. The orbicularis, has a cylindrical tail,

tail, and a roundifh belly. It is a native of Mexico. 24. The quinque-lineata, has a cylindrical tail, and five white lines on the back. It is found in Carolina. 25. The bafiiifcus, has a long cylindrical tail, a radiated fin on the back, and a creft on the hind part of the head. It is a native of South America. 26. The ignava, has a long cylindrical tail, a teethed ridge on the back, and a creft on the throat. It is a native of the Indies. 27. The calotes, has a long cylindrical tail, with the fore-part of the back and hind-part of the head teethed. It is a native of Ceylon. 28. The agama, has a long cylindrical tail, with prickles on the neck and hind part of the head. It is a native of America. 29. The umbra, has a long cylindrical tail, a callous creft on the nape of the neck, and a ftreaked back. It is a native of fouthern climates. 30. The plica, has a long cylindrical tail, a callous creft on the hind head, and a warty neck. It is a native of the Indies. 31. The marmorata, has a long cylindrical tail, a fmooth back, and a fmall teethed creft on the throat. It is a native of Spain. 32. The bullaris, has a long cylindrical tail, and a bladder on the throat, which it blows up when enraged. It is a native of Jamaica. 33. The ftrumofa has a long cylindrical tail, and a gibbous breaft. It is found in South America. 34. The tequifein, has a long cylindrical tail, and a plaited future on the fide. It is a native of the Indies. 35. The aurata, has a cylindrical tail, and round fhining fcales like gold. It is found in the iflands of Cyprus and Jerfey. 36. The nilotica, has a long tail with a triangular edge, and four lines of fcales on the back. It is a native of Egypt. 37. The punctata, has a long cylindrical tail, two yellow lines on the back, and is interfperfed with black points. It is found in Afia. 38. The lemnifcata, has a long cylindrical tail, and 8 white lines on the back. It is found in Guinea. 39. The fafciata, has a blue cylindrical tail, and five yellow lines on the back. It is a native of Carolina. 40. The chalcides, has a long cylindrical tail, and very fhort legs, with five toes on the feet. It is a native of Europe and Africa. 41. The vulgaris, has a cylindrical tail, four toes on the fore feet, and two dufky-coloured lines on the back. It is a native of Europe. 42. The aquatica, has a tail fomewhat cylindrical, and four toes on the fore-feet. It lives in the frefh waters, pools, &c. of Europe. 43. The paluftris, has a lanceolated tail, and four toes on the fore-feet. It inhabits the ftagnant waters of Europe. 44. The punctata, has a cylindrical tail, four toes on the fore-feet, and longitudinal rows of white fpots on the back. It is a native of Carolina. 45. The quatuor-lineata, has a long cylindrical tail, four toes on the fore-feet, and four yellow lines on the back. It is a native of North America. 46. The falamandra, has a fhort cylindrical tail, four toes on the fore-feet, and a naked porous body. This animal is vulgarly faid to live in fire; but it is found to be a miftake. It is found in the fouthern countries of Europe. 47. The anguina, has a very long verticillated tail, extremely rigid at the point. It is found at the Cape of Good-hope.

LACHNÆA, in botany, a genus of the octandria monogynia clafs. It has no calix; the corolla is divided into four fegments; the limbus is unequal; and the fruit, which is a kind of berry, contains but one feed. There are two fpecies, both natives of warm climates.

LACHRYMAL, in anatomy, an appellation given to feveral parts of the eye. See ANATOMY, p. 289.

LACHRYMATORY, in antiquity, a veffel wherein were collected the tears of a deceafed perfon's friends, and preferved along with the afhes and urn.

LACTEAL VESSELS, in anatomy. See ANAT. p. 263.

LACTIFEROUS, an appellation given to plants abounding with a milky juice, as the fow-thiftle, and the like.

LACTUCA, LETTUCE, in botany. See LETTUCE.

LACUNÆ, in anatomy. See ANATOMY, p. 275, 276.

LACUNAR, in architecture, an arched roof or ceiling, more efpecially the planking or flooring above porticos and piazzas.

LADENBURG, a town of Germany, fituated on the river Neckar, eighty miles north-weft of Heidelburg.

LADRONE ISLANDS, are fituated in the Pacific Ocean, between 12° and 28° of N. lat. and about 140° E long.

LADY'S BEDSTRAW. See GALLIUM.

LADY'S MANTLE. See ALCHIMILLA.

LALY'S SMOCK. See CARDAMINE.

LADY'S SLIPPER. See CYPRIPEDIUM.

LADY'S TRACES. See OPHRYS.

LADY DAY, in law, the 25th of March, being the annunciation of the holy virgin. See ANNUNCIATION.

LAGOECIA, ROUND-HEADED CUMMIN, in botany, a genus of the pentandria monogynia clafs. It has both an univerfal and partial involucrum; the petals are bifid; and the feed is folitary. There is but one fpecies, a native of Crete.

LAGOPUS, in ornithology. See TETRAO.

LAGOS, a port-town of Portugal, in the province of Algarva: W. long. 9° 27′, N. lat. 36° 45′.

LAGURUS, in botany, a genus of the triandria digynia clafs. The calix has a double valve, with a villous aun, and the exterior petal has two auns at the end. There are two fpecies, none of them natives of Britain.

LAHOLM, a port-town of Gothland, in Sweden, fixty miles north of Copenhagen.

LAHOR, the capital of a province of the fame name in the hither India: E. long. 75° and N. lat. 33°.

LAKE, a collection of waters contained in fome cavity in an inland place, of a large extent, furrounded with land, and having no communication with the ocean.

LAMA, the fovereign pontiff, or rather god of the Afiatic Tartars, inhabiting the country of Barantola. The lama is not only adored by the inhabitants of the country, but alfo by the kings of Tartary, who fend him rich prefents, and go in pilgrimage to pay him adoration, calling him *lama congiu*, i. e. god the everlafting father of heaven. He is never to be feen but in a fecret place of his palace, amidft a great number of lamps, fitting crofs-legged upon a cufhion, and adorned all

all over with gold and precious ftones; where, at a diftance, they proftrate themfelves before him, it not being lawful for any to kifs even his feet. He is called the great lama, or lama of lamas, that is, prieft of priefts. And to perfuade the people that he is immortal, the inferior priefts, when he dies, fubftitute another in his ftead, and fo continue the cheat from generation to generation. Thefe priefts perfuade the people, that the lama was raifed from death many hundred years ago, that he has lived ever fince, and will continue to live for ever.

LAMB, in zoology, the young of the fheep kind. See Ovis.

LAMBOIDES, in anatomy. See Anatomy, p. 152.

LAMELLÆ, in natural hiftory, denotes very thin plates, fuch as the fcales of fifhes are compofed of.

LAMENTATIONS, a canonical book of the Old Teftament, written by the prophet Jeremiah. The two firft chapters of this book are employed in defcribing the calamities of the fiege of Jerufalem. In the third, the author deplores the perfecutions he himfelf had fuffered. The fourth turns upon the defolation of the city and temple, and the misfortune of Zedekiah. The fifth chapter is a prayer for the Jews in their difperfion and captivity; and at the end of all, he fpeaks of the cruelty of the Edomites, who had infulted Jerufalem in her mifery. The firft four chapters of the lamentations are an abcedary, every verfe or couplet beginning with one of the letters of the Hebrew alphabet, in the alphabetical order.

LAMINÆ, in phyfiology, the thin plates whereof many fubftances confift.

LAMIUM, dead-nettle, in botany, a genus of the didynamia gymnofpermia clafs. The fuperior labium is entire and vaulted; the inferior one confifts of two lobes; in the margin of the faux on each fide there is a remarkable tooth. There are eight fpecies, three of them natives of Britain, *viz.* the album, or white dead-nettle; the rubrum, or red dead nettle; and the amplexicaule, or great henbit.

LAMMAS-day, a feftival celebrated on the firft of Auguft by the Romifh church, in memory of St. Peter's imprifonment.

LAMP, a veffel containing oil, with a lighted wick.

Dr. St. Clair, in Phil. Tranf. n° 245, gives the defcription of an improvement upon the common lamp. He propofes that it fhould be made two or three inches deep, with a pipe coming from the bottom almoft as high as the top of the veffel: let it be filled fo high with water as to cover the hole of the pipe at the bottom, that the oil may not get in at the pipe, and fo be loft. Then let the oil be poured in, fo as to fill the veffel almoft brim full, which muft have a cover pierced with as many holes as there are wicks defigned. When the veffel is thus filled, and the wicks are lighted, if water falls in by drops at the pipe, it will always keep the oil at the fame height, or very near; the weight of the water being to that of the oil as 20 $\frac{8}{11}$ to 19, which in two or three inches makes no great difference. If the water runs fafter than the oil waftes, it will only run over at the top of the pipe, and what does not run over will come under the oil, and keep it at the fame height.

LAMPAS, in farriery. See Farriery, p. 557.

LAMPREY. See Petromyzon.

LAMPSACUS, a port-town of the leffer Afia, at the entrance of the Propontis, oppofite to Gallipoli, fituated eighty miles fouth-weft of Conftantinople: E. long. 28°, N. lat. 40° 12′.

LANCASTER, the county-town of Lancafhire: W. long. 2° 44′, N. lat. 54°. It fends two members to parliament.

LANCEOLATED leaf. See Botany, p. 639.

LANCET, a chirurgical inftrument, fharp-pointed, and two-edged, chiefly ufed for opening veins in the operation of phlebotomy, or bleeding; alfo for laying open abfceffes, tumors, &c.

LANCHANG, the capital of the kingdom of Laos, in the further India: E. long. 101°, N. lat. 20°.

LAND, in a limited fenfe, denotes arable ground. See Agriculture.

Land, in the fea-language, makes part of feveral compound terms; thus *land-laid*, or to lay the land, is juft to lofe fight of it. *Land-locked*, is when land lies all round the fhip, fo that no point of the compafs is open to the fea; if fhe is at anchor in fuch a place, fhe is faid to ride land-locked, and is therefore concluded to ride fafe from the violence of winds and tides. *Land mark*, any mountain, rock, fteeple, tree, &c. that may ferve to make the land known at fea. *Land is fhut in*, a term ufed to fignify that another point of land hinders the fight of that the fhip came from. *Land to*, or the fhip *lies land to;* that is, fhe is fo far from fhore that it can only be juft difcerned. *Land turn*, is a wind that in almoft all hot countries blows at certain times from the fhore in the night. *To fet the land*, that is, to fee by the compafs how it bears.

LANDAFF, a city and bifhop's fee of Glamorganfhire, in fouth Wales, twenty-fix miles north weft of Briftol: W. long. 3° 20′, N. lat. 51° 33′.

LANDAU, a city of Germany, in the circle of the Upper Rhine, and landgraviate of Alface, fituated fifteen miles fouth-weft of Spire: E. long. 8°, N. lat. 49° 12′.

LANDEN, a fmall town of the Auftrian Netherlands, in the province of Brabant, eighteen miles fouth eaft of Louvain, and twenty miles north of Namur.

LANDGRAVE, the German name for a count or earl, that has the government of a province, country, or large tract of land.

LANDGRAVIATE, or landgravate, the office, authority, jurifdiction, or teritory of a landgrave.

LANDRECY, a town of the French Netherlands, in the province of Hainault: E. long. 3° 25′, N. lat. 50° 5′.

LANDSCROON, a port-town of Sweden, in the province of Gothland, and territory of Schonen, fituated on the Baltic fea, within the Sound: E. long. 14° 20′, N. lat. 55° 42′.

LANDSHUT, a city of Germany, and the capital of Lower Bavaria, fituated forty miles north-eaft of Munich: E. long. 12° 6′, N. lat. 48° 30′.

LANDSKIP, or LANDSCAPE, in painting, the view or profpect of a country, extended as far as the eye will reach.

Landfkips are efteemed one of the loweft branches of painting, reprefenting fome rural fcene, as hills, valleys, rivers, country-houfes, *&c.* where human figures are only introduced as accidents.

LANDSPERG, the name of two towns in Germany; one fituated on the river Warta, thirty-two miles north-eaft of Frankfort upon the Oder; and the other in Bavaria, twenty-three miles fouth of Augfburg.

LANERK, a parliament town of Scotland, fituated on the river Clyde, twenty miles fouth-eaft of Glafgow.

LANGREL SHOT, at fea, that confifting of two bars of iron, joined by a chain or fhackle, and having half a ball of iron fixed on each end; by means of which apparatus, it does great execution among the enemy's rigging.

LANGRES, a great city of Champaign, the bifhop of which is one of the twelve peers of France: E. long. 5° 22′, and N. lat. 48°.

LANGUAGE, in the moft general meaning of the word, fignifies any found uttered by an animal, by which it expreffes any of its paffions, fenfations, or affections; but it is more particularly underftood to denote thofe various modifications of the human voice, by which the feveral fenfations and ideas of one man are communicated to another.

Nature has endowed every animal with powers fufficient to communicate to others of the fame fpecies fome of its fenfations and defires. The organs of moft animals are fo formed, as readily to perceive and underftand (as far as is neceffary for their particular fpecies of exiftence) the voice of thofe of their own kind; by means of which they affemble together, for the defence or prefervation of the fpecies. But as they rife higher in the order of intellectual powers, the powers of expreffion likewife increafe. However, the voice alone, even when endowed with a great extent of modulation, is incapable of conveying all that variety of emotions and fenfations, which on many occafions are neceffary to be communicated. In all thefe cafes, motion and gefture are called in to fupply the defects of the voice. The amorous pigeon does not truft folely to his plaintive cooing in order to foften the rigour of his reluctant mate, but adds to it the moft fubmiffive and expreffive geftures; and the faithful dog, finding his voice alone infufficient to exprefs his joy at meeting with his mafter, is obliged to have recourfe to a variety of endearing actions. But man—the moft diftinguifhed of all the animal creation,—although endowed with a power of voice and expreffion of countenance and gefture eminently fuperior to all the creatures of God, finds that all thefe united are not fufficient to exprefs the infinite variety of ideas with which his mind is ftored: for although thefe may powerfully exprefs the paffions and ftronger feelings of the mind; yet as they are incapable of expreffing the feveral progreffive fteps of perception by which his *reafon* afcends from one degree of knowledge to another, he has been obliged to difcover, by means of his reafoning faculty, a method of expreffing with certainty, and communicating with the utmoft facility, every perception of his mind.—With this view, having obferved, that befides the power of uttering fimple founds, and the feveral variations of thefe into acute or grave, open or fhrill. *&c.* by which his ftronger feelings were naturally expreffed, he was likewife endowed with a power of ftopping or interrupting thefe founds, by certain clofings of of the lips with one another, and of the tongue with the palate, *&c.* he has taken advantage of thefe circumftances, and formed unto himfelf a language capable of expreffing every perception of the mind; for by affixing at all times the fame idea to any one found or combination of founds thus modified and joined together, he is enabled at any time to excite in the mind of any other perfon an idea fimilar to that in his own mind, provided the other perfon has been previoufly fo far inftructed as to know the particular modification of found which has been agreed upon as the *fymbol* of that idea.—Thus man is endowed with two different fpecies of language: one confifting of tones and geftures; which as it is natural to man confidered as a diftinct fpecies of animals, and neceffary for the prefervation and well-being of the whole, is univerfally underftood by all mankind: thus laughter and mirth univerfally exprefs chearfulnefs of mind; while tears, in every part of the globe, difcover a heart overflowing with tender fenfations; and the humble tone of fupplication, or the acute accent of pain, are equally underftood by the Hurons of America, and by the more refined inhabitants of Europe. The other fpecies of language, as it is entirely artificial, and derives its power from particular compact, (for before any thing can be recognifed as the fymbol of an idea, feveral perfons muft firft agree that fuch an idea muft always be denoted by this fymbol,) muft be different in different parts of the globe; and every diftinct form which it may affume, from the different genius of every fociety who originally formed a particular language for themfelves, will be altogethet unintelligible to every other body of men, but thofe belonging to the fame fociety where that language was originally invented, or thofe who have been at pains to acquire a knowledge of it by means of ftudy.

It is unneceffary for us here to draw any parallel between the nature of thefe two different fpecies of language; it being fufficiently evident, that the artificial language does not debar the ufe of the tones and geftures of the natural, but tends to afcertain the meaning of thefe with greater precifion, and confequently to give them greater power. Man muft therefore reap many advantages from the ufe of artificial language, which he could not have enjoyed without it. It is equally plain, that the one, being natural and infpired, muft remain nearly the fame, without making any progrefs to perfection; whereas the other, being entirely the invention of man, muft have been exceedingly rude and imperfect at firft, and muft have arrived by flow degrees at greater and greater perfection, as the reafoning faculties acquired vigour and acutenefs. It muft likewife be fubject to perpetual changes, from that variety of incidents which affect all fublunary things: and

and thefe changes muft always correfpond with the change of circumftances in the people who make ufe of that particular language: for when any particular fet of ideas become prevalent among any fociety of men, words muft be adopted to exprefs them; and from thefe the language muft affume its character. Hence the reafon why the language of all barbarous and uncivilized people is rude and uncultivated; while thofe nations which have improved their reafoning faculties, and made fome progrefs in the polite arts, have been no lefs diftinguifhed by the fuperiority of their language than by their pre-eminence in other refpects.—The language of a brave and martial people is bold and nervous, although perhaps rude and uncultivated; while the language of thofe nations in which luxury and effeminancy prevail, is flowing and harmonious, but devoid of force and energy of expreffion.

It may be confidered as a general rule, that the language of any nation is an exact index of the ftate of their minds, But as man is naturally an imitative animal, and in matters of this kind never has recourfe to invention but through neceffity; if by fome accident any part of a nation fhould be feparated from that community to which they belonged, after a language had been invented, they would retain the fame general founds and *idiom* of language with thofe from whom they were feparated; although in procefs of time thefe two people, by living in countries of a diffimilar nature, or being engaged in different occupations, and leading a different manner of life, might in time lofe all knowledge of one another, affume a different national character and oppofite difpofitions of mind, and form each of them a diftinct language to themfelves, totally different in genius and ftyle, though agreeing with one another in the fundamental founds and general idiom: fo that if this particular idiom, formed before their feparation, fhould happen to be more peculiarly adapted to the genius of one of thefe people than the other, that particular people whofe natural genius and ftyle of language was not in concord with the *idiom* which they had adopted, would labour under an inconvenience on this account which they never would be able entirely to overcome; and this inconvenience would prevent their language from attaining fuch a degree of perfection, as the genius of the people would otherwife naturally have led them to. Thus languages have been originally formed; and thus that happy concord of circumftances which have concurred to raife fome languages to that height of perfection which they have attained may be eafily accounted for, while many ineffectual efforts have been made to raife other languages to the fame degree of excellence.

We fhall not here enter upon any fruitlefs inquiries, with a view to difcover if only one language was originally formed, or if any language that we are acquainted with has a greater claim to that much envied pre-eminence than others. We have feen, that the difcovery of language is entirely within our reach, and evidently the invention of man; and therefore that the invention of different languages by different focieties, is extremely probable. But thefe different focieties, in procefs of time, behoved to intermix by war or commerce, and their different languages would likewife become mixed. Hence during the fucceffion of many ages, while the principles of language were not underftood, many different languages muft have been formed, while others may have funk into oblivion, efpecially in thofe early ages before the invention of letters, which alone could preferve their memory. In vain, therefore, would we endeavour to difcover the ftate of thofe nations or languages of which we have but obfcure traces in hiftory. Indeed we have no reafon to lament our lofs in this particular; for fuppofing fuch a difcovery could be made, we could derive little advantage from it. The antiquity of a language does not imply any degree of excellence: fome nations have made more progrefs in improving their mental faculties, and refining their language, in a few years, than others have done in many ages. We fhall therefore leave this fubject, and proceed to make fome remarks on the advantages or defects of fome of thofe *idioms* of language with which we are moft intimately acquainted, as this may perhaps lead us to fome difcoveries of real utility to ourfelves.

As the words IDIOM and GENIUS of a language are often confounded, it will be neceffary to inform the reader, that by IDIOM we would here be underftood to mean *that general mode of arranging words into fentences which prevails in any particular language*; and by the GENIUS of a language we mean to exprefs *the particular fet of ideas which the words of any language, either from their formation or multiplicity, are moft naturally apt to excite in the mind of any one who hears it properly uttered.* Thus although the *Englifh*, *French*, *Italian*, and *Spanifh* languages, nearly agree in the fame general IDIOM; yet the particular GENIUS of each is remarkably different: The *Englifh* is naturally bold nervous, and ftrongly articulated; the *French* is weaker, and more flowing; the *Italian* more foothing and harmonius; and the *Spanifh* more grave, fonorous, and ftately. Now, when we examine the feveral languages which have been moft efteemed in Europe, we find that there are only two diftinct IDIOMS among them which are effentially diftinguifhed from one another; and all thefe languages are divided between thefe two idioms, following fometimes the one, and fometimes the other, either wholly or in part. The languages which may be faid to adhere to the firft IDIOM, are thofe which in their conftruction follow the order of nature; that is, exprefs their ideas in the natural order in which they occur to the mind; the fubject which occafions the action appearing firft; then the action, accompanied with its feveral modifications; and, laft of all, the object to which it has reference.—Thefe may be properly called ANALOGOUS languages; and of this kind are the Englifh, French, and moft of the modern languages in Europe.—The languages which may be referred to the other IDIOM, are thofe which follow no other order in their conftruction than what the tafte or fancy of the compofer may fuggeft; fometimes making the object, fometimes the action, and fometimes the modification of the action, to precede or follow the other parts. The confufion which this might occafion is avoided by the particular manner of *inflecting* their words, by which they are made to refer to the others with which they ought to be connected, in whatever

ever part of the fentence they occur, the mind being left at liberty to connect the feveral parts with one another after the whole fentence is concluded. And as the words may be here tranfpofed at pleafure, thofe languages may be called TRANSPOSITIVE languages. To this clafs we muft, in an efpecial manner, refer the *Latin* and *Greek* languages.—As each of thefe IDIOMS has feveral advantages and defects peculiar to itfelf, we fhall endeavour to point out the moft confiderable of them, in order to afcertain with greater precifion the particular character and excellence of fome of thofe languages now principally fpoken or ftudied in Europe.

The partiality which our forefathers, at the revival of letters in Europe, naturally entertained for the Greek and Roman languages, made them look upon every diftinguifhing peculiarity belonging to them, as *one* of the *many* caufes of the amazing fuperiority which thefe languages evidently enjoyed above every other at that time fpoken in Europe.—This blind deference ftill continues to be paid to them, as our minds are early prepoffeffed with thefe ideas, and as we are taught in our earlieft infancy to believe, that to entertain the leaft idea of our own language being equal to the Greek or Latin in any particular whatever, would be a certain mark of ignorance or want of tafte.—Their rights, therefore, like thofe of the church in former ages, remain ftill to be examined; and we, without exerting our reafon to difcover truth from falfehood, tamely fit down fatisfied with the idea of their undoubted pre-eminence in every refpect.—But if we look around us for a moment, and obferve the many excellent productions which are to be met with in almoft every language of Europe, we muft be fatisfied, that *even thefe* are now poffeffed of *fome* powers which might afford at leaft a prefumption, that, if they were cultivated with a proper degree of attention, they might, in *fome refpects*, be made to rival, if not to excel, thofe beautiful and juftly admired remains of antiquity.—Without endeavouring to derogate from their merit, let us, with the cool eye of philofophic reafoning, endeavour to bring before the facred tribunal of Truth fome of thofe opinions which have been moft generally received upon this fubject, and reft the determination of the caufe on her impartial decifion.

The learned reader well knows, that the feveral changes which take place in the arrangement of the words in every TRANSPOSITIVE language could not be admitted without occafioning great confufion, unlefs certain claffes of words were endowed with particular variations, by means of which they might be made to refer to the other words with which they ought naturally to be connected.—From this caufe proceeds the neceffity of feveral variations of *verbs*, *nouns*, and *adjectives;* which are not in the leaft effential or neceffary in the ANALOGOUS languages, as we have pretty fully explained under the article GRAMMAR, to which we refer for fatisfaction on this head. We fhall in this place confider, whether thefe variations are an advantage or a difadvantage to language.

As it is generally fuppofed, that every language whofe verbs admit of *inflection*, is on that account much more perfect than one where they are varied by *auxiliaries;* we fhall, in the firft place, examine this with fome degree of attention; and that what is faid on this head may be the more intelligible, we fhall give examples from the Latin and Englifh languages. We make choice of thefe languages, becaufe the Latin is more purely *tranfpofitive* than the Greek, and the Englifh admits of lefs *inflection* than any other language that we are acquainted with.

If any preference be due to a language from the one or the other method of *conjugating* verbs, it muft in a great meafure be owing to one or more of thefe three caufes: —Either it muft admit of a greater variety of founds, and confequently more room for harmonious diverfity of tones in the language;—or a greater freedom of expreffion is allowed in utering any fimple idea, by the one admitting of a greater variety in the arrangement of the words which are neceffary to exprefs that idea than the other does;—or, laftly, a greater precifion and accuracy in fixing the meaning of the perfon who ufes the language, arife from the ufe of one of thefe forms above the other! —for, as every other circumftance which may ferve to give a diverfity to language, fuch as the general and moft prevalent founds, the frequent repetition of any one particular letter, and a variety of other circumftances of that nature, which may ferve to debafe a particular language, are not influenced in the leaft by the different methods of varying the verbs, they cannot be here confidered. We fhall therefore proceed to make a comparifon of the advantages or difadvantages which may accrue to a language by inflecting their verbs, with regard to each of thefe particulars.

The *firft* particular that we have to examine, is, Whether the one method of expreffing the variations of a verb admits of a greater variety of founds.—In this refpect the *Latin* feems, at firft view, to have a great advantage over the *Englifh:* for the word *amo*, *amabam*, *amaveram*, *amavero*, *amem*, &c. feem to be more different from one another than the Englifh tranflations of thefe, *I love*, *I did love*, *I had loved*, *I fhall have loved*, *I may love*, &c. for, although the fyllable AM is repeated in every one of the firft, yet as the laft fyllable ufually ftrikes the ear with greater force, and leaves a greater impreffion than the firft, it is very probable that many will think the frequent repetition of the word LOVE will, in the laft inftance, appear more ftriking to the ear than the other: we will therefore allow this its full weight, and grant that there is as great, or even a greater difference between the founds of the different *tenfes* of a Latin verb, than there is between the words that are equivalent to them in Englifh.—But as we here confider the variety of founds of the language in general, before any juft conclufion can be drawn, we muft not only compare the different parts of the fame verb, but alfo compare the different verbs with one another in each of thefe languages.—And here, at firft view, we perceive a moft ftriking diftinction in favours of the *analogous* language over the *inflected:* for as it would be impoffible to form a particular fet of inflections different from one another for each particular verb, all thofe languages which have adopted this method have been obliged to reduce their verbs into a fmall number of claffes; all the words of each of which claffes, commonly called *conjugations*, have the feveral variations of the *modes*, *tenfes*, and *perfons*, expreffed

expreſſed exactly in the ſame manner, which muſt of neceſſity introduce a ſimilarity of ſounds into the language in general, much greater than where every particular verb always retains its own diſtinguiſhing ſound.—To be convinced of this, we need only repeat any number of verbs in Latin and Engliſh, and obſerve one which ſide the preference with reſpect to variety of ſounds muſt fall.

Pono,	*I put.*	Moveo,	*I move.*
Dono,	*I give.*	Doleo,	*I ail.*
Cano,	*I ſing.*	Lugeo,	*I mourn.*
Sono,	*I ſound.*	Obeo,	*I die.*
Orno,	*I adorn.*	Gaudeo,	*I rejoice.*
Pugno,	*I fight.*	Incipio,	*I begin.*
Lego,	*I read.*	Faceo,	*I make.*
Scribo,	*I write.*	Fodio,	*I dig.*
Puto,	*I think.*	Odio,	*I hate.*
Vivo,	*I live.*	Rideo,	*I laugh.*
Ambulo,	*I walk.*	Impleo,	*I fill.*
Loqueo,	*I ſpeak.*	Abſtineo,	*I forbear.*

The ſimilarity of ſounds is here ſo obvious in the Latin as to be perceived at the firſt glance: nor can we be ſurpriſed to find it ſo, when we conſider, that all their regular verbs, amounting to four thouſand or upwards, muſt all be reduced to four conjugations, and even theſe differing but little from one another, which muſt of neceſſity produce the ſameneſs of ſounds which we here perceive; whereas every language that follows the natural order, like the Engliſh, inſtead of theſe ſmall number of uniform terminations, have almoſt as many diſtinct ſounds as original verbs in their language.

But if, inſtead of the preſent of the indicative mood, we ſhould take almoſt any other tenſe of the Latin verb, the ſimilarity of ſounds would be ſtill more perceptible, as many of theſe tenſes have the ſame termination in all the four conjugations, particularly in the imperfect of the indicative, as below.

Pona-bam;	*I did put,*	*I put.*
Dona-bam;	*I did give,*	*I gave.*
Cane-bam;	*I did ſing,*	*I ſung.*
Sona-bam;	*I did ſound,*	*I ſounded.*
Orna-bam;	*I did adorn,*	*I adorned.*
Pugna-bam;	*I did fight,*	*I fought.*
Lege-bam;	*I did read,*	*I read.*
Scribe-bam;	*I did write,*	*I wrote.*
Puta-bam;	*I did think,*	*I thought.*
Vive-bam;	*I did live,*	*I lived.*
Ambula-bam	*I did walk,*	*I walked.*
Loque-bam;	*I did ſpeak,*	*I ſpoke.*
Move-bam;	*I did move,*	*I moved.*
Dole-bam;	*I did ail,*	*I ailed.*
Luge-bam;	*I did mourn,*	*I mourned.*
Obie-bam;	*I did die,*	*I died.*
Gaudie-bam;	*I did rejoice,*	*I rejoiced.*
Incipie-bam;	*I did begin,*	*I began.*
Facie-bam;	*I did make,*	*I made.*
Fodie-bam;	*I did dig,*	*I dug.*
Odie-bam;	*I did hate,*	*I hated.*
Ride-bam;	*I did laugh,*	*I laughed.*
Imple-bam;	*I did fill,*	*I filled.*
Abſtinie-bam	*I did forbear,*	*I forbore.*

It is unneceſſary to make any remarks on the Latin words in this example: but in the Engliſh tranſlation we have carefully marked, in the firſt column, the words without any inflection; and, in the ſecond, have put down the ſame meaning by an inflection of our verb; which we have been enabled to do, from a peculiar excellency in our own language unknown to any other, either ancient or modern.—Were it neceſſary to purſue this ſubject farther, we might obſerve, that the *perfect* tenſe in all the conjugations ends univerſally in *I*, the *pluperfect* in ERAM, the *future* in AM or BO; in the ſubjunctive mood, the *imperfect* univerſally in REM, the *perfect* in ERIM, and the *pluperfect* in ISSEM and ERO: and as a ſtill greater ſameneſs is obſervable in the different variations for the perſons in theſe tenſes, ſeeing the firſt perſon plural in all tenſes ends in MUS, and the ſecond perſon in TIS, with little variation in the other perſons; it is evident, that, in reſpect of diverſity of ſounds, this method of conjugating verbs by *inflection*, is greatly inferior to the more natural method of expreſſing the various connections and relations of the verbal attributive by different words, uſually called *auxiliaries*.

The *ſecond* particular by which the different methods of marking the relation of the verbal attributive can affect language, ariſes from the variety of expreſſions, which either of theſe may admit of in uttering the ſame ſentiment.—In this reſpect likewiſe the method of conjugating by inflection ſeems to be deficient. Thus the preſent of the indicative mood in Latin can at moſt be expreſſed only in two ways, *viz.* SCRIBO, and EGO SCRIBO; which ought perhaps in ſtrictneſs to be admitted only as one: whereas, in Engliſh, we can vary it in four different ways, *viz.* *1ſt*, I WRITE; *2dly*, I DO WRITE; *3dly*, WRITE I DO; *4thly*, WRITE DO I*. And if we conſider the further variation which theſe receive in power as well as in ſound, by having the accent placed on the different words; inſtead of four, we will find eleven different variations: thus, *1ſt*, I *write*, with the emphaſis upon the *I*;—*2dly*, *I* WRITE, with the emphaſis upon the word WRITE. Let any one pronounce theſe with the different accent neceſſary, and he will be immediately ſatisfied that they are not only diſtinct from each other with reſpect to meaning, but alſo with regard

* We are ſufficiently aware, that the laſt variation cannot in ſtrictneſs be conſidered as good language: although many examples of this manner of uſing it in ſerious compoſitions, both in poetry and proſe, might be eaſily produced from the beſt authors in the Engliſh language.---But however unjuſtifiable it may be to uſe it in ſerious compoſition; yet, when judiciouſly employed in works of humour, this and other forced expreſſions of the like nature produce a fine effect, by giving a burleſque air to the language, and beautifully contraſting it to the purer diction of ſolid reaſoning. The ſagacious Shakeſpeare has, on many occaſions, ſhewed how ſucceſsfully theſe may be employed in compoſition, particularly in drawing the character of *ancient Piſtol*, in Henry V. Without this liberty, Butler would have found greater difficulty in drawing the inimitable character of Hudibras.--Let this apology ſuffice for our having inſerted this and other variations of the ſame kind; which, although they may be often improper for ſerious compoſition, have ſtill their uſe in language.

regard to found; and the fame muft be underftood of all the other parts of this example.

3. I *do write*,	8. *Write I* DO,
4. *I* DO *write*,	9. WRITE *do I*,
5. *I do* WRITE,	10. *Write* DO *I*,
6. WRITE *I do*,	11. *Write do* I.
7. *Write* I *do*.	

None of the Latin tenfes admit of more variations than the two above mentioned: nor do almoft any of the Englifh admit of fewer than in the above example; and feveral of thefe phrafes, which muft be confidered as exact tranflations of fome of the tenfes of the Latin verb, admit of many more. Thus the imperfect of the fubjunctive mood, which in Latin admits of the above two variations, admits in Englifh of the following:

1. *I might have wrote.*	4. *Wrote might have I.*
2. *Wrote I might have.*	5. *I wrote might have.*
3. *Have wrote I might.*	6. *Have wrote might I.*

And if we likewife confider the variations which may be produced by a variation of the emphafis, they will be as under.

1. I *might have wrote.*	13. WROTE *might have I.*
2. *I* MIGHT *have wrote.*	14. *Wrote* MIGHT *have I.*
3. *I might* HAVE *wrote.*	15. *Wrote might* HAVE *I.*
4. *I might have* WROTE.	16. *Wrote might have* I.
5. WROTE *I might have.*	17 I *wrote might have.*
6. *Wrote* I *might have.*	18. *I* WROTE *might have.*
7. *Wrote I* MIGHT *have.*	19. *I wrote* MIGHT *have.*
8. *Wrote I might* HAVE.	20. *I wrote might* HAVE.
9. HAVE *wrote I might.*	21 HAVE *wrote might I.*
10. *Have* WROTE *I might.*	22. *Have* WROTE *might I.*
11. *Have wrote* I *might.*	23. *Have wrote* MIGHT *I.*
12. *Have wrote I* MIGHT.	24. *Have wrote might* I.

In all twenty-four variations, inftead of two.—If we likewife confider, that the Latins were obliged to employ the fame word, not only to exprefs "I *might* have wrote." but alfo "I *could*, I *would*, or I *fhould* have wrote," each of which would admit of the fame variations as the word *might*, we have in all *ninety-fix* different expreffions in Englifh for the fame phrafe which in Latin admits only of two, unlefs they have recourfe to other forced turns of expreffion, which the defects of their verbs in this particular has compelled them to invent.

But, if it fhould be objected, that the laft circumftance we have taken notice of as a defect, can only be confidered as a defect of the Latin language, and is not to be attributed to the *inflection* of their verbs, feeing they might have had a particular tenfe for each of thefe different words *might*, *could*, *would*, and *fhould*; we anfwer, that, even admitting this excufe as valid, the fuperiority of the analogous language, as fuch, ftill remains in this refpect as twelve to one.—Yet even this conceffion is greater than ought to have been made: For as the difficulty of forming a fufficient variety of words for all the different modifications which a verb may be made to undergo is too great for any rude people to be able to overcome; we find, that every nation which has adopted this mode of inflection, not excepting the Greeks themfelves, has been obliged to remain fatisfied with fewer words than would have been neceffary even to effect this purpofe, and make the fame word ferve a double, treble, or even quadruple office, as in the Latin tenfe which gave rife to thefe obfervations: So that however in phyfical neceffity this may not be chargeable upon this particular mode of conftruction, yet in moral certainty this muft always be the cafe; and therefore we may fafely conclude, that the mode of varying verbs by *inflection* affords lefs variety in the arrangement of the words of the particular phrafes, than the method of varying them by the help of auxiliaries.

But if there fhould ftill remain any fhadow of doubt in the mind of the reader, whether the method of varying the verbs by *inflection*, is inferior to that by *auxiliaries*, with regard to diverfity of founds, or variety of expreffion; there cannot be the leaft doubt, but that, with refpect to precifion, diftinctnefs, and accuracy in expreffing any idea, the latter enjoys a fuperiority beyond all comparifon.—Thus the Latin verb *Amo*, may be Englifhed either by the words *I love*, or *I do love*, and the emphafis placed upon any of the words that the circumftances may require; by means of which, the meaning is pointed out with a force and energy which it is altogether impoffible to produce by the ufe of any fingle word. The following line from Shakefpear's Othello may ferve as an example;

——Excellent wretch!
Perdition catch my foul, but *I* DO *love* thee:

In which the ftrong emphafis upon the word DO, gives it a force and energy which conveys, in an irrefiftible manner, a moft perfect knowledge of the fituation of the mind of the fpeaker at the time.—That the whole energy of the expreffion depends upon this feemingly infignificant word, we may be at once fatisfied of, by keeping it away in this manner;

——Excellent wretch!
Perdition catch my foul, but *I love* thee.

How poor—how tame—how infignificant is this, when compared with the other! Here nothing remains but a tame affertion, ufhered in with a pompous exclamation which could not here be introduced with any degree of propriety. Whereas, in the way that Shakefpear has left it to us, it has a forcible power which nothing can furpafs; for, overpowered with the irrefiftible force of Defdemona's charms, this ftrong exclamation is forced from the foul of Othello in fpite of himfelf. Surprifed at this tender emotion which brings to his mind all thofe amiable qualities for which he had fo much efteemed her, and at the fame time fully impreffed with the firm perfuafion of her guilt, he burfts out into that feemingly inconfiftent exclamation—*Excellent wretch!* And then he adds in the warmth of his furprife,——thinking it a thing moft aftonifhing that any warmth of affection fhould ftill remain in his breaft, he even confirms it with an oath,—"*Perdition catch my foul, but I* DO *love thee.*"—"In fpite of all the falfehoods with which I know thou haft deceived me—in fpite of all the crimes of which I know thee guilty—in fpite of all thefe reafons for which I ought to hate thee—in fpite of myfelf,—ftill I find that I love,—yes, I DO love thee."—We look upon it as a thing altogether impoffible to tranf-

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fuſe the energy of this expreſſion into any language whoſe verbs are regularly inflected.

In the ſame manner we might go through all the other tenſes, and ſhew that the ſame ſuperiority is to be found in each.—Thus in the *perfect tenſe* of the Latins, inſtead of the ſimple AMAVI, we ſay, I HAVE LOVED; and by the liberty we have of putting the emphaſis upon any of the words which compoſe this phraſe, we can in the moſt accurate manner fix the preciſe idea which we mean to excite: for if we ſay *I have loved*, with the emphaſis upon the word I, it at once points out the perſon as the principal object in that phraſe, and makes us naturally look for a contraſt in ſome other perſon, and the other parts of the phraſe become ſubordinate to it;—"HE *has loved* thee much, but I *have loved* thee infinitely more"—The Latins too, as they were not prohibited from joining the pronoun with their verb, were alſo acquainted with this excellence, which Virgil has beautifully uſed in this verſe:

——————Nos *patriam fugimus;*
Tu, *Tytere*, *lentis in umbra*, &c.

But *we* are not only enabled thus to diſtinguiſh the perſon in as powerful a manner as the Latins, but can alſo with the ſame facility point out any of the other circumſtances as principals; for if we ſay, with the emphaſis upon the word *Have*, "I HAVE *loved*," it as naturally points out the time as the principal object, and makes us look for a contract in that peculiarity, *I* HAVE: "I *have* loved indeed;—my imagination *has* been led aſtray—my reaſon *has* been perverted:—but, *now* that time has opened my eyes, I can ſmile at thoſe imaginary diſtreſſes which once perplexed me."—In the ſame manner we can put the emphaſis upon the other word of the phraſe *loved*,—"I *have* LOVED."—Here the paſſion is exhibited as the principal circumſtance; and as this can never be excited without ſome object, we naturally wiſh to know the object of that paſion—"Who! what have you *loved?*" are the natural queſtions we would put in his caſe. "I have LOVED ——Eliza."——In this manner we are, on all occaſions, enabled to expreſs, with the utmoſt preciſion, that particular idea which we would wiſh to excite, ſo as to give an energy and perſpicuity to the language, which can never be attained by thoſe languages whoſe verbs are conjugated by inflection; and if to this we add the inconconvenience which all inflected languages are ſubjected to, by having too ſmall a number of tenſes, ſo as to be compelled to make one word on many occaſions ſupply the place of two, three, or even four, the balance is turned ſtill more in our favours.—Thus, in Latin, the ſame word AMABO ſtands for *ſhall* or *will* love, ſo that the reader is left to gueſs from the context which of the two meanings it was moſt likely the writer had in view.—In the ſame manner, *may* or *can* love are expreſſed by the ſame word AMEM; as is alſo *might*, *could*, *would*, or *ſhould* love, by the ſingle word AMAREM, as we have already obſerved; ſo that the reader is left to gueſs which of theſe four meanings the writer intended to expreſs; which occaſions a perplexity very different from that clear preciſion which our language allows of, by not only pointing out the different words, but alſo by allowing us to put the emphaſis upon any of them we pleaſe, which ſuperadds energy and force to the preciſion it would have had without that of aſſiſtance.

Upon the whole, therefore, after the moſt candid examination, we muſt conclude, that the method of conjugating verbs by *inflection* is inferior to that which is performed by the help of *auxiliaries*;—becauſe it does not afford ſuch a diverſity of ſounds,—nor allow ſuch variety in the arrangement of expreſſion for the ſame thought,—nor give ſo much diſtinction and preciſion in the meaning.——It is, however, attended with one conſiderable advantage above the other method: for as the words of which it is formed are neceſſarily of greater length, and more ſonorous, than in the analogous languages, it admits of a more flowing harmony of expreſſion; for the number of monoſyllables in this laſt greatly checks that pompous dignity which naturally reſults from longer words. Whether this ſingle advantage is ſufficient to counterbalance all the other defects with which it is attended, is left to the judgment of the reader to determine:—but we may remark, before we quit the ſubject, that even this excellence is attended with ſome peculiar inconveniences, which ſhall be more particularly pointed out in the ſequel.

But perhaps it might ſtill be objected, that the compariſon we have made above, although it may be fair, and the concluſion juſt with regard to the Latin and Engliſh languages; yet it does not appear clear, that on that account the method of conjugating verbs by *inflection* is *inferior* to that by *auxiliaries:* for although it be allowed, that the Latin language is defective in point of tenſes; yet if a language were formed which had a ſufficient number of inflected tenſes to anſwer every purpoſe; if it had, for inſtance, a word properly formed for every variation of each tenſe; one for *I love*, another for *I do love;* one for *I ſhall*, another for *I will love;* one for *I might*, another for *I could*, and *would*, and *ſhould* love; and ſo on through all the other tenſes; that this lanouage would not be liable to the objections we have brought againſt the inflection of verbs; and that of courſe, the objections we have brought are only valid againſt thoſe languages which have followed that mode and executed it imperfectly.——We anſwer, that although this would in ſome meaſure remedy the evil, yet it would not remove it entirely. For in the firſt place, unleſs every verb, or a very ſmall number of verbs, was conjugated in one way, having the ſound of the words in each tenſe, and diviſions of tenſes, as we may ſay, different from all the other conjugations,—it would always occaſion a ſameneſs of ſounds which would in ſome meaſure prevent that variety of ſounds ſo proper for a language. And even if this could be effected, it would not give ſuch a latitude to the expreſſion as auxiliaries allow: for although there ſhould be two words, one for *I might*, and another for *I could* love; yet as theſe are ſingle words, they cannot be varied; whereas, by auxilaries, either of theſe can be varied twenty-four different ways, as has been ſhewn above.—In the laſt place, no ſingle word can ever expreſs all that variety of meaning which we can do by the help of our auxilaries and the emphaſis. *I have loved*, if expreſſed by any one word, could only denote at all times one diſtinct meaning; ſo that, to give it

it the power of ours, there behoved to be three diſtinct words at leaſt. However, if all this was done ;—that is, if there was a diſtinct conjugation formed for every forty or fifty verbs;—if each of the tenſes was properly formed, and all of them different from every other tenſe as well as every other verb; and theſe all carried through each of the different perſons, ſo as to be all different from one another;—and if likewiſe there was a diſtinct word to mark each of the ſeparate meanings which the ſame tenſe could be made to aſſume by means of the emphaſis;—and if all this infinite variety of words could be formed in a diſtinct manner, different from each other and harmonious;—this language would have powers greater than any that could be formed by auxiliaries, if it were poſſible for the human powers to acquire ſuch a degree of knowledge as to be able to employ it with facility. But how could this be attained, ſince upwards of ten thouſand words would be neceſſrty to form the variations of any one verb, and a hundred times that number would not include the knowledge of the verbs alone of ſuch a language *?—How much, therefore, ought we to admire the ſimple perſpicuity of our language, which which enables us, by the proper application of ten or twelve ſeemingly trifling words, the meaning and uſe of which can be attained with the utmoſt eaſe, to expreſs all that could be expreſſed by this unwieldy apparatus? What can equal the ſimplicity or the power of the one method, but the well-known powers of the twenty-four letters, the knowledge of which can be obtained with ſo much eaſe—and their power knows no limits?—or what can be compared to the fancied perfection of the other, but the tranſcrpt of it which the Chineſe ſeem to have formed in their unintelligible language?

Having thus conſidered pretty fully the advantages and defects of each of theſe two methods of varying verbs, we cannot help feeling a ſecret wiſh ariſe in our mind, that there had been a people ſagacious enough to have united the powers of the one method with thoſe of the other;—nor can we help being ſurpriſed, that, among the changes which took place in the ſeveral languages of Europe after the downfall of the Roman monarchy, ſome of them did not accidentally ſtumble on the method of doing it.—From many concurring circumſtances, it ſeems probable, that the greateſt part, if not all the Gothic nations that over-ran Italy at that time, had their verbs varied by the help of auxiliaries; and many of the modern European languages which have ſprung from them, have ſo far borrowed from the Latin, as to have ſome of the tenſes of their verbs inflected: yet the Engliſh alone have in any inſtance combined the joint powers of the two: which could only be done by forming inflections for the different tenſes in the ſame manner as the Latins, and at the ſame time retaining the original method of varying them by auxiliaries; by which means either the one or the other method could have been employed as occaſion required. —We have luckily two tenſes formed in that way; the *preſent* of the indicative, and the *paſt*. In almoſt all our verbs theſe can be declined either with or without auxiliaries. Thus the preſent, without an auxiliary, is, *I love*, *I write*, *I ſpeak*; with an auxiliary, *I do write*, *I do love*, *I do ſpeak*. In the ſame manner, the paſt tenſe, by inflection, is, *I loved*, *I wrote*, *I ſpoke*; by auxiliaries, *I did love*, *I did ſpeak*, *I did write*. Every author, who knows any thing of the power of the Engliſh language, knows the uſe which may be made of this diſtinction. What a pity is it that we ſhould have ſtopt ſhort ſo ſoon? how blind was it in ſo many other nations to imitate the defects, without making a proper uſe of that beautiful language which is now numbered among the dead?

After the verbs, the next moſt conſiderable variation we find between the *Analogous* and *tranſpoſitive* languages, is in the nouns; the latter varying the different caſes of theſe by *inflection*; whereas the former expreſs all the different variations of them by the help of other words prefixed, called *prepoſitions*. Now, if we conſider the advantages or diſadvantages of either of theſe methods under the ſame heads as we have done the verbs, we will find, that with regard to the firſt particular, *viz.* variety of ſounds, almoſt the ſame remarks may be made as upon the verbs;—for if we compare any particular noun by itſelf, the variety of ſound appears much greater between the different caſes in the *Tranſpoſitive*, than between the tranſlation of theſe in the *Analogous* language. Thus, REX, REGIS, REGI, REGEM, *&c.* are more diſtinct from one another in point of ſound, than the tranſlation of theſe, *a king*, *of a king*, *to a king*, *a king*, &c. But if we proceed one ſtep further, and conſider the variety which is produced in the language *in general*, by the one or the other of theſe methods, the caſe is entirely reverſed. For as it would have been impoſſible to form diſtinct variations, different from one another, for each caſe of every noun, they have been obliged to reduce all their nouns into a few general claſſes, called *declenſions*, and endowed all of thoſe included under each claſs with the ſame termination in every caſe; which produces a like ſimilarity of ſound with what we already obſerved was occaſioned to the verbs from the ſame cauſe; whereas in the analogous languages, as there is no neceſſity for any conſtraint, there is almoſt as great a variety of ſounds as there are of nouns. The Latins have only five different declenſions, ſo that all the great number of words of this general order muſt be reduced to the very ſmall diverſity of ſounds which theſe few claſſes admit of; and even the ſounds of theſe few claſſes are not ſo much diverſified as they ought to have been, as many of the different *caſes* in the different *declenſions* have exactly the ſame ſounds, as we ſhall have occaſion to remark more fully hereafter.—We might here produce examples to ſhew the great *ſimilarity* of ſounds between different nouns in the Latin language, and *variety* in the Engliſh, in the ſame way as we did of the verbs: but as every reader, in the leaſt acquainted

* This aſſertion may perhaps appear to many very much exaggerated: but if any ſhould think ſo, we only beg the favour that he will ſet himſelf to mark all the variation of tenſes, mode, perſon, and number, which an Engliſh verb can be made to aſſume, varying each of theſe in every way that it will admit, both as to the diverſity of expreſſions, and the emphaſis; he will ſoon be convinced that we have here ſaid nothing more than enough.

acquainted with theſe two languages, can ſatisfy himſelf in this particular, without any further trouble than by marking down any number of Latin nouns, with their tranſlations in Engliſh; we thought it unneceſſary to dwell longer on this particular.

But if the inflection of nouns is a diſadvantage to a language in point of diverſity of ſounds, it is very much the reverſe with regard to the variety it allows in the arranging the words of the phraſe. Here, indeed, the Tranſpoſitive language ſhines forth in all its glory, and the Analogous muſt yield the palm without the ſmalleſt diſpute. For as the *nominative caſe* (or that noun which is the cauſe of that energy expreſſed by the verb) is different from the *accuſative* (or that noun upon which the energy expreſſed by the verb is exerted) theſe may be placed in any ſituation that the writer ſhall think proper, without occaſioning the ſmalleſt confuſion: whereas in the analogous languages, as theſe two different ſtates of the noun are expreſſed by the ſame word, they cannot be diſtinguiſhed but by their poſition alone; ſo that the noun which is the efficient cauſe muſt always precede the verb, and that which is the active ſubject muſt follow; which greatly cramps the harmonious flow of compoſition. —Thus the Latins, without the ſmalleſt perplexity in the meaning, could ſay either *Brutum amavit Caſſius*, or *Caſſius amavit Brutum*, or *Brutum Caſſius amavit*, or *Caſſius Brutum amavit*. As the termination of the word *Caſſius* always points out that it is in the *nominative caſe*, and therefore that he is the perſon from whom the energy proceeds; and in the ſame manner, as the termination of the word *Brutum* points out that it is in the *accuſative caſe*, and conſequently that he is the object upon which the energy is exerted; the meaning continues ſtill diſtinct and clear, notwithſtanding of all theſe ſeveral variations: whereas in the Engliſh language, we could only ſay *Caſſius loved Brutus*, or, by a more forced phraſeology, *Caſſius Brutus loved*: Were we to reverſe the caſe, as in the Latin, the meaning alſo would be reverſed; for if we ſay *Brutus loved Caſſius*, it is evident, that, inſtead of being the perſon beloved, as before, *Brutus* now becomes the perſon from whom the energy proceeds, and *Caſſius* becomes the object beloved.—In this reſpect, therefore, the analogous languages are greatly inferior to the tranſpoſitive; and indeed it is from this ſingle circumſtance alone that they derive their chief excellence.

But although it thus appears evident, that any language, which has a particular variation of its nouns to diſtinguiſh the *accuſative* from the *nominative caſe*, has an advantage over thoſe languages which have none; yet it does not appear that any other of their *caſes* adds to the variety, but rather the reverſe: for, in Latin, we can only ſay *Amor Dei;* in Engliſh the ſame phraſe may be rendered, either,—*the love of God*,—*of God the love*,—or, by a more forced arrangement, *God the love of*. And as theſe oblique caſes, as the Latins called them, except the accuſative, are clearly diſtinguiſhed from one another, and from the nominative, by the prepoſition which accompanies them, we are not confined to any particular arrangement with regard to theſe as with the accuſative, but may place them in what order we pleaſe, as in Milton's elegant invocation at the beginning of Paradiſe Loſt:—

Of man's firſt diſobedience, and the fruit
Of that forbidden tree, whoſe mortal taſte
Brought death into the world, and all our wo,
With loſs of Eden, till one greater Man
Reſtore us, and regain the bliſsful ſeat,
Sing, heavenly muſe.

In this ſentence the tranſpoſition is almoſt as great as the Latin language would admit of, and the meaning as diſtinct as if Milton had begun with the plain language of proſe, thus,—"Heavenly muſe, ſing of man's firſt diſobedience," *&c.*

Before we leave this head, we may remark, that the little attention which ſeems to have been paid to this peculiar advantage derived from the uſe of an accuſative caſe different from the nominative, is ſomewhat ſurpriſing.—The Latins, who had more occaſion to attend to this with care than any other nation, have in many caſes overlooked it, as is evident from the many inſtances we meet with in their language where this is not diſtinguiſhed. For the nominative and accuſative are the ſame in the ſingular number of all thoſe of the firſt declenſion ending in E; as is likewiſe the caſe with thoſe in UM of the ſecond, in E of the third, and in U of the fourth. In the plural number, there is no diſtinction between theſe two caſes in thoſe of the ſecond declenſion ending in UM, nor in all thoſe of the third, fourth, and fifth, of every termination, the number of which is very conſiderable. So that their language reaps no advantage in this reſpect from almoſt one half of their nouns. Nor have any of the modern languages in Europe, however much they may have borrowed from the ancient languages in other reſpects, attempted to copy from them in this particular; from which perhaps more advantage would have been gained, than from copying all the other ſuppoſed excellencies of their language.—But to return to our ſubject.

It remains that we conſider, whether the inflection of nouns gives any advantage over the method of defining them by prepoſitions, in point of diſtinctneſs and preciſion of meaning.—But in this reſpect too the analogous language muſt come off victorious.—Indeed this is the particular in which their greateſt excellence conſiſts; nor was it, we believe, ever diſputed, but that, in point of accuracy and preciſion, this method muſt excel all others, however it may be defective in other reſpects.—We obſerved under this head, when ſpeaking of verbs, that it might perhaps be poſſible to form a language by inflection which ſhould be capable of as great accuracy as in the more ſimple order of auxiliaries: but this would have been ſuch an infinite labour, that it was not to be expected that ever human powers would have been able to accompliſh it. More eaſy would it have been to have formed the ſeveral inflections of the nouns ſo different from one another, as to have rendered it impoſſible ever to miſtake the meaning. Yet even this has not been attempted. And as we find that thoſe languages which have adopted the method of inflecting their verbs are more imperfect in point of preciſion than the other, ſo the ſame may be ſaid of inflecting the nouns: for, not to mention the energy which

which the analogous languages acquire by putting the accent upon the noun, or its prepoſition (when in an oblique caſe), according as the ſubject may require, to expreſs which variation of meaning no particular variety of words have been invented in any inflected language, they are not even complete in other reſpects.—The Latin, in particular, is in many caſes defective, the ſame termination being employed in many inſtances for different caſes of the ſame noun.—Thus the genitive and dative ſingular, and nominative and vocative plural, of the firſt declenſion, are all exactly alike, and can only be diſtinguiſhed from one another by the formation of the ſentences;—as are alſo the nominative, vocative and ablative ſingular, and the dative and ablative plural. In the ſecond, the genitive ſingular, and nominative and vocative plural, are the ſame; as are alſo the dative and ablative ſingular, and dative and ablative plural; except thoſe in UM, whoſe nominative, accuſative, and vocative ſingular, and nominative, accuſative and vocative plural, are alike. The other three declenſions agree in as many of their caſes as theſe do; which evidently tends to perplex the meaning, unleſs the hearer is particularly attentive to, and well acquainted with, the particular conſtruction of the other parts of the ſentence; all of which is totally removed, and the cleareſt certainty exhibited, at once, by the help of prepoſitions in the analogous languages.

It will hardly be neceſſary to enter into ſuch a minute examination of the advantages or diſadvantages attending the variation of *adjectives;* as it will appear evident, from what has been already ſaid, that the endowing them with terminations ſimilar to, and correſponding with the nouns, muſt tend ſtill more and more to increaſe the ſimilarity of ſounds in any language, than any of thoſe particulars we have already taken notice of; and were it not for the liberty which they have, in tranſpoſitive languages, of ſeparating the adjective from the noun, this muſt have occaſioned ſuch a jingle of ſimilar ſounds as behoved to have been moſt diſguſting to the ear: but as it would have been impoſſible in many caſes, in thoſe languages where the verbs and nouns are inflected, to have pronounced the words which ought to have followed each other, unleſs their adjectives could have been ſeparated from the nouns; therefore, to remedy this inconvenience, they were forced to deviſe this unnatural method of inflecting them alſo; by which means it is eaſy to recognize to what noun any adjective has a reference, in whatever part of the ſentence it may be placed.—In theſe languages, therefore, this inflection, both as to gender, number, and caſe, becomes abſolutely neceſſary; and, by the diverſity which it admitted in the arranging the words of the ſeveral phraſes, might counterbalance the jingle of ſimilar ſounds which it introduced into the language.—But what ſhall we ſay of thoſe European nations, who, although poſſeſſed of a language in every reſpect different from the tranſpoſitive idiom, have neverthelefs adopted the variations of their adjectives in the fulleſt ſenſe? for here they have nothing to counterbalance this diſagreeable jingle of ſimilar ſounds, ſo deſtructive of all real harmony.—In the days of monkiſh ignorance, when this cuſtom was probably introduced, the claſhing of words with one another might be eſteemed an ornament; but now that mankind have attained a higher ſenſe of harmony and propriety, we in Britain may felicitate ourſelves to find, that our language has eſcaped this mark of barbarity, which ſo many others are now ſubjected to.

Having thus examined the moſt ſtriking particulars in which the tranſpoſitive and analogous languages differ, and endeavoured to ſhow the general tendency of every one of the particulars ſeparately, it would not be fair to diſmiſs the ſubject without conſidering each of theſe as a whole, and pointing out their general tendency in that light: for we all know, that it often happens in human inventions, that every part which compoſes a whole, taken ſeparately, may appear extremely fine; and yet, when all theſe parts are put together, they may not agree, but produce a jarring and confuſion very different from what we might have expected. We therefore imagine a few remarks upon the genius of each of theſe two diſtinct IDIOMS of language conſidered as a whole will not be deemed uſeleſs.

Although all languages agree in this reſpect, that they are the means of conveying the ideas of one man to another; yet as there are an infinite variety of ways in which we might wiſh to convey theſe ideas, ſometimes by the eaſy and familiar mode of converſation, and at other times by more ſolemn addreſſes to the underſtanding, by pompous declamation, *&c.* it may ſo happen, that the genius of one language may be more properly adapted to the one of theſe than the other, while another language may excel in the oppoſite particular. This is exactly the caſe in the two general IDIOMS of which we now treat.—Every particular in a *tranſpoſitive* language, is peculiarly calculated for that ſolemn dignity which is neceſſary for pompous orations. Long ſounding words, formed by the inflection of the different parts of ſpeech,—flowing periods, in which the attention is kept awake by the harmony of the ſounds, and an expectation of that word which is to unravel the whole,—if compoſed by a ſkilful artiſt, are admirably ſuited to that ſolemn dignity and awful grace which conſtitute the eſſence of a public harangue. On the contrary, in private converſation, where the mind wiſhes to unbend itſelf with eaſe, theſe become ſo many cloggs which encumber and perplex. At theſe moments we wiſh to transfuſe our thoughts with eaſe and facility—we are tired with every unneceſſary ſyllable—and wiſh to be freed of the trouble of attention as much as may be. Like our ſtate-robes, we would wiſh to lay aſide our pompous language, and enjoy ourſelves at home with freedom and eaſe. Here the ſolemnity and windings of the *tranſpoſitive* language are burdenſome; while the facility with which a ſentiment can be expreſſed in the the *analogous* language is the thing that we wiſh to acquire.—In this humble, though moſt engaging ſphere, the analogous language moves unrivalled;—in this it wiſhes to indulge, and never tires. But it in vain attempts to rival the *tranſpoſitive* in dignity and pomp: The number of monoſyllables interrupt the flow of harmony; and altho' they may give a greater variety of ſounds, yet they do not naturally poſſeſs that dignified gravity which ſuits the other language. This, then, muſt be conſidered as the ſtriking particular in the genius of theſe two different IDIOMS, which marks their characters.

If

If we confider the effects which thefe two different characters of language muft naturally produce upon the people who employ them, we will foon perceive, that the genius of the *analogous* language is much more favourable for the moft engaging purpofes of life, the civilizing the human mind by mutual intercourfe of thought, *than the tranfpofitive*. For as it is chiefly by the ufe of fpeech that man is raifed above the brute creation;—as it is by this means he improves every faculty of his mind, and, to the obfervations which he may himfelf have made, has the additional advantage of the experience of thofe with whom he may converfe, as well as the knowledge which the human race have acquired by accumulated experience of all preceding ages;—as it is by the enlivening glow of converfation that kindred fouls catch fire from one another, that thought produces thought, and each improves upon the other, till they foar beyond the bounds which human reafon, if left alone, could ever have afpired to;—we muft furely confider that language as the moft beneficial to fociety, which moft effectually removes thefe bars that obftruct its progrefs. Now, the genius of the *analogous* languages is fo eafy, fo fimple and plain, as to be within the reach of every one who is born in the kingdom where it is ufed, to fpeak it with facility; even the rudeft among the vulgar can hardly fall into any grammatical errors: whereas, in the *tranfpofitive* languages, fo many rules are neceffary to be attended to, and fo much variation is produced in the meaning by the flighteft variations in the found, that it requires a ftudy far above the reach of the illiterate mechanic ever to attain. So that, how perfect foever the language may be when fpoken with purity, the bulk of the nation muft ever labour under the inconvenience of rudenefs and inacurracy of fpeech, and all the evils which this naturally produces.—Accordingly we find, that in Rome, a man, even in the higheft rank, received as much honour, and was as much diftinguifhed among his equals, for being able to converfe with eafe, as a modern author would be for writing in an eafy and elegant ftyle; and Cæfar among his cotemporaries was as much efteemed for his fuperiority in fpeaking the language in ordinary converfation with eafe and elegance, as for his powers of oratory, his fkill in arms, or his excellence in literary compofition. It is needlefs to point out the many inconveniences that this behoved to produce in a ftate. It is fufficient to obferve, that it naturally tends to introduce a vaft diftinction between the different orders of men; to fet an impenetrable barrier between thofe born in a high and thofe born in a low ftation; to keep the latter in ignorance and barbarity, while it elevates the former to fuch a height as muft fubject the other to be eafily led by every popular demagogue.—How far the hiftory of the nations who have followed this IDIOM of language confirms this obfervation, every one is left to judge for himfelf.

Having thus confidered LANGUAGE in general, and pointed out the genius and tendency of the two moft diftinguifhed IDIOMS which have prevailed; we fhall clofe thefe remarks with a few obfervations upon the particular nature and genius of thofe language which are now chiefly ftudied or fpoken in Europe.

Of all the nations whofe memory hiftory has tranfmitted to us, none have been fo eminently diftinguifhed for their literary accomplifhments, as well as acquaintance with the polite arts, as the Greeks; nor are we as yet acquainted with a language poffeffed of fo many advantages, with fo few defects, as that which they ufed, and which continues ftill to be known by their name.—The neceffary connection between the progrefs of knowledge and the improvement of language has been already explained; fo that it will not be furprifing to find their progrefs in the one keep pace with that of the other: but it will be of utility to point out fome advantages which that diftinguifhed people poffeffed, which other nations, perhaps not lefs diftinguifhed for talents or tafte, have not enjoyed, which has contributed to render their language the moft univerfally admired in ancient as well as in modern times.

As it is probable, that many different focieties of men, in the early ages of antiquity, may have found themfelves in fuch circumftances as to be obliged to invent a language to themfelves; each would naturally adopt thofe founds into their language which chance might fuggeft, or were moft agreeable to their perception of harmony, or moft confonant to the difpofition of mind of the original inventors; in the fame manner as we fee that each compofer of mufic has a particular fpecies of founds of which he is fonder than any other, which will predominate through all his compofitions, and give them a certain characteriftic tone by which they may be diftinguifhed from that of other compofers:—So the language of each particular fet of people would have originally a certain characteriftic tone of harmony, which would diftinguifh it from all others; and behoved to be more or lefs perfect, according to the greater or lefs degree of that delicate fenfe of harmony, diftinguifhed by the name of *tafte*, which thefe original inventors were poffeffed of. Thefe founds, then, being once eftablifhed by cuftom, would become familiar to the ear of the defcendents of thefe particular tribes: new words would be invented as knowledge increafed; but thefe behoved to be modulated fo as to be agreeable to the general tenor of their language, from the neceffity of making it confonant as well to the organs of hearing as the organs of fpeech.—Hence it happens, that the characteriftic tones of a language are preferved much longer without variation than any other particular relating to it; and if it change at all, the change muft be flow and imperceptible. Knowledge after this may increafe;—tafte may be improved;—it may be perceived that the language is not copious enough to exprefs the ideas, or harmonious enough to pleafe the ear of the compofer;—he may readily invent words to fupply the deficiency in that refpect; but the founds in a great meafure remain without the reach of his power, and he muft reft fatisfied with thefe, fuch as they are, without attempting innovations.——Happy therefore, in this refpect, muft we deem thofe nations, whofe earlieft anceftors have been fo fortunate as to adopt no unharmonious founds into their language, whereby they are freed from one bar to the cultivating thofe refined pleafures which proceed from the ufe of a delicate tafte, which others may perhaps never be able to furmount:—and in this refpect no nation was ever fo eminently diftinguifhed as the

the Greeks; which no doubt contributed its ſhare to promote that general elegance and harmony of proportion which prevailed in all their arts. The original ſounds and fundamental tones of that language are the moſt harmonious, and the moſt agreable to the ear, of any that have hitherto been invented; inſomuch, that from this principle alone the ſound of their language is agreeable to every nation who have heard it, even when the meaning of the words are not underſtood; whereas almoſt all other languages, till they are underſtood, appear, to an ear which has not been accuſtomed to them, jarring and diſcordant. This is the fundamental excellence of that juſtly admired language; nor have the people failed to improve this to the utmoſt of their power, by many aids of their own invention.—The Greek language is of the *tranſpoſitive* kind: but a people ſo lively, ſo acute, and ſo loquacious, could ill bear the ceremonious reſtraint which that mode of language naturally ſubjected them to; and have therefore, by various methods, freed it in a great meaſure from the ſtiffneſs which that produced. In inflecting their nouns and verbs, they ſometimes prefix a ſyllable, and ſometimes add one; which, beſides the variety that it gives to the ſounds of the language, adds greatly to the diſtinctneſs, and admits of a more natural arrangement of the words than in the Latin, and of conſequence renders it much fitter for the eaſineſs of private converſation: and indeed, the genius of the people ſo far prevailed over the *idiom* of the language, as to render it, in the age of its greateſt perfection, capable of almoſt as much eaſe, and requiring almoſt as little tranſpoſition of words, as thoſe languages which have been called analogous. But as thoſe nations who ſpoke this language were all governed by popular aſſemblies, and as no authority could be obtained among them but by a ſkill in rhetoric and the powers of perſuaſion; it became neceſſary for every one, who wiſhed to acquire power or conſideration in the ſtate, to improve himſelf in the knowledge of that language, in the uſe of which alone he could expect honours or reputation. Hence it happened, that while the vivacity of the people rendered it eaſy, the great men ſtudiouſly improved every excellence that it could reap from its powers as a *tranſpoſitive* language; ſo that, when brought to its utmoſt perfection by the amazing genius of the great Demoſthenes, it attained a power altogether unknown to any other language.—Thus happily circumſtanced, the Greek language arrived at that envied pre-eminence which it ſtill juſtly retains. From the progreſs of arts and ſciences; from the gaiety and inventive genius of the people; from the number of free ſtates into which Greece was divided, each of which invented words of its own, all of which contributed to the general ſtock; and from the natural commutation which took place between theſe ſtates, which excited in the ſtrongeſt degree the talents of the people; it acquired a copiouſneſs unknown to any ancient language, and excelled by few of the moderns.—In point of harmony of numbers, it is altogether unrivalled; and on account of the eaſe as well as dignity which it admitted of from the cauſes aſſigned above, it admits of perfection in a greater number of particular kinds of compoſition than any other language ever known.—The irreſiſtible force and overwhelming impetuoſity of *Demoſthenes* ſeems not more natural to the genius of the language; than the more flowery charms of Plato's calm and harmonious cadences, or the unadorned ſimplicity of Xenophon; nor does the majeſtic pomp of Homer ſeem to be more naturally adapted to the genius of the language, than the more humble ſtrains of Theocritus, or the laughing feſtivity of Anacreon: Equally adapted to all purpoſes, when we peruſe any of theſe authors, we would imagine the language was moſt happily adapted for his particular ſtyle alone The ſame powers it likewiſe in a great meaſure poſſeſſed for converſation; and the dialogue ſeems not more natural for the dignity of Sophocles or Euripides, than for the more eaſy tenderneſs of Menander, or buffoonery of Ariſtophanes.—With all theſe advantages, however, it muſt be acknowledged, that it did not poſſeſs that unexceptionable clearneſs of meaning, which ſome analogous languages enjoy, or that characteriſtic force which the accent has power to give it, were not theſe defects counterbalanced by other cauſes which we ſhall afterwards point out.

The Romans, a people of fierce and warlike diſpoſitions, for many ages during the infancy of their republic, more intent on purſuing conqueſts and military glory, than in making improvements in literature or the fine arts, beſtowed little attention to their language. Of a diſpoſition leſs ſocial and more phlegmatic than the Greeks, they gave themſelves no trouble about rendering their language fit for converſation; and it remained ſtrong and nervous, but, like their ideas, was limited and confined. More diſpoſed to command reſpect by the power of their arms than by the force of perſuaſion, they deſpiſed the more effeminate powers of ſpeech: ſo that, before the Punic wars, their language was perhaps more reſerved and uncourtly than any other at that time known.—But after their rival Carthage was deſtroyed, and they had no longer that powerful curb upon their ambition; when riches flowed in upon them by the multiplicity of that conqueſts;—luxury began to prevail, the ſtern auſterity of their manners to relax, and ſelfiſh ambition to take place of that diſintereſted love for their country ſo eminently conſpicuous among all orders of men before that period.—Popularity began then to be courted: ambitious men, finding themſelves not poſſeſſed of that merit which inſured them ſucceſs with the virtuous ſenate, amuſed the mob with artful and ſeditious harangues; and by making them believe that they were poſſeſſed of all power, and had their ſacred rights encroached upon by the ſenate, led them about at their pleaſure, and got themſelves exalted to honours and riches by theſe inſidious arts. It was then the Romans firſt began to perceive the uſe to which a command of language could be put.—Ambitious men then ſtudied it with care, to be able to accompliſh their ends; while the more virtuous were obliged to acquire a ſkill in this, that they might be able to repel the attacks of their adverſaries.—Thus it happened, that in a ſhort time that people, from having entirely neglected, began to ſtudy their language with the greateſt aſſiduity; and as Greece happened to be ſubjected to the Roman yoke about that time, and a friendly intercourſe was eſtabliſhed between theſe two countries, this greatly conſpired to nouriſh in the minds

minds of the Romans a taste for that art of which they had lately become so much enamoured. Greece had, long before this period, been corrupted by luxury; their taste for the fine arts had degenerated into unnecessary refinement; and all their patriotism consisted in popular harangues and unmeaning declamation. Oratory was then studied as a refined art; and all the subtleties of it were taught by rule, with as great care as the gladiators were afterwards trained up in Rome. But while they were thus idly trying who should be the lord of their own people, the nerves of government were relaxed, and they became an easy prey to every invading power. In this situation they became the *subjects*, under the title of the *allies*, of Rome, and introduced among them the same taste for haranguing which prevailed among themselves. Well acquainted as they were with the powers of their own language, they set themselves with unwearied assiduity to polish and improve that of their new masters: but with all their assiduity and pains they never were able to make it arrive at that perfection which their own language had acquired; and in the Augustan age, when it had arrived at the summit of its glory, Cicero bitterly complains of its want of copiousness in many particulars.

But as it was the desire of all who studied this language with care, to make it capable of that stately dignity and pomp necessary for public harangues; they followed the genius of the language in this particular, and in a great measure neglected those lesser delicacies which form the pleasure of domestic enjoyment; so that, while it acquired more copiousness, more harmony, and precision, it remained stiff and inflexible for conversation; nor could the minute distinction of nice grammatical rules be ever brought down to the apprehension of the vulgar; so that the language spoken among the lower class of people remained rude and unpolished even till the end of the monarchy. The Huns who over run Italy, incapable of acquiring any knowledge of such a difficult and abstruse language, never adopted it; and the native inhabitants being made acquainted with a language more natural and easily acquired, quickly adopted that idiom of speech introduced by their conquerors, although they still retained many of those words which the confined nature of the barbarian language made necessary to allow them, to express their ideas.—And thus it was that the language of Rome, that proud mistress of the world, from an original defect in its formation, although it had been carried to a perfection in other respects far superior to any northern language at that time, easily gave way to them, and in a few ages the knowledge of it was lost among mankind: while, on the contrary, the more easy nature of the Greek language has still been able to keep some slight footing in the world, although the nations in which it has been spoken have been subjected to the yoke of foreign dominion for upwards of two thousand years, and their country has been twice ravaged by barbarous nations, and more cruelly depressed than ever the Romans were.

From the view which we have already given of the Latin language, it appears evident, that its idiom was more strictly transpositive than any other language yet known, and was attended with all the defects to which that idiom is naturally subjected: nor could it boast of such favourable alleviating circumstances as the Greek, the prevailing sounds of the Latin being far less harmonious to the ear: and although the formation of the words are such as to admit of full and distinct sounds, and so modulated as to lay no restraint upon the voice of the speaker; yet, to a person unacquainted with the language, they do not convey that enchanting harmony so remarkable in the Greek language. The Latin is stately and solemn, it does not excite disgust; but at the same time it does not charm the ear, so as to make it listen with pleased attention. To one acquainted with the language indeed, the nervous boldness of the thoughts, the harmonious rounding of the periods, the full solemn swelling of the sounds, so distinguishable in the most eminent writers in that language which have been preserved to us, all conspire to make it pleasing and agreeable.—In these admired works we meet with all its beauties, without perceiving any of its defects; and we naturally admire, as perfect, a language which is capable of producing such excellent works.—Yet with all these seeming excellencies, this language is less copious, and more limited in its style of composition, than many modern languages far less capable of precision and accuracy than almost any of these, and infinitely behind them all in point of easiness in conversation. But these points have been so fully proved already, as to require no further illustration.—Of the compositions in that language which have been preserved to us, the *orations* of Cicero are best adapted to the genius of the language, and we there see it in its utmost perfection. In the *philosophical works* of that great author we perceive some of its defects; and it requires all the powers of that great man, to render his *epistles* agreeable, as these have the genius of the language to struggle with.—Next to oratory, history agrees with the genius of this language; and Cæsar, in his Commentaries, has exhibited the language in its purest elegance, without the aid of pomp or foreign ornament. ——Among the Poets, Virgil has best adapted his works to his language. The flowing harmony and pomp of it is well adapted for the epic strain, and the correct delicacy of his taste rendered him perfectly equal to the task. But Horace is the only poet whose force of genius was able to overcome the bars which the language threw in his way, and succeed in lyric poetry. Were it not for the brilliancy of the thoughts, and acuteness of remarks, which so eminently distinguish this author's compositions, his odes would long ere now have sunk into utter oblivion.—But so conscious have all the Roman poets been of the unfitness of their language for easy dialogue; that almost none of them, after Plautus and Terence, have attempted any dramatic compositions in that language.—Nor have we any reason to regret that they neglected this branch of poetry, as it is probable, if they had ever become fond of these, they would have been obliged to have adopted so many unnatural contrivances to render them agreeable, as would have prevented us (who of course would have considered ourselves as bound to follow them) from making that progress in the drama which so particularly distinguishes the productions of modern times.

The modern *Italian* language, from an inattention quite common in literary subjects, has been usually called a child

child of the Latin language, and is commonly believed to be the ancient Latin a little debased by the mixture of the barbarous language of those people who conquered Italy. The truth is, it is directly the reverse: for this language, in its general idiom, and fundamental principles, is evidently of the analogous kind, first introduced by these fierce invaders, although it has borrowed many of its words, and some of its modes of phraseology, from the Latin, with which they were so intimately blended that this could scarcely be avoided; and it has been from remarking this slight connection so obvious at first sight, that superficial observers have been led to draw this general conclusion, so contrary to fact.

When Italy was over-run with the Lombards, and the empire destroyed by these northern invaders, they, as conquerors, continued to speak their own native language. Fierce and illiterate, they would not stoop to the servility of studying a language so clogged with rules, and difficult of attainment, as the Latin behoved to be to a people altogether unacquainted with nice grammatical distinctions: while the Romans of necessity were obliged to study the language of their conquerors, as well to obtain some relief of their grievances by prayers and supplications, as to destroy that odious distinction which subsisted between the conquerors and conquered while they continued as distinct people. As the language of their new masters, although rude and confined, was natural in its order, and easy to be acquired, the Latins would soon attain a competent skill in it: and as they bore such a proportion to the whole number of people, the whole language behoved to partake somewhat of the general sound of the former: for, in spite of all their efforts to the contrary, the organs of speech could not at once be made to acquire a perfect power of uttering any unaccustomed sounds; and as the language of the barbarians behoved to be much less copious than the Latin, whenever they found themselves at a loss for a word, they would naturally adopt those which most readily presented themselves from their new subjects. Thus a language in time was formed, somewhat resembling the Latin, both in the general tenor of the sounds, and in the meaning of many words: and as the barbarians gave themselves little trouble about language, and in some cases perhaps hardly knew the general analogy of their own language, it is not surprising if their new subjects should find themselves sometimes at a loss on that account, or if, in these situations, they followed, on some occasions, the analogy suggested to them by their own: which accounts for the strange degree of mixture of heterogeneous grammatical analogy we meet with in the Italian as well as Spanish and French languages.—The Idiom of all the Gothic languages is purely analogous; and in all probability, before their mixture with the Latins and other people in their provinces, the several grammatical parts of speech followed the plain simple idea which that supposes; the verbs and nouns were all probably varied by auxiliaries, and their adjectives retained their simple unalterable state:—but by their mixture with the Latins, this simple form has been in many cases altered; their verbs became in some cases inflected; but their nouns in all these languages still retained their original form; although they have varied their adjectives, and foolishly clogged their nouns with gender, according to the Latin idioms. From this heterogeneous, and fortuitous (as we may say, because injudicious) mixture of parts, results a language possessing almost all the defects of each of the languages of which it is composed; with few of the excellencies of either: for it has neither the ease and precision of the *analogous*, nor the pomp and boldness of the *transpositive* languages; at the same time that it is clogged with almost as many rules, and liable to as great abuses.

These observations are equally applicable to the French and Spanish, as to the Italian language.—With regard to this last in particular, we may observe, that as the natural inhabitants of Italy, before the last invasion of the barbarians, were sunk and enervated by luxury and that depression of mind and genius which anarchy always produces; they had become fond of feasting and entertainments, and the enjoyment of sensual pleasures constituted their highest delight; and their language partook of the same debility as their body.——The barbarians too—unaccustomed to the seductions of pleasure—soon fell from their original boldness and intrepidity,—and, like Hannibal's troops of old, were enervated by the sensual gratifications into which a nation of conquerors unaccustomed to the restraint of government freely indulged.—The softness of the air—the fertility of the climate—the unaccustomed flow of riches which they at once acquired,—together with the voluptuous manner of their conquered subjects,—all conspired to enervate their minds, and render them soft and effeminate.—No wonder then, if a language new-moulded should at this juncture partake of the genius of the people who formed it; and instead of participating of the martial boldness and ferocity of either of their ancestors, should be softened and enfeebled by every device which an effeminate people could invent.——The strong consonants which terminated the words, and gave them life and boldness, being thought too harsh for the delicate ears of these sons of sloth, were banished their language;—while sonorous vowels, which could be protracted to any length in music, were substituted in their stead.——Thus the Italian language is formed flowing and harmonious, but destitute of those nerves which constitute the strength and vigour of a language: at the same time, the sounds are neither enough diversified, nor in themselves of such an agreeable tone, as to afford great pleasure without the aid of musical notes;—and the small pleasure which this affords is still lessened by the little variety of measure which the great similarity of the termination of words occasions.—Hence it happens, that this language is fitted for excelling in fewer branches of literature than almost any other:—and although we have excellent historians, and more than ordinary poets, in this language; yet they labour under great inconveniences from the language in which they write,—as it wants nerves and stateliness for the former,—and sufficient variety of modulation for the latter.—It is, more particularly on this account, altogether unfit for an epic poem:—and although attempts have been made in this way by two men, whose genius, if not fettered by the language, might have been crowned with success; yet these, notwithstanding the fame that

with

with ſome they may have acquired, muſt, in point of poetic harmony, be deemed defective by every impartial perſon. Nor is it poſſible that a language which hardly admits of poetry without rhime, can ever be capable of producing a perfect poem of great length; and the ſtanza to which their poets have ever confined themſelves, muſt always produce the moſt diſagreeable effect in a poem where unreſtrained pomp or pathos are neceſſary qualifications. The only ſpecies of poetry in which the Italian language can claim a ſuperior excellence, is the tender tone of elegy: and here it remains unrivalled and alone:—the plaintive melody of the ſounds, and ſmooth flow of the language, ſeem perfectly adapted to expreſs that ſoothing melancholy which this ſpecies of poetry requires.—On this account, the plaintive ſtanzas of the *Paſtor Fido* of *Guarini* have juſtly gained to that poem an univerſal applauſe; although, unleſs on this account alone, it is perhaps inferior to almoſt every other poem of the kind which ever appeared.——We muſt obſerve with ſurpriſe, that the Italians, who have fettered every other ſpecies of poetry with the ſevereſt ſhackles of rhime, have in this ſpecies ſhewed an example of the moſt unreſtrained freedom; the happy effects of which ought to have taught all Europe the powerful charms attending it: yet with amazement we perceive, that ſcarce an attempt to imitate them has been made by any poet in Europe except by Milton in his Lycidas; no dramatic poet, even in Britain, having ever adopted the unreſtrained harmony of numbers to be met with in this and many other of their beſt dramatic compoſitions

Of all the languages which ſprung up from the mixture of the Latins with the northern people on the deſtruction of the Roman empire, none of them approach ſo near to the genius of the Latin as the Spaniſh does. For as the Spaniards have been always remarkable for their military prowefs and dignity of mind, their language is naturally adapted to expreſs ideas of that kind. Sonorous and ſolemn, it admits nearly of as much dignity as the Latin. For converſation, it is the moſt elegant and courteous language in Europe.—The humane and generous order of chivalry was firſt invented and kept its footing longeſt in this nation; and although it run at laſt into ſuch a ridiculous exceſs as deſervedly made it fall into univerſal diſrepute, yet it left ſuch a ſtrong tincture of romantic heroiſm upon the minds of all ranks of people, as made them jealous of their glory, and ſtrongly emulous of cultivating that heroic politeneſs, which they conſidered as the higheſt perfection they could attain. Every man diſdained to flatter, or to yield up any point of honour which he poſſeſſed: at the ſame time, he rigorouſly exacted from others all that was his due. Theſe circumſtances have given riſe to a great many terms of reſpect, and courteous condeſcenſion, without meanneſs or flattery, which give their dialogue a reſpectful politeneſs and elegance unknown to any other European language. This is the reaſon why the characters ſo finely drawn by Cervantes in Don Quixote are ſtill unknown to all but thoſe who underſtand the language in which he wrote.—Nothing can be more unlike the gentle meekneſs and humane heroiſm of the knight, or the native ſimplicity, warmth of affection, and reſpectful loquacity of the ſquire,—than the inconſiſtent follies of the one, or the impertinent forwardneſs and diſreſpectful petulance of the other, as they are exhibited in every Engliſh tranſlation.—Nor is it poſſible to repreſent ſo much familiarity, united with ſuch becoming condeſcenſion in the one, and unfeigned deference in the other, in any other European language, as is neceſſary to paint theſe two admirable characters.

Although this language, from the ſolemn dignity and majeſtic elegance of its ſtructure, is perhaps better qualified than any other modern one for the ſublime ſtrains of epic poetry; yet as the poets of this nation have all along imitated the Italians by a moſt ſervile ſubjection to rhime, they never have produced one poem of this ſort, which in point of poeſy of ſtyle deſerves to be tranſmitted to poſterity. And in any other ſpecies of poetry but this, or the higher tragedy, is it not naturally fitted to excel. But although the drama and other polite branches of literature were early cultivated in this country, and made conſiderable progreſs in it, before the thirſt of gain debaſed their ſouls, or the deſire of univerſal dominion made them forfeit that liberty which they once ſo much prized; ſince they became enervated by an overbearing pride, and their minds enſlaved by ſuperſtition; all the polite arts have been neglected: ſo that, while other European nation have been advancing in knowledge, and improving their language, they have remained in a ſtate of torpid inactivity; and their language has not arrived at that perfection which its nature would admit, or the acute genius of the people would have made us naturally expect.

It will perhaps, by ſome, be thought an unpardonable inſult, if we do not allow the French the preference of all modern languages in many reſpects. But ſo far muſt we pay a deference to truth, as to be obliged to rank it among the pooreſt languages in Europe.—Every other language has ſome ſounds which can be uttered clearly by the voice: even the Italian, although it wants energy, ſtill poſſeſſes diſtinctneſs of articulation. But the French is almoſt incapable of either of theſe beauties; for in that language the vowels are ſo much curtailed in the pronunciation, and the words run into one another in ſuch a manner, as of neceſſity to produce an indiſtinctneſs which renders it incapable of meaſure or harmony. From this cauſe, it is in a great meaſure incapable of poetic modulation, and rhime has been obliged to be ſubſtituted in its ſtead; ſo that this pooreſt of all contrivances which has ever yet been invented to diſtinguiſh poetry from proſe, admitted into all the modern languages when ignorance prevailed over Europe, has ſtill kept ſome footing in the greateſt part of theſe, rather through a deference for eſtabliſhed cuſtoms, than from any neceſſity.—Yet as the French language admits of ſo little poetic modulation, rhime is in ſome meaſure *neceſſary* to it; and therefore they have adopted, and dignified this poor deviation from proſe with the name of Poetry; and, by their blind attachment to this art, have neglected to improve ſo much as they might have done the ſmall powers for harmony that their language is poſſeſſed of; and, by being long accuſtomed to this falſe taſte, have become fond of it to ſuch a ridiculous exceſs, as to have all their tragedies,—nay even their comedies, in rhime. While the poet is obliged to enervate his language, and check the flow of compoſition, for the

the ſake of linking his lines together, the judicious actor finds more difficulty in deſtroying the appearance of that meaſure, and preventing the clinking of the rhimes, than in all the reſt of his taſk.——After this we will not be ſurpriſed to find Voltaire attempt an epic poem in this ſpecies of poetry; although the more judicious Fenelon in his *Telemaque* had ſhewn to his countrymen the only ſpecies of poeſy which their language could admit of for any poem which aſpired to the dignity of the epic ſtrain.——Madam Deſpouliers, in her *Idyllie*, has ſhewn the utmoſt extent of harmony to which their language can attain in ſmaller poems:—indeed in the tenderneſs of an elegy, or the gaiety of a ſong, it may ſucceed; but it is ſo deſtitute of force and energy, that it can never be able to reach the Pindaric, or even perhaps the Lyric ſtrain,—as the ineffectual efforts even of the harmonious Rouſſeau, in his tranſlation of the Pſalms of David of this ſtamp, may fully convince us.

With regard to its power in other ſpecies of compoſition, the ſententious rapidity of Voltaire, and the more nervous dignity of Rouſſeau, afford us no ſmall preſumption, that, in a ſkilful hand, it might acquire ſo much force, as to tranſmit to futurity hiſtorical facts in a ſtyle not altogether unworthy of the ſubject—In attempts at pathetic declamation, the ſuperior abilities of the compoſer may perhaps on ſome occaſions excite a great idea, but this is ever cramped by the genius of the language: and altho' no nation in Europe can boaſt of ſo many orations where this grandeur is attempted; yet perhaps there are few who cannot produce more perfect, although not more laboured, compoſitions of this kind.

But notwithſtanding the French language labours under all theſe inconveniences;—although it can neither equal the dignity or genuine politeneſs of the Spaniſh, the nervous boldneſs of the Engliſh, nor the melting ſoftneſs of the Italian;—although it is deſtitute of poetic harmony, and ſo much cramped in ſound as to be abſolutely unfit for almoſt every ſpecies of muſical compoſition*;—yet the ſprightly genius of that volatile people has been able to ſurmount all theſe difficulties, and render it the language moſt generally eſteemed, and moſt univerſally ſpoken, of any in Europe: for this people, naturally gay and loquacious, and fond to exceſs of thoſe ſuperficial accompliſhments which engage the attention of the fair ſex, have invented ſuch an infinity of words capable of expreſſing vague and unmeaning compliment, now dignified by the name of *politeneſs*, that, in this ſtrain, one who uſes the French can never be at a loſs; and as it is eaſy to converſe *more*, and really ſay *leſs*, in this than any other language, a man of very moderate talents may diſtinguiſh himſelf much more by uſing this than any other that has ever yet been invented.—On this account, it is peculiarly well adapted for that ſpecies of converſation which muſt ever take place in thoſe general and promiſcuous companies, where many perſons of both ſexes are met together for the purpoſes of relaxation or amuſement; and muſt of courſe be naturally admitted into the courts of princes, and aſſemblies of great perſonages; who, having fewer equals with whom they can aſſociate, are more under a neceſſity of converſing with ſtrangers, in whoſe company the tender ſtimulus of friendſhip does not ſo naturally expand the heart to mutual truſt or unreſtrained confidence. In theſe circumſtances, as the heart remaineth diſengaged, converſation muſt neceſſarily flag; and mankind in this ſituation will gladly adopt that language in which they can converſe moſt eaſily without being deeply intereſted—One theſe accounts the French now is, and probably will continue to be reckoned the moſt polite language in Europe, and therefore the moſt generally ſtudied and known: nor ſhould we envy them this diſtinction, if our countrymen would not weaken and enervate their own manly language, by adopting too many of their unmeaning phraſes.

The Engliſh is perhaps poſſeſſed of a greater degree of excellence, blended with a greater number of defects, than any of the languages that we have hitherto mentioned.—As the people of great Britain are a bold, daring, and impetuous race of men; ſubject to ſtrong paſſions, and, from the abſolute freedom and independence which reigns among all ranks of people throughout this happy iſle, little ſolicituous about controuling theſe paſſions;—our language takes its ſtrongeſt characteriſtic diſtinction from the genius of the people; and, being bold, daring, and abrupt, is admirably well adapted to expreſs thoſe great emotions which ſpring up in an intrepid mind at the proſpect of intereſting events. Peculiarly happy too in the full and open ſound of the vowels, which forms the characteriſtic *tone* of the language, and in the ſtrong uſe of the aſpirate H in almoſt all thoſe words which are uſed as exclamations, or marks of ſtrong emotions upon intereſting occaſions, that particular claſs of words called *interjections* have, in our language, more of that fulneſs and unreſtrained freedom of tones, in which their chief power conſiſts, and are puſhed forth from the inmoſt receſſes of the ſoul in a more forcible and unreſtrained manner, than any other language whatever. Hence it is more

* An author of great diſcernment, and well acquainted with the French language, has lately made the ſame remark; and as the loftineſs of his genius often prevents him from bringing down his illuſtrations to the level of ordinary comprehenſion, he has on this, and many other occaſions, been unjuſtly accuſed of being fond of paradoxes.---But as muſic never produces its full effect but when the tones it aſſumes are in uniſon with the idea that the words naturally excite, it of neceſſity follows, that if the words of any language do not admit of that fulneſs of ſound, or of that ſpecies of tones, which the paſſion or affection that may be deſcribed by the words would naturally require to excite the ſame idea in the mind of one who was unacquainted with the language, it will be impoſſible for the muſic to produce its full effect, as it will be cramped and confined by the ſound of the words;---and as the French language does not admit of thoſe full and open ſounds which are neceſſary for pathetic expreſſion in muſic, it muſt of courſe be unfit for muſical compoſition.---It is true indeed, that in modern times, in which ſo little attention is beſtowed on the ſimple and ſublime charms of pathetic expreſſion, and a fantaſtical tingling of unmeaning ſounds is called muſic---where the ſenſe of the words are loſt in fugues, quavers, and unneceſſary repetition of particular ſyllables,---all languages are nearly equally fitted for it; and among theſe the French: nor is it to be doubted, that, in the eaſy gaiety of a ſong, this language can properly enough admit of all the muſical expreſſion which that ſpecies of compoſition may require.

more peculiarly adapted for the great and intereſting ſcenes of the *Drama* than any language that has yet appeared in the globe.—Nor has any other nation ever arrived at that perfection which the Engliſh may juſtly claim in that reſpect; for however faulty our dramatic compoſitions may be in ſome of the critical niceties which relate to this art,—in nervous force of diction, and in the natural expreſſion of thoſe great emotions which conſtitute its ſoul and energy, we claim, without diſpute, an unrivalled ſuperiority.—Our language too, from the great intercourſe that we have had with almoſt all the nations of the globe by means of our extenſive commerce, and from the eminent degree of perfection which we have attained in all the arts and ſciences, has acquired a copiouſneſs beyond what any other modern nation can lay claim to; and even the moſt partial favourers of the Greek language are forced to acknowledge, that in this reſpect it muſt give place to the Engliſh. Nor is it leſs happy in that facility of conſtruction which renders it more peculiarly adapted to the genius of a free people, than any other form of language.—Of an *idiom* purely analogous, is has deviated leſs from the genius of that *idiom*, and poſſeſſes more of the characteriſtic advantages attending it, than any other language that now exiſts: for, while *others*, perhaps by their more intimate connection with the Romans, have adopted ſome of their tranſpoſitions, and clogged their language with unneceſſary fetters, *we* have preſerved ourſelves free from the contagion, and ſtill retain the primitive ſimplicity of our language. Our *verbs* are all varied by auxiliaries (except in the inſtance we have already given, which is ſo much in our favours); our *nouns* remain free from the perplexing embarraſſment of *genders*, and our pronouns mark this diſtinction where neceſſary with the moſt perfect accuracy; our *articles* alſo are of courſe freed from this unnatural encumbrance, and our *adjectives* preſerve their natural freedom and independence. From theſe cauſes, our language follows an order of conſtruction ſo natural and eaſy, and the rules of *ſyntax* are ſo few and obvious, as to be within the reach of the moſt ordinary capacity. So that from this, and the great clearneſs and diſtinctneſs of meaning which this mode of conſtruction neceſſarily is accompanied with, it is much better adapted for the familiar intercourſe of private ſociety, and liable to fewer errors in uſing it, than any other language yet known; and on this account we may boaſt, that in no nation of Europe do the lower claſs of people ſpeak their language with ſo much accuracy, or have their minds ſo much enlightened by knowledge, as thoſe of great Britain.——What then ſhall we ſay of the diſcernment of thoſe grammarians, who are every day echoing back to one another complaints of the poverty of our language on account of the few and ſimple rules which it requires in ſyntax? As juſtly might we complain of an invention in mechanics, which, by means of one or two ſimple movements, obvious to an ordinary capacity, little liable to accidents, and eaſily put in order by the rudeſt hand, ſhould poſſeſs the whole powers of a complex machine, which had required an infinite apparatus of wheels and contrary movements, the knowledge of which could only be acquired, or the various accidents to which it was expoſed by uſing it be repaired, by the powers of an ingenious artiſt, as complain of this characteriſtic excellence of our language as a defect.

But if we thus enjoy in an eminent degree the advantages attending an *analogous* language; we likewiſe feel in a conſiderable meaſure the defects to which it is expoſed; as the number of monoſyllables with which it always muſt be embarraſſed, notwithſtanding the great improvements which have been made in our language ſince the revival of letters in Europe, prevents in ſome degree that ſwelling fulneſs of ſound which ſo powerfully contributes to harmonious dignity and graceful cadences in literary compoſitions.—And as the genius of the people of Britain has always been more diſpoſed to the rougher arts of command, than the ſofter inſinuations of perſuaſion, no pains have been taken to correct theſe natural defects of our language; but on the contrary, by an inattention of which we have hardly a parallel in the hiſtory of any civilized nation, we meet with many inſtances, even within this laſt century, of the harmony of ſound being ſacrificed to that brevity ſo deſireable in converſation, as many elegant words have been curtailed, and harmonious ſyllables ſuppreſſed, to ſubſtitute in their ſtead others, ſhorter indeed, but more barbarous and uncouth.—Nay, ſo little attention have our forefathers beſtowed upon the harmony of ſounds in our language, that one would be tempted to think, on looking back to its primitive ſtate, that they had on ſome occaſions ſtudiouſly debaſed it.—Our language, at its firſt formation, ſeems to have laboured under a capital defect in point of ſound, as ſuch a number of S's enter into the formation of our words, and ſuch a number of letters and combinations of other letters aſſume a ſimilar ſound, as to give a general hiſs through the whole tenor of our language, which muſt be exceedingly diſagreeable to every unprejudiced ear. We would therefore have naturally expected, that at the revival of letters, when our forefathers became acquainted with the harmonious languages of Greece and Rome, they would have acquired a more correct taſte, and endeavoured, if poſſible, to have diminiſhed the prevalence of this diſguſting ſound. But ſo far have they been from thinking of this, that they have multiplied this letter exceedingly. The plurals of almoſt all our nouns were originally formed by adding the harmonious ſyllable *en* to the ſingular, which has given place to the letter *s*; and inſtead of *houſen* formerly, we now ſay *houſes*. In like manner, many of the variations of our verbs were formed by the ſyllable *eth*, which we have likewiſe changed into the ſame diſagreeable letter; ſo that, inſtead of *loveth*, *moveth*, *writeth*, *walketh*, &c. we have changed them into the more modiſh form of *loves*, *moves*, *writes*, *walks*, &c.—Our very auxiliary verbs have ſuffered the ſame change; and inſtead of *hath* and *doth*, we now make uſe of *has* and *does*. From theſe cauſes, notwithſtanding the great improvements which have been made in language, within theſe few centuries, in other reſpects; yet, with regard to the pleaſingneſs of ſound alone, it was perhaps much more perfect in the days of Chaucer than at preſent: and although cuſtom may have rendered theſe ſounds ſo familiar to our ear, as not to affect us much; yet to an unprejudiced perſon, unacquainted with our language, we have

have not the smallest doubt, but the language of *Bacon* or *Sydney* would appear more harmonious than that of *Robertson* or *Hume*.—This is indeed the fundamental defect of our language, and loudly calls for reformation.

But notwithstanding this great and radical defect in our language with regard to pleasingness of sounds, which must be so strongly perceived by every one who is unacquainted with the meaning of our words; yet to those who understand the language, the exceeding copiousness which it allows in the choice of words proper for the occasion, and the nervous force which it derives from the accent, with the perspicuity and graceful elegance the emphasis bestows upon it, makes this defect be totally overlooked; and we could produce such numerous works of prose which excel in almost every different style of composition as would be tiresome to enumerate; and every reader of taste and discernement will be able to recollect a sufficient number of writings which excel in point of style, between the graceful and becoming gravity so conspicuous in all the works of the author of the *Whole Duty of Man*, and the animated and nervous diction of Robertson in his history of Charles the fifth,—the more flowery style of Shaftsbury, or the Attic simplicity and elegance of Addison. But although we can equal, if not surpass, every modern language in works of prose, it is in its poetical powers that our language shines forth with the greatest lustre.—The brevity to which we must here necessarily confine ourselves, prevents us from entering into a minute examination of the poetical powers of our own, compared with other languages; otherwise it would be easy to shew, that every other modern language labours under great restraints in this respect which ours is freed from;—that our language admits of a greater variety of poetic movements, and diversity of cadence, than any of the admired languages of antiquity;—that it distinguishes with the greatest accuracy between accent and quantity, and is possessed of every other poetic excellence which their languages were capable of: so that we are possessed of all the sources of harmony which they could boast; and, besides all these, have one superadded, which is the cause of greater variety and more forcible expression in numbers than all the rest; that is, the unlimited power given to the emphasis over quantity and cadence; by means whereof, a necessary union between sound and sense, numbers and meaning, in versification, unknown to the ancients, has been brought about, which gives our language in this respect a superiority over all those justly admired languages.—But as we cannot here further pursue this subject, we shall only observe, that these great and distinguishing excellencies far more than counterbalance the inconveniencies that we have already mentioned; and although, in mere pleasantness of sounds, or harmonious flow of syllables, our language may be inferior to the Greek, the Latin, Italian, and Spanish; yet in point of manly dignity, graceful variety, intuitive distinctness, nervous energy of expression, unconstrained freedom and harmony of poetic numbers, it will yield the palm to none.—Our immortal Milton, slowly rising, in graceful majesty stands up as equal, if not superior in these respects to any poet, in any other language, that ever yet existed;—while Thomson, with more humble aim, in melody more smooth and flowing, softens the soul to harmony and peace:—the plaintive moan of Hammond calls forth the tender tear and sympathetic sigh; while Gray's more soothing melancholy fixes the sober mind to silent contemplation:—more tender still than these, the amiable Shenston comes; and from his Doric reed, still free from courtly affectation, flows a strain so pure, so simple, and of such tender harmony, as even Arcadian shepherds would be proud to own. But far before the rest, the daring Shakespear steps forth conspicuous, clothed in native dignity; and, pressing forward with unremitting ardour, boldly lays claim to both dramatic crowns, held out to him by Thalia and Melpomene:—his rivals, far behind, look up, and envy him for these unfading glories; and the astonished nations round, with distant awe, behold and tremble at his daring flight.——Thus the language, equally obedient to all, bends with ease under their hands, whatever form they would have it assume; and, like the yielding wax, readily receives, and faithfully transmits to posterity, those impressions which they have stamped upon it.

Such are the principal outlines of the language of Great Britain, such are its beauties, and such its most capital defects; a language more peculiarly circumstanced than any that has ever yet appeared.——It is the language of a great and powerful nation, whose fleets surround the globe, and whose merchants are in every port; a people admired, or revered by all the world;—and yet it is less known in every foreign country, than any other language in Europe.—In it are written more perfect treatises on every art and science, than are to be found in any other language;—yet it is less sought after or esteemed by the literati in any part of the globe, than almost any of these. Its superior powers for every purpose of language are sufficiently obvious from the models of perfection, in almost every particular, which can be produced in it;—yet it is neglected, despised, and vilified by the people who use it; and many of those authors who owe almost the whole of their fame to the excellence of the language in which they wrote, look upon that very language with the highest contempt.—Neglected and despised, it has been trodden under foot as a thing altogether unworthy of cultivation or attention. Yet in spite of all these inconveniences, in spite of the many wounds it has thus received, it still holds up its head, and preserves evident marks of that comeliness and vigour which are its characteristical distinction. Like a healthy oak planted in a rich and fertile soil, it has sprung up with vigour: and although neglected, and suffered to be over-run with weeds; although exposed to every blast, and unprotected from every violence; it still beareth up under all these inconveniences, and shoots up with a robust healthiness and wild luxuriance of growth. Should this plant, so sound and vigorous, be now cleared from those weeds with which it has been so much encumbered;—should every obstacle which now buries it under thick shades, and hides it from the view of every passenger, be cleared away;—should the soil be cultivated with care, and a strong fence be placed around it, to prevent the idle or the wicked from breaking, or distorting its branches;—who can tell with what additional vigour it would flourish, or what amazing magnitude and perfection

tion it might at laſt attain!—How would the aſtoniſhed world behold, with reverential awe, the majeſtic gracefulneſs of that object which they ſo lately deſpiſed!

[N. B. *Some unavoidable circumſtances which attended the printing of the preceding article, have occaſioned ſeveral miſtakes in it, of which the following deſerve immediate notice.*]

Page 864. column 1. line 29. the words *in time* ſhould be delete.
P. 865. col. 2. l. 34. for *word*, read *words*.
P. 866. col. 1. l. 6. for *one*, read *on*.
Ibid. col. 1. and 2. delete *Loqueo*, *Odio*, *Loque-bam*, *Odie-bam*, with the Engliſh words accompanying them;---and for *Faceo*, *Pona-bam*, *Obie-bam*, *Gaudie-bam*, and *Abſtinie-bam*, read *Facio*, *Pone-bam*, *Obi-bam*, *Gaude-bam*, and *Abſtine-bam*.
Ibid. col. 2. l. 22. for "and the *pluperfect* in ISSEM and ERO," read, "the *pluperfect* in ISSEM, and the *future* in ERO."
P. 868. for, TU, *Tytere, lentis in umbra*, &c. read, TU, *Tityre, lentus in umbra*, &c.
Ibid. col. 1. l. 28. for *contract*, read *contraſt*;---l. 37. for *paſion*, read *paſſion*;--- and delete the ſyllable *con* at the beginning of l. 45.
P. 870. col. 2. lines 22, 23, 24, 25, and 26. read thus:---For all their nouns in UM of the ſecond declenſion, in E of the third, and in U of the fourth, have each their nominative and accuſative ſingular alike. Nor in the plural number is there any diſtinction between theſe caſes, &c.
Ibid. col. 2. l. 19. from the bottom, for *language*, read *languages*.
P. 873. col. 2. l. 38. for *that*, read *their*.
P. 876. col. 2. l. 16. for *is it*, read *it is*.

LANGUED, in heraldry, expreſſes ſuch animals whoſe tongue apppearing out of the mouth, is borne of a different colour from that of the body.

LANGUEDOC, a province of France, bounded by Lionois, on the north; by the river Rhone, which divides it from Dauphine and Provence, on the eaſt; by the Mediterranean and the the Pyrenees, on the ſouth; and by Guienne and Gaſcony, on the weſt.

LANGUOR, among phyſicians, ſignifies great weakneſs and loſs of ſtrength, attended with a dejection of mind; ſo that the patients can ſcarce walk, or even ſtand upright, but are apt to faint away.

LANIGEROUS, an appellation given to whatever bears wool.

LANIUS, the BUTCHER-BIRD, in ornithology, a genus belonging to the order of accipitres; the characters of which are theſe: The beak is ſomewhat ſtrait, with a tooth on each ſide towards the apex, and naked at the baſe; and the tongue is lacerated. There are twenty-ſix ſpecies, diſtinguiſhed by the ſhape of the tail, and colour.

LANNIERS, or LANNIARDS, in a ſhip, are ſmall ropes reeved into the dead-man's-eyes of all ſhrowds, either to ſlacken them or ſet them taught: the ſtays of all maſts are alſo ſet taught by lanniers.

LANTANA, in botany, a genus of the didynamia angioſpermia claſs. The calix conſiſts of four obſolete teeth; and the drupa has two cells. There are ſeven ſpecies, none of them natives of Britain.

LANUGO, the ſoft down of plants, like that growing on the fruit of the peach tree.

LANZO, a town of Italy, in the territory of Piedmont, ſituated fifteen miles north of Turin.

LAODICEA, an ancient city of the leſſer Aſia, ſituated eaſt of Epheſus, now in ruins.

LAON, a city of France, in the province of the Iſle of France, ſituated in E. long. 3° 45′, lat. 49′ 37.

LAOS, a country of the farther India in Aſia, bounded by China on the north; by Tonquin, on the eaſt; by Siam and Cambodia, on the ſouth; and Ava and Pegu, on the weſt.

LAPATHUM, in botany. See RUMEX.

LAPIDARY, an artificer, who cuts precious ſtones.

The art of cutting precious ſtones is of great antiquity. The French, though they fell into it but lately, have notwithſtanding carried this art to a very great perfection, but not in any degree ſuperior to the Engliſh.

There are various machines employed in the cutting of precious ſtones, according to their quality: the diamond, which is extremely hard, is cut on a wheel of ſoft ſteel, turned by a mill, with diamond-duſt, tempered with olive-oil, which alſo ſerves to poliſh it.

The deſcription of the diamond-cutter's wheel or mill, as repreſented in Plate CIII. fig. 7. is as follows: *a* is the pincers; *b*, the ſcrew of the pincers; *c*, the ſhell that carries the maſtic and the diamond; *d*, the maſtic that ſoftens the diamond at the end of the ſhell; *e*, the diamond preſented to the wheel, to be cut facetwiſe; *f*, the iron-wheel turning on its pivot; *g*, iron-pegs, to fix and keep the pincers ſteady; *h*, ſmall pigs of lead of different weights, wherewith the pincers are loaded at pleaſure to keep them ſteady; *i*, a wooden wheel; *k*, the axis of the wheel. It is bended and makes an elbow under the wheel, to receive the impulſion of a bar that does the office of a turning handle; *l*, the ſole, or ſquare piece of ſteel, wherein the pivot of the tree or axis moves; *m*, the turning handle, that ſets the wheel a-going by means of the elbow of its axis; the elbow of the piercer wherewith a hogſhead is broached, will give an idea of this kind of motion; *n*, the cat-gut ſtring, that goes round both the iron and the wooden wheels. If the wooden wheel is twenty times larger than the iron-one, the latter ſhall make twenty turns upon the diamond, whilſt the large wheel makes but one round its axis; and whilſt the boy gives, without any reſiſtance, a hundred impulſions to the turning handle, the diamond experiences a thouſand times the friction of the whole grinding wheel.

The diamond-cutter follows the work with his eyes, without taking any other ſhare in it than that of changing the place of the diamond to bite on a new ſurface; and of timely thrown upon it, with a few drops of oil, the minute particles of the diamonds firſt ground one againſt the other, to begin the cutting of them.

The oriental ruby, ſapphire, and topaz, are cut on a copper wheel with diamond duſt, tempered with olive-oil, and are poliſhed on another copper-wheel with tripoli and water. The hyacinth, emerald, amethyſt, garnets, agats, and other ſtones, not of an equal degree of hardneſs with the other, are cut on a leaden wheel with ſmalt and water, and poliſhed on a tin-wheel with tripoli. The turquois of the old and new rock, giraſol and opal, are cut and poliſhed on a wooden wheel with tripoli alſo.

The lapidaries of Paris have been a corporation ſince the year 1290. It is governed by four jurats, who ſuperintend their rights and privileges, viſit the maſter-workmen, take care of the maſter-piece of workmanſhip, bind apprentices, and adminiſter the freedom.

LAPIS, in general, is uſed to denote a ſtone of any kind.

LAPLAND, the moſt northerly part of Europe, divided

Plate CIII.

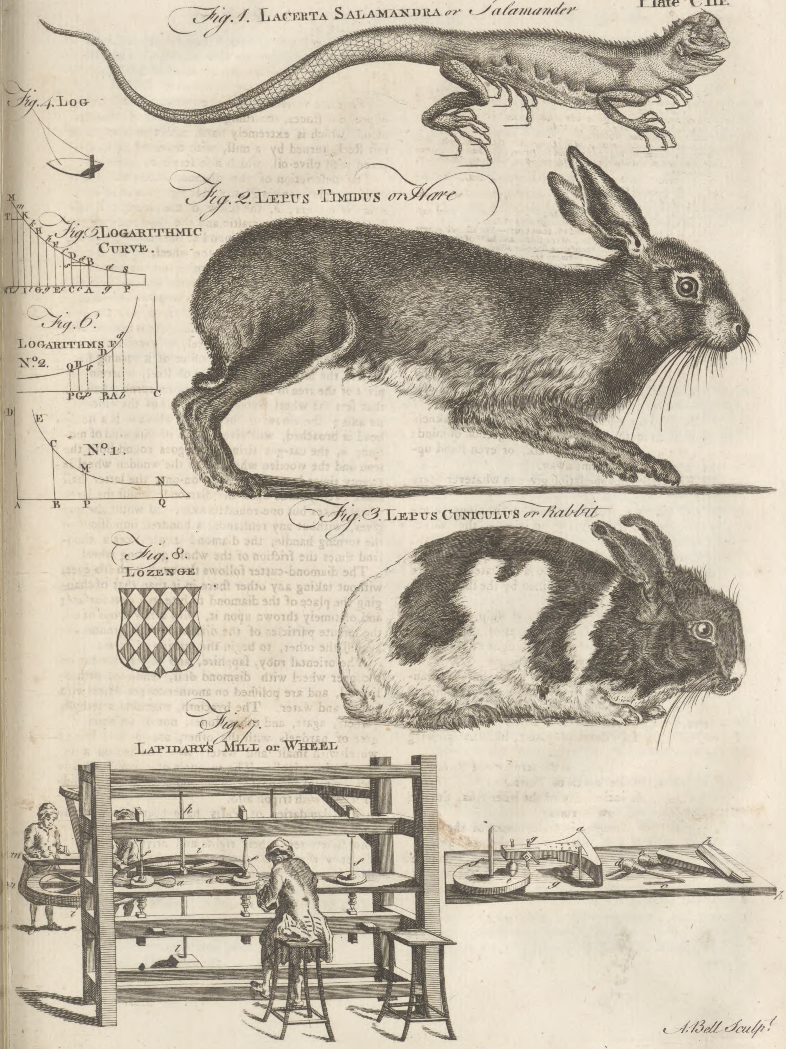
Fig. 1. Lacerta Salamandra or Salamander
Fig. 2. Lepus Timidus or Hare
Fig. 3. Lepus Cuniculus or Rabbit
Fig. 4. Log
Fig. 5. Logarithmic Curve.
Fig. 6.
Logarithms
N°. 2.
N°. 1.
Fig. 8
Lozenge
Fig. 7.
Lapidary's Mill or Wheel
A. Bell Sculp.

ded into Norwegian Lapland, Swedish Lapland, and Russian Lapland: it lies between 10° and 35° of E. long. and between 65 and 72° of N. lat.

LAPWING, in ornithology. See FRINGA.

LAQUEUS, in surgery, a kind of ligature, so contrived, that when stretched by any weight, or the like, it draws up close. Its use is to extend broken or disjointed bones, to keep them in their places when they are set, and to bind the parts close together.

LAR-BOARD, among seamen, the left-hand side of the ship, when you stand with your face towards the head.

LARCENY, in law, a felonius carrying away another person's goods; and this, according to the value of the thing stolen, is either grand, or petit larceny; the first being stealing effects above the value of 1 s. and the last such as are either of that value, or under it.

LAREDO, a port-town of Spain, in the province of Biscay, situated on the coast of Biscay: W. lon. 3° 40′, N. lat. 43° 30′.

LARES, certain inferior deities among the ancient Romans, who were the guardians of houses; they were also sometimes taken for the guardians of streets and ways, and Tibullus makes them the guardians of the fields. According to Ovid, they were the sons of Mercury and Lara, whose tongue was cut out by Jupiter, because she revealed his adulteries to Juno; and not contented with this, he delivered her to Mercury, with orders to conduct her to hell; but he falling in love with her by the way, had twins by her, who from their mother were called lares.

These domestic deities were sometimes represented under the figure of a dog, the symbol of fidelity; because dogs have the same function as the lares, which is to guard the house. At other times their images were covered with the skin of a dog, and had the figure of that domestic animal standing by them. The principal sacrifices to the lares, were incense, fruit, and a hog.

LARIX. See PINUS.

LARK, in ornithology. See ALAUDA.

LARUS, the GULL, in ornithology, a genus belonging to the order of anseres, the characters of which are these: The bill is strait, cultrated, a little crooked at the point, and without teeth; the inferior mandible is gibbous below the apex, the nostrils are linear, a little broader before, and situate in the middle of the back. There are 11 species, principally distinguished by their colour.

LARYNX, in anatomy. See ANAT. p. 300.

LASERPITIUM, LASER-WORT, a genus of the pentandria digynia class. The fruit is oblong, with eight membranaceous angles. There are nine species, none of them natives of Britain.

LASSITUDE, or WEARINESS, in medicine, a morbid sensation, that comes on spontaneously, without any previous motion, exercise, or labour. This is a frequent symptom in acute distempers: it arises either from an increase of bulk, a diminution of proper evacuation, or too great a consumption of the fluids necessary to maintain the spring of the solids, or from a vitiated secretion of that juice.

LAST, in general, signifies the burden or load of a ship.

It signifies also a certain measure of fish, corn, wool, leather, *&c.* A last of codfish, white herrings, meal, and ashes for soap, is twelve barrels; of corn or rapeseed, ten quarters; of gun-powder, twenty-four barrels; of red-herrings, twenty cades; of hides, twelve dozen; of leather, twenty dickers; of pich and tar, fourteen barrels; of wool, twelve sacks; of stock-fish, one thousand; of flax or feathers, 1700 lb.

LASTAGE, or LESTAGE, a duty exacted in some fairs and markets, for carrying things bought whither one will. It signifies also the ballast or lading of a ship; and sometimes is used for garbage, rubbish, or such like filth.

LATERAN COUNCILS, those councils held in the basilica of the Latin church at Rome. See COUNCIL,

There have been five councils held in this place. *viz.* in the years 1123, 1139, 1179, 1215, and 1513.

LATH, in building, a long, thin and narrow slip of wood, nailed to the rafters of a roof or ceiling, in order to sustain the covering.

LATHE, in turning, a well-known engine used in turning wood, ivory, and other materials.

LATHRÆA, in botany, a genus of the didynamia angiospermia class. The calix consists of four segments; and the capsule has but one cell. There are four species, only one of which, *viz.* the squamaria, or toothwort, is a native of Britain.

LATHYRUS, in botany, a genus of the diadelphia decandria class. The stylus is plain, villous above, and broader below; and the two superior laciniæ of the calix are shorter than the others. There are 21 species, seven of them natives of Britain; *viz.* the pissolia or crimson grass-vetch; the yellow vetchling; the hirsutus, or rough-codded chickling-vetch; the latifolius, or broad-leaved pease-everlasting; the sylvestris, or narrow-leaved pease-everlasting; the palustris, or marsh chickling-vetch; and the pratensis, or common yellow vetchling.

LATIN, a dead language, first spoken in Latium, and afterwards at Rome; and still used in the Romish church, and among many of the learned. See LANGUAGE.

LATISSIMUS, in anatomy. See ANAT. p. 195.

LATITUDE. See GEOGRAPHY, and ASTRONOMY.

LATITUDINARIAN, a person of moderation with regard to religious opinions, who believes there is a latitude in the road to heaven, which may admit people of different persuasions.

LATTEN, denotes iron-plates tinned over, of which tea-canisters are made.

LAVANDULA, LAVENDER, in botany, a genus of the didynamia-gymnospermia class. The calix is oval, subdentated, and supported by a bractea; and the stamina are within the tube. There are four species, none of them natives of Britain.

LAVATERA, in botany, a genus of the monadelphia polyandria class. The calix is double, the exterior one being divided into three segments; and there are many capsules, containing each a number of seeds. There are nine species, only one of which, *viz.* the arborea,

arborea, or sea tree mallow, is a native of Britain.

LAUBACH, a city of Germany, in the circle of Austria, and the capital of the duchy of Carinthia: E. lon. 14° 40′, and N. lat. 46° 28′.

LAUDANUM. See OPIUM.

LAUDER, a borough town of Scotland, in the shire of Mers, situated twenty-two miles south-east of Edinburgh.

LAVENDER. See LAVENDULA.

LAUGHTER, an affection peculiar to mankind, occasioned by something that tickles the fancy.

In laughter, the eye-brows are raised about the middle, and drawn down next the nose; the eyes are almost shut; the mouth opens, and shews the teeth, the corners of the mouth being drawn back and raised up; the cheeks seem puffed up, and almost hide the eyes; the face is usually red, and nostrils open, and the eyes wet.

LAUNCESTON, the county-town of Cornwal, thirty-six miles west of Exeter; W. lon. 4° 40′, N. lat. 50° 45′.

It sends two members to parliament.

LAUNCH, in the sea language, signifies to put out: as, *launch the ship*, that is, put her out of the dock: *launch aft*, or *forward*, speaking of things that are stowed in the hold, is, put them more forward: *launch, ho!* is a term used when a yard is hoisted high enough, and signifies, *hoist no more*.

LAURA, in church-history, a name given to a collection of little cells, at some distance from each other, in which the hermits, in ancient times, lived together in a wilderness.

These hermits did not live in community, but each monk provided for himself in his distinct cell. The most celebrated lauras mentioned in ecclesiastical history, were in Palestine; as the Laura of St Euthymus, at four or five leagues distance from Jerusalem; the laura of St Saba, near the brook Cedron; the laura of the Towers, near the river Jordan, *&c.*

LAURENTALIA, in Roman antiquity, a festival celebrated in honour of Acca Laurentia, Romulus's nurse.

LAURUS, in botany, a genus of the enneandria monogynia class. It has no calix; the corolla consists of six petals; the nectarium consists of three glands, with two bristles surrounding the germen; and the drupa contains but one seed. There are eleven species, among which are the cinnamonium, or cinnamon-tree; the camphora, or camphor-tree, (see CAMPHOR;) and the sassafras, or sassafras-tree.

The bark of the cinnamon-tree is light, thin, and of a reddish colour, rolled up in long quills or canes; of a fragrant delightful smell, and an aromatic sweet pungent taste, with some degree of astringency. It is generally mixed with the casia bark: this last is easily distinguishable by its breaking over smooth, whilst cinnamon splinters; and by its slimy mucilaginous taste, without any thing of the roughness of the true cinnamon. Cinnamon is a very elegant and useful aromatic, more grateful both to the palate and stomach than most other substances of this class: by its astringent quality it likewise corroborates the viscera, and proves of great service in several kinds of alvine fluxes and immoderate discharges from the uterus. As essential oil, a simple and spirituous distilled water, and a tincture of it, are kept in the shops: it is likewise employed as a spicy ingredient in a great number of compositions.

The root of the sassafras-tree is brought to us in long straight pieces, very light, and of a spongy texture, covered with a rough fungous bark; outwardly of an ash colour, inwardly of the colour of rusty iron. It has a fragrant smell, and a sweetish aromatic subacrid taste: the bark tastes much stronger than any other part; and the small twigs stronger than the large pieces. As to the virtues of this root, it is a warm aperient and corroborant; and frequently employed, with good success, for purifying and sweetening the blood and juices. For these purposes, infusions made from the rasped root or bark may be drank as tea. In some constitutions, these liquors, by their fragrance, are apt, on first taking them, to affect the head: in such cases, they may be advantagiously freed from their flavour by boiling; a decoction of sassafras, boiled down to the consistence of an extract, proves simply bitterish and subastringent. Hoffman assures us, that he has frequently given this extract to the quantity of a scruple at a time, with remarkable success, for strengthening the tone of the viscera in cachexies; as also in the decline of intermittent fevers, and in hypochondriacal spasms. Sassafras yields in distillation an extremely fragrant oil, of a penetrating pungent taste, so ponderous (notwithstanding the lightness of the drug itself) as to sink in water. Rectified spirit extracts the whole taste and smell of sassafras: and elevates nothing in evaporation: hence the spirituous extract proves the most elegant and efficacious preparations, as containing the virtue of the root entire.

The only officinal preparation of sassafras is the essential oil. The sassafras itself is an ingredient in the decoction of the woods and the compound lime waters, and the oil in the elixir guaiacinum.

LAUSANNE, a city of Switzerland, in the canton of Bern, situated on the north side of the lake of Geneva: E. lon. 6° 31′, and N. lat. 46° 33′.

L A W.

LAW may be defined, "The command of the sovereign power, containing a common rule of life for the subjects." It is divided into the law of nature, the law of nations, and civil or municipal law.

1. The law of nature is that which God has prescribed to all men, by the internal dictate of reason alone. It is discovered by a just consideration of the agreeableness or disagreeableness of human actions to the nature of man; and

and comprehends all the duties we owe either to the Supreme Being, to ourfelves, or to our neighbour; as reverence to God, felf-defence, temperance, honour to our parents, benevolence to all, a ftrict adherence to our engagements, gratitude, *&c.* The law of nature, where it either commands or forbids, is immutable, and cannot be controlled by any human authority; but where that law does no more than confer a right, without obliging us to ufe it, the fupreme power may diveft us thereof, in whole or in part.

2. The law of nations is alfo the refult of reafon, and has God for its author; but it fuppofes mankind formed into feveral bodies politic, or ftates; and comprifes all the duties which one ftate owes to another. Thefe muft of neceffity be fimilar to the duties arifing between individuals, fince both are dictated by reafon; fo that what is the law of nature when applied to men confidered fimply as fuch, is indeed the law of nations when applied to kingdoms or ftates. From this fource proceed the rights of war, the fecurity of ambaffadors, the obligations arifing from treaties, *&c.* The particular ufages of nations in their mutual correfpondence which are not neceffarily founded in reafon, are no part of the law of nations in its proper fenfe: for they are arbitrary, and derive their fole authority from compact, either exprefs or prefumed; and may therefore, without violating the law of nature, be altered. For this reafon, they ought to be thrown into the clafs of pofitive laws, whofe obligation lafts no longer than the agreement upon which it is founded. Of this fort, are the ceremonial ufed in receiving and entertaining ambaffadors, the privileges indulged to fome of their fervants, the rules obferved in cartels for exchanging prifoners of war, *&c.*

3. Civil or municipal law, is that which every fovereign kingdom or ftate has appropriated to itfelf. The appellation of municipal was originally confined to the laws of *municipia*, or dependent ftates; but it came by degrees to fignify all civil laws without diftinction. No fovereign ftate can fubfift without a fupreme power, or a right of commanding in the laft refort; the fupreme power of one age cannot therefore be fettered by any enactment of a former age, otherwife it would ceafe to be fupreme. Hence the law laft in date derogates from prior laws.

PRINCIPLES OF THE LAW OF SCOTLAND.

Title I. *General Obfervations.*

1. The municipal law of Scotland, as of moft other countries, confifts partly of ftatutory or written law, which has the exprefs authority of the legiflative power; partly of cuftomary or unwritten law, which derives force from its prefumed or tacit confent.

2. Under our ftatutory or written law is comprehended, (1.) Our acts of parliament: not only thofe which were made in the reign of James I. of Scotland, and from thence down to our union with England in 1707, but fuch of the Britifh ftatutes enacted fince the union as concern this part of the united kingdom.

3. The remains of our ancient written law were publifhed by Sir John Skene clerk-regifter, in the beginning of the laft century, by licence of parliament. The books of *Regiam Majeftatem*, to which the whole collection owes its title, feem to be a fyftem of Scots law, written by a private lawyer at the command of David I.; and though no exprefs confirmation of that treatife by the legiflature appears, yet it is admitted to have been the ancient law of our kingdom by exprefs ftatutes. The borough-laws, which were alfo enacted by the fame king David, and the ftatutes of William, Alexander II. David II. and the three Roberts, are univerfally allowed to be genuine. Our parliaments have once and again appointed commiffions to revife and amend the *Regiam Majeftatem*, and the other ancient books of our law, and to make their report: but, as no report appears to have been made, nor confequently any ratification by parliament, none of thefe remains are received, as of proper authority, in our courts; yet they are of excellent ufe in proving and illuftrating our moft ancient cuftoms.

4. Our written law comprehends, (2.) The acts of federunt, which are ordinances for regulating the forms of proceeding before the court of feffion in the adminiftration of juftice, made by the judges, who have a delegated power from the legiflature for that purpofe. Some of thefe acts dip upon matter of right, which declare what the judges apprehend to be the law of Scotland, and what they are to obferve afterwards as a rule of judgment.

5. The civil or Roman and canon laws, though they are not perhaps to be deemed proper parts of our written law, have undoubtedly had the greateft influence in Scotland. The powers exercifed by our fovereigns and judges have been juftified upon no other ground, than that they were conformable to the civil or canon laws; and a fpecial ftatute was judged neceffary, upon the reformation, to refcind fuch of their conftitutions as were repugnant to the Proteftant doctrine. From that period, the canon law has been little refpected, except in queftions of tithes, patronages, and fome few more articles of ecclefiaftical right: But the Roman continues to have great authority in all cafes where it is not derogated from by ftatute or cuftom, and where the genius of our law fuffers us to apply it.

6. Our unwritten or cuftomary law, is that which, without being exprefsly enacted by ftatute, derives its force from the tacit confent of king and people; which confent is prefumed from the ancient cuftom of the community. Cuftom, as it is equally founded in the will of the lawgiver with written law, has therefore the fame effects: Hence, as one ftatute may be explained by another, fo a ftatute may be explained or repealed by the uniform practice of the community, and even go into difufe by a pofterior contrary cuftom. But this power of cuftom to derogate from prior ftatutes, is generally confined by lawyers to ftatutes concerning private right, and does not extend to thofe which regard public policy.

7. An

7. An uniform tract of the judgments or decisions of the court of session, is commonly considered as part of our customary law; and without doubt, where a particular custom is thereby fixed or proved, such custom of itself constitutes law: But decisions, though they bind the parties litigating, have not, in their own nature, the authority of law in similar cases; yet, where they continue uniform, great weight is justly laid on them. Neither can the judgments of the house of peers of Great Britain reach farther than to the parties in the appeal, since in these the peers act as judges, not as lawgivers.

8. Though the laws of nature are sufficiently published by the internal suggestion of natural light, civil laws cannot be considered as a rule for the conduct of life, till they are notified to those whose conduct they are to regulate. The *Scots* acts of parliament were, by our most ancient custom, proclaimed in all the different shires, boroughs, and baron-courts of the kingdom. But after our statutes came to be printed, that custom was gradually neglected; and at last, the publication of our laws, at the market-cross of Edinburgh, was declared sufficient; and they became obligatory forty days thereafter. *British* statutes are deemed sufficiently notified, without formal promulgation; either because the printing is truly a publication, or because every subject is, by a maxim of the English law, party to them, as being present in parliament, either by himself or his representative. After a law is published, no pretence of ignorance can excuse the breach of it.

9. As laws are given for the rule of our conduct, they can regulate future cases only; for past actions, being out of our power, can admit of no rule. Declaratory laws form no exception to this; for a statute, where it is declaratory of a former law, does no more than interpret its meaning; and it is included in the notion of interpretation, that it must draw back to the date of the law interpreted.

10. By the rules of interpreting statute-law received in Scotland, an argument may be used from the title to the act itself, *a rubro ad nigrum;* at least, where the rubric has been either originally framed, or afterwards adopted by the legislature. The preamble or narrative, which recites the inconveniences that had arisen from the former law, and the causes inducing the enactment, may also lead a judge to the general meaning of the statute. But the chief weight is to be laid on the statutory words.

11. Laws, being directed to the unlearned as well as the learned, ought to be construed in their most obvious meaning, and not explained away by subtle distinctions; and no law is to suffer a figurative interpretation, where the proper sense of the words is as commodious, and equally fitted to the subject of the statute. Laws ought to be explained so as to exclude absurdities, and in the sense which appears most agreeable to former laws, to the intention of the lawgiver, and to the general frame and structure of the constitution. In prohibitory laws, where the right of acting is taken from a person, solely for the private advantage of another, the consent of him, in whose behalf the law was made, shall support the act done in breach of it; but the consent of parties immediately interested has no effect in matters which regard the public utility of a state. Where the words of a statute are capable but of one meaning, the statute must be observed, however hard it may bear on particular persons. Nevertheless, as no human system of laws can comprehend all possible cases, more may be sometimes meant by the lawgiver than is expressed; and hence certain statutes, where extension is not plainly excluded, may be extended beyond the letter, to similar and omitted cases: others are to be confined to the statutory words.

12. A strict interpretation is to be applied, 1. To correctory statutes, which repeal or restrict former laws, and to statutes which enact heavy penalties, or restrain the natural liberties of mankind. 2. Laws, made on occasion of present exigencies in a state, ought not to be drawn to similar cases, after the pressure is over. 3. Where statutes establish certain solemnities as requisite to deeds, such solemnities are not suppliable by equivalents; for solemnities lose their nature, when they are not performed specifically. 4. A statute, which enumerates special cases, is, with difficulty, to be extended to cases not expressed; but, where a law does not descend to particulars, there is greater reason to extend it to similar cases. 5. Statutes, which carry a dispensation or privilege to particular persons or societies, suffer a strict interpretation; because they derogate from the general law, and imply a burden upon the rest of the community. But at no rate can a privilege be explained to the prejudice of those in whose behalf it was granted. As the only foundation of customary law is usage, which consists in fact, such law can go no farther than the particular usage has gone.

13. All statutes, concerning matters specially favoured by law, receive an ample interpretation; as laws for the encouragement of commerce, or of any useful public undertaking, for making effectual the wills of dying persons, for restraining fraud, for the security of creditors, *&c.* A statute, though its subject-matter should not be a favourite of the law, may be extended to similar cases, which did not exist when the statute was made; and for which, therefore, it was not in the lawgiver's power to provide.

14. Every statute, however unfavourable, must receive the interpretation necessary to give it effect: And, on the other hand, in the extension of favourable laws, scope must not be given to the imagination, in discovering remote resemblances; the extension must be limited to the cases immediately similar. Where there is ground to conclude that the legislature has omitted a case out of the statute purposely, the statute cannot be extended to that case, let it be ever so similar to the cases expressed.

Tit. 2. *Of Jurisdiction and Judges in general.*

1. The object of law are persons, things, and actions: among persons, judges, who are invested with jurisdiction, deserve the first consideration. Jurisdiction is a power conferred upon a judge or magistrate, to take cognisance of, and decide causes according to law, and to carry his sentences into execution. That tract of ground, or district, within which a judge has the right of jurisdiction,

is

is called his territory: and every act of jurisdiction, exercised by a judge without his territory, either by pronouncing sentence, or carrying it into execution, is null.

2. The supreme power, which has the right of enacting laws, falls naturally to have the right of erecting courts, and appointing judges, who may apply these laws to particular cases: But, in Scotland, this right has been always intrusted with the Crown, as having the executive power of the state.

3. Jurisdiction is either supreme, inferior, or mixed. That jurisdiction is supreme, from which there lies no appeal to a higher court. Inferior courts are those whose sentences are subject to the review of the supreme courts, and whose jurisdiction is confined to a particular territory. Mixed jurisdiction participates of the nature both of the supreme and inferior: thus, the judge of the high court of Admiralty, and the commissaries of Edinburgh, have an universal jurisdiction over Scotland, and they can review the decrees of inferior admirals and commissaries; but since their own decrees are subject to the review of the courts of Session or Justiciary, they are, in that respect, inferior courts.

4. Jurisdiction is either civil or criminal: by the first, questions of private right are decided; by the other, crimes are punished. But, in all jurisdiction, though merely civil, there is a power inherent in the judge to punish, either corporally, or by a pecuniary fine, those who offend during the proceedings of the court, or who shall afterwards obstruct the execution of the sentence.

5. Jurisdiction is either privative or cumulative. Privative jurisdiction, is that which belongs only to one court, to the exclusion of all others. Cumulative, otherwise called concurrent, is that which may be exercised by any one of two or more courts, in the same cause. In civil cumulative jurisdiction, the private pursuer has the right of election before which of the courts he shall sue; but as, in criminal questions which are prosecuted by a public officer of court, a collision of jurisdiction might happen, through each of the judges claiming the exercise of their right, that judge, by whose warrant the delinquent is first cited or apprehended, (which is the first step of jurisdiction), acquires thereby (*jure præventionis*) the exclusive right of judging in the cause.

6. All rights of jurisdiction, being originally granted in consideration of the fitness of the grantee, were therefore personal, and died with himself. But, upon the introduction of the feudal system, certain jurisdictions were annexed to lands, and descended to heirs, as well as the lands to which they were enexed; but now all heritable jurisdictions, except those of admiralty and a small pittance reserved to barons, are either abolished, or resumed and annexed to the crown.

7. Jurisdiction is either proper or delegated. Proper jurisdiction, is that which belongs to a judge or magistrate himself, in virtue of his office. Delegated, is that which is communicated by the judge to another who acts in his name, called a depute or deputy. Where a deputy appoints one under him, he is called a substitute. No grant of jurisdiction, which is an office requiring personal qualifications, can be delegated by the grantee to another, without an express power in the grant.

8. Civil jurisdiction is founded, 1. *Ratione domicilii*, if the defender has his domicile within the judge's territory. A domicile is the dwelling-place where a person lives with an intention to remain; and custom has fixed it as a rule, that residence for forty days founds jurisdiction. If one has no fixed dwelling-place, *e. g.* a soldier, or a travelling-merchant, a personal citation against him within the territory is sufficient to found the judge's jurisdiction over him, even in civil questions. As the defender is not obliged to appear before a court to which he is not subject, the pursuer must follow the defender's domicile.

9. It is founded, 2. *Ratione rei sitæ*, if the subject in question lie within the teritory. If that subject be immoveable, the judge, whose jurisdiction is founded in this way, is the sole judge competent, excluding the judge of the domicile.

10. Where one, who has not his domicile within the territory, is to be sued before an inferior court *ratione rei sitæ*, the court of session must be applied to, whose jurisdiction is universal, and who, of course, grants letters of supplement to cite the defender to appear before the inferior judge. Where the party to be sued resides in another kingdom, and has an estate in this, the court of session is the only proper court, as the *commune forum* to all persons residing abroad; and the defender, if his estate be heritable, is considered as lawfully summoned to that court, by a citation at the market-cross of Edinburgh, and pier and shore of Leith: but where a stranger, not a native of Scotland, has only a moveable estate in this kingdom, he is deemed to be so little subject to the jurisdiction of our courts, that action cannot be brought against him till his effects be first attached by an arrestment *jurisdictionis fundandæ causa*, *Harc.* 487, which is laid on by a warrant issuing from the supreme courts of session, or admiralty, or from that within whose territory the subject is situated, at the suit of the creditor.

11. A judge may, in special cases, arrest or secure the persons of such as have neither domicile nor estate within his territory, even for civil debts. Thus, on the border between Scotland and England, warrants are granted of course by the judge-ordinary of either side, against those who have their domicile upon the opposite side, for arresting their persons, till they give caution *judicio sisti*: and even the persons of citizens or natives may be so secured, where there is just reason to suspect that they are *in meditatione fugæ*, i. e. that they intend suddenly to withdraw from the kingdom; upon which suspicion, the creditor who applies for the warrant must make oath. An inhabitant of a borough-royal, who has furnished one who lives without the borough in meat, cloaths, or other merchandize, and who has no security for it but his own compt-book, may arrest his debtor, till he give security *judicio sisti*.

12. A judge may be declined, *i. e.* his jurisdiction disowned judicially, 1. *Ratione causæ*, from his incompetency to the special cause brought before him. 2. *Ratione suspecti judicis*; where either the judge himself, or his near kinsman, has an interest in the suit. No judge can vote in the cause of his father, brother, or son, either by consanguinity or affinity; nor in the cause of his uncle or nephew by consanguinity. 3. *Ratione privilegii*;

vilegii; where the party is by privilege exempted from their jurifdiction.

13 Prorogated jurifdiction *(jurifdictio in confentientes)* is that which is, by the confent of parties, conferred upon a judge, who, without fuch confent, would be incompetent. Where a judge is incompetent, every ftep he takes muft be null, till his jurifdiction be made competent by the parties actual fubmiffion to it. It is otherwife where the judge is competent, but may be declined by the party upon privilege.

14. In order to prorogation, the judge muft have jurifdiction, fuch as may be prorogated. Hence, prorogation cannot be admitted where the judge's jurifdiction is excluded by ftatute. Yet where the caufe is of the fame nature with thofe to which the judge is competent, though law may have confined his jurifdiction within a certain fum, parties may prorogate it above that fum unlefs where prorogation is prohibited. Prorogation is not admitted in the king's caufes; for the intereft of the Crown cannot be hurt by the negligence of its officers.

15. All judges muft at their admiffion fwear, 1. The oath of allegiance, and fubfcribe the affurance; 2. The oath of abjuration; 3. The oath of fupremacy; laftly, The oath *de fideli adminiftratione*.

16. A party who has either properly declined the jurifdiction of the judge before whom he had been cited, or who thinks himfelf aggrieved by any proceedings in the caufe, may, before decree, apply to the court of feffion to iffue letters of advocation for calling the action from before the inferior court to themfelves. The grounds therefore, upon which a party may pray for letters of advocation, are incompetency and iniquity. Under incompetency, is comprehended not only defect of jurifdiction, but all the grounds of declining a jurifdiction, in itfelf competent, arifing either from fufpicion of the judge, or privilege in the parties. A judge is faid to commit iniquity, when he either delays juftice, or pronounces fentence, in the exercife of his jurifdiction, contrary to law.

17. That the court of feffion may not wafte their time in trifles, no caufe for a fum below twelve pound Sterling can be advocated to the court of feffion from the inferior judge competent: but if an inferior judge fhall proceed upon a caufe to which he is incompetent, the caufe may be carried from him by advocation, let the fubject be ever fo inconfiderable.

Tit. 3. *Of the fupreme Judges and Courts of* Scotland.

1. The King, who is the fountain of jurifdiction, might by our conftitution have judged in all caufes, either in his own perfon, or by thofe whom he was pleafed to veft with jurifdiction.

2. The parliament of Scotland, as our court of the laft refort, had the right of reviewing the fentences of all our fupreme courts.

3. By the treaty of union, 1707, the parliaments of Scotland and England are united into one parliament of Great Britain. From this period, the Britifh houfe of Peers, as coming in place of the Scots parliament, is become our court of the laft refort, to which appeals lie from all the fupreme courts of Scotland: But that court has no original jurifdiction in civil matters, in which they judge only upon appeal. By *art.* 22. of that treaty, the Scots fhare of the reprefentation in the houfe of Peers is fixed to fixteen Scots peers elective; and in the houfe of Commons, to forty-five commoners, of which thirty are elected by the freeholders of counties, and fifteen by the royal boroughs. The Scots privy council was alfo thereupon abolifhed, and funk into that of Great Britain, which for the future is declared to have no other powers than the Englifh privy council had at the time of the union.

Court of Session.

4. A court was erected in 1425, confifting of certain perfons to be named by the king, out of the three eftates of parliament, which was vefted with the jurifdiction formerly lodged in the privy council, and got the name of the Seffion, becaufe it was ordained to hold annually a certain number of feffions at the places to be fpecially appointed by the king. This court had a jurifdiction, cumulative with the judge ordinary, in fpuilzies, and other poffeffory actions, and in debts; but they had no cognizance in queftions of property of heritable fubjects. No appeal lay from its judgments to the parliament. The judges of this court ferved by rotation, and were changed from time to time, after having fat forty days; and became fo negligent in the adminiftration of juftice, that it was at laft thought neceffary to transfer the jurifdiction of this court to a council to be named by the king, called the daily council.

5. The prefent model of the court of feffion, or college of juftice, was formed in the reign of James V. The judges thereof, who are vefted with an univerfal civil jurifdiction, confifted originally of feven churchmen, feven laymen, and a prefident, whom it behoved to be a prelate; but fpiritual judges were in 1584 partly, and in 1640 totally prohibited. The judges of feffion have been always received by warrants from the crown. Anciently his Majefty feems to have transferred to the court itfelf the right of chufing their own prefident; and in a federunt recorded June 26. 1593, the king condefcended to prefent to the lords, upon every vacancy in the bench, a lift of three perfons, out of which they were to chufe one. But his Majefty foon refumed the exercife of both rights, which continued with the Crown till the ufurpation; when it was ordained, that the king fhould name the judges of the feffion, by the advice of parliament. After the reftoration, the nomination was again declared to be folely in the Sovereign.

6. Though judges may, in the general cafe, be named at the age of twenty-one years, the lords of feffion muft be at leaft twenty-five. No perfon can be named lord of feffion, who has not ferved as an advocate or principal clerk of feffion for five years, or as a writer to the fignet for ten: and in the cafe of a writer to the fignet, he muft undergo the ordinary trials upon the Roman law, and be found qualified two years before he can be named. Upon a vacancy in the bench, the king prefents the fucceffor by a letter addreffed to the lords, wherein he requires them to try and admit the perfon prefented. The powers given them to reject the prefentee upon trial are taken

taken away, and a bare liberty to remonſtrate ſubſtituted in its place.

7. Beſides the fifteen ordinary judges, the king was allowed to name three or four lords of his great council, who might ſit and vote with them. Theſe extraordinary lords were ſuppreſſed in the reign of Geo. I.

8. Though the juriſdiction of the ſeſſion be properly limited to civil cauſes, the judges have always ſuſtained themſelves as competent to the crime of falſehood. Where the falſehood deſerves death or demembration, they, after finding the crime proved, remit the criminal to the court of juſticiary. Special ſtatute has given to the court of ſeſſion juriſdiction in contraventions of law-burrows, deforcements, and breach of arreſtment; and they have been in uſe to judge in battery *pendente lite*, and in uſury.

9. In certain civil cauſes, the juriſdiction of the ſeſſion is excluſive of all inferior juriſdictions; as in declarators of property, and other competitions of heritable rights, provings of the tenor, *ceſſiones bonorum*, reſtitution of minors, reductions of decrees or of writings, ſales of the eſtates of minors or bankrupts, *&c.* In a ſecond claſs of cauſes, their juriſdiction can be only exerciſed in the way of review, after the cauſe is brought from the inferior court; as in maritime and conſiſtorial cauſes, which muſt be purſued in the firſt inſtance before the admiral or commiſſary; and in actions below twelve pounds Sterling, which muſt be commenced before the judge-ordinary. In all civil actions, which fall under neither of theſe claſſes, the juriſdiction of the ſeſſion is concurrent, even in the firſt inſtance, with that of the judge-ordinary. The ſeſſion may proceed as a court of equity by the rules of conſcience, in abating the rigour of law, and giving aid in proper caſes to ſuch as in a court of law can have no remedy: and this power is inherent in the ſupreme court of every country, where ſeparate courts are not eſtabliſhed for law and for equity.

Court of Justiciary.

10. The ſupreme criminal judge was ſtyled the Juſticiar; and he had anciently an univerſal civil juriſdiction, even in matters of heritage. He was obliged to hold two juſtice courts or ayres yearly at Edinburgh or Peebles, where all the free-holders of the kingdom were obliged to attend. Beſides this univerſal court, ſpecial juſtice-ayres were held in all the different ſhires of the kingdom twice in the year. Theſe laſt having gone into diſuſe, eight deputies were appointed, two for every quarter of the kingdom, who ſhould make their circuits over the whole in April and October.

11. The office of deputies was ſuppreſſed in 1972; and five lords of ſeſſion were added, as commiſſioners of Juſticiary, to the juſtice-general and juſtice-clerk. The juſtice-general, if preſent, is conſtant preſident of the court, and in his abſence the juſtice-clerk. The kingdom is divided into three diſtricts, and two of the judges are appointed to hold circuits in certain boroughs of each diſtrict twice in the year; one judge may proceed to buſineſs in the abſence of his collegue.

12. By an old ſtatute, the crimes of robbery, rape, murder, and wilful fire raiſing, (the four pleas of the Crown), are ſaid to be reſerved to the King's court of Juſticiary; but the only crime in which, *de praxi*, the juriſdiction of Juſticiary became at laſt excluſive of all inferior criminal juriſdiction, was that of high treaſon. The court of Juſticiary, when ſitting at Edinburgh, has a power of advocating cauſes from all inferior criminal judges, and of ſuſpending their ſentences.

13. The circuit-court can alſo judge in all criminal cauſes which do not infer death or demembration, upon appeal from any inferior court within their diſtrict; and has a ſupreme civil juriſdiction, by way of appeal, in all cauſes not exceeding twelve pounds Serling, in which their decrees are not ſubject to review; but no appeal is to lie to the circuit, till the cauſe be finally determined in the inferior court.

Court of Exchequer.

14. The court of Exchequer, as the King's chamberlain court, judged in all queſtions of the revenue. In purſuance of the treaty of Union, that court was aboliſhed, and a new court erected, conſiſting of the Lord High Treaſurer of Great Britain, and a chief Baron, with four other Barons of Exchequer; which Barons are to be made of ſerjeants at law, Engliſh barriſters, or Scots advocates of five years ſtanding. This court has a privative juriſdiction conferred upon it, as to the duties of cuſtoms, exciſe, or other revenues appertaining to the King or Prince of Scotland, and as to all honours and eſtates that may accrue to the crown; in which matters, they are to judge by the forms of proceeding uſed in the Engliſh court of Exchequer, under the following limitations; that no debt due to the Crown ſhall affect the debtor's real eſtate in any other manner than ſuch eſtate may be affected by the laws of Scotland, and that the validity of the Crown's titles to any honours or lands ſhall continue to be tried by the court of Seſſion. The Barons have the powers of the Scots court transferred to them, of paſſing the accounts of ſheriffs, or other officers who have the execution of writs iſſuing from, or returnable to the court of Exchequer, and of receiving reſignations, and paſſing ſignatures of charters, gifts of caſualties, *&c.* But though all theſe muſt paſs in Exchequer, it is the court of Seſſion only who can judge of their preference after they are completed.

Admiral Court.

15. The juriſdiction of the Admiral in maritime cauſes was of old concurrent with that of the Seſſion. The High-admiral is declared the King's Juſtice-General upon the ſeas, on freſh water within flood-mark, and in all harbours and creeks. His civil juriſdiction extends to all maritime cauſes, and ſo comprehends queſtions of charter parties, freights, ſalvages, bottomries, *&c.* He exerciſes this ſupreme juriſdiction by a delegate, the judge of the high-court of admiralty; and he may alſo name inferior deputies, whoſe juriſdiction is limited to particular diſtricts, and whoſe ſentences are ſubject to the review of the high court. In cauſes which are declared to fall under the Admiral's cogniſance, his juriſdiction is now ſole; in ſo much that the Seſſion itſelf, though they may review his decrees by ſuſpenſion or reduction, cannot

not carry a maritime queſtion from him by advocation. The Admiral has acquired, by uſage, a juriſdiction in mercantile cauſes, even where they are not ſtrictly maritime, cumulative with that of the judge-ordinary.

16. All our ſupreme courts have ſeals or ſignets, proper to their ſeveral juriſdictions. The courts of Seſſion and Juſticiary uſed formerly the ſame ſignet, which was called the King's, becauſe the writs iſſuing from thence run in the King's name; and though the Juſticiary got at laſt a ſeparate ſignet for itſelf, yet that of the Seſſion ſtill retains the appellation of the *King's Signet*. In this office are ſealed ſummonſes for citation, letters of executorial diligence, or for ſtaying or prohibiting of diligence, and generally whatever paſſes by the warrant of the Seſſion, and is to be executed by the officers of the court. All theſe muſt, before ſealing, be ſigned by the writers or clerks of the ſignet: But letters of diligence, where they are granted in a depending proceſs, merely for probation, though they paſs by the ſignet, muſt be ſubſcribed by a clerk of Seſſion. The clerks of the ſignet alſo prepare and ſubſcribe all ſignatures of charters, or other royal grants, which paſs in Exchequer.

Tit. 4. *Of the inferior Judges and Courts of* Scotland.

Sheriff.

Sheriff, from *reeve*, governor, and *ſheer*, to cut or divide, is the judge ordinary conſtituted by the Crown over a particular diviſion or county. The Sheriff's juriſdiction, both civil and criminal, was, in ancient times, nearly as ample within his own territory as that of the ſupreme courts of Seſſion and Juſticiary was over the whole kingdom.

2. His civil juriſdiction now extends to all actions upon contracts, or other perſonal obligations, forthcomings, poindings of the ground, mails and duties, and to all poſſeſſory actions, as removings, ejections, ſpuilzies, *&c.* to all brieves iſſuing from the chancery, as of inqueſt, terce, diviſion, tutory, *&c.* and even to adjudications of land-eſtates, when proceeding on the renunciation of the apparent heir. His preſent criminal juriſdiction extends to certain capital crimes, as theft, and even murder, though it be one of the pleas of the Crown; and he is competent to moſt queſtions of public police, and has a cumulative juriſdiction with juſtices of the peace in all riots and breaches of the peace.

3. Sheriffs have miniſterial power, in virtue of which, they return juries, in order to the trial of cauſes that require juries. The writs for electing members of parliament have been, ſince the union, directed to the Sheriffs, who, after they are executed, return them to the crown-office from whence they iſſued. They alſo execute writs iſſuing from the court of Exchequer; and in general, take care of all eſtates, duties, or caſualties that fall to the Crown within their territory, for which they muſt account to the Exchequer.

Lord of Regality.

4. A Lord of Regality was a magiſtrate, who had a grant of lands from the Sovereign, with royal juriſdiction annexed thereto. His civil juriſdiction was equal to that of a Sheriff; his criminal extended to the four pleas of the crown. He had a right to repledge or reclaim all criminals, ſubject to his juriſdiction, from any other competent court, though it were the Juſticiary itſelf, to his own. He had alſo right, according to the moſt common opinion, to the ſingle eſcheat of all denounced perſons reſiding within his juriſdiction, even though ſuch privilege had not been expreſſed in the grant of regality.

Stewart.

5. The Stewart was the magiſtrate appointed by the King over ſuch regality lands as happened to fall to the Crown by forfeiture, *&c.* and therefore the ſtewart's juriſdiction was equal to that of a regality. The two ſtewartries of Kircudbright, and of Orkney and Zetland, make ſhires or counties by themſelves, and ſend each a repreſentative to parliament.

Bailie.

6. Where lands, not erected into a regality, fell into the King's hands, he appointed a Bailie over them, whoſe juriſdiction was equal to that of a Sheriff.

7. By the late juriſdiction act 20. *Geo.* II. all heritable regalities and bailieries, and all ſuch heritable ſheriffſhips and ſtewartries as were only parts of a ſhire, are diſſolved; and the powers formerly veſted in them are made to devolve upon ſuch of the King's courts as theſe powers would have belonged to if the juriſdictions diſſolved had never been granted. All ſheriffſhips and ſtewartries that were no part of a ſhire, where they had been granted, either heritably or for life, are reſumed and annexed to the crown. No High Sheriff or Stewart can hereafter judge perſonally in any cauſe. One Sheriff or Stewart-depute is to be appointed by the King in every ſhire, who muſt be an advocate of three years ſtanding; and after a certain term not yet expired, all commiſſions to theſe deputies are to be granted for life.

Prince of Scotland.

8. The appanage, or patrimony, of the Prince of Scotland, has been long erected into a regality-juriſdiction, called the Principality. It is perſonal to the King's eldeſt ſon, upon whoſe death or ſucceſſion it returns to the Crown. The prince has, or may have, his own chancery, from which his writs iſſue, and may name his own chamberlain and other officers for receiving and managing his revenue. The vaſſals of the Prince are intitled to elect, or to be elected members of Parliament for counties, equally with thoſe who hold of the Crown.

Justices of the Peace.

9. Juſtices of the Peace are magiſtrates named by the Sovereign over the ſeveral counties of the kingdom, for the ſpecial purpoſe of preſerving the public peace. Anciently their power reached little farther than to bind over diſorderly perſons for their appearance before the Privy Council or Juſticiary; afterwards they were authoriſed to judge in breaches of the peace, and in moſt of the laws concerning public policy. They may compel workmen or labourers to ſerve for a reaſonable fee, and

they

they can condemn masters in the wages due to their servants. They have power to judge in questions of highways, and to call out the tenants with their cotters and servants to perform six days work yearly for upholding them.

10. Since the Union, our justices of the peace, over and above the powers committed to them by the laws of Scotland, are authorised to exercise whatever belonged to the office of an English justice of the peace, in relation to the public peace. From that time, the Scots and the English commissions have run in the same style, which contain powers to inquire into, and judge in all capital crimes, witchcrafts, felonies, and several others specially enumerated, with this limitation subjoined, *of which justices of the peace may lawfully inquire.* Two justices can constitute a court. Special statute has give the cognisance of several matters of excise to the justices, in which their sentences are final.

Boroughs.

11. A borough is a body-corporate, made up of the inhabitants of a certain tract of ground erected by the Sovereign, with jurisdiction annexed to it. Boroughs are erected, either to be holden of the Sovereign himself, which is the general case of royal boroughs; or of the superior of the lands erected, as boroughs of regality and barony. Boroughs-royal have power, by their charters, to chuse annually certain office-bearers or magistrates; and in boroughs of regality and barony, the nomination of magistrates is, by their charter, lodged sometimes in the inhabitants, sometimes in the superior. Bailies of boroughs have jurisdiction in matters of debt, services, and questions of possession betwixt the inhabitants. Their criminal jurisdiction extends to petty riots, and reckless fire-raising. The Dean of Guild is that magistrate of a royal borough, who is head of the merchant-company: he has the cognisance of mercantile causes within borough, and the inspection of buildings, that they incroach neither on private property, nor on the public streets; and he may direct insufficient houses to be pulled down. His jurisdiction has no dependance on the court of the borough, or bailie-court.

Barons.

12. A Baron, in the large sense of that word, is one who holds his lands immediately of the Crown; and, as such, had, by our ancient constitution, right to a seat in parliament, however small his freehold might have been. The lesser Barons were exempted from the burden of attending the service of parliament. This exemption grew insensibly into an utter disability in all the lesser Barons from sitting in parliament, without election by the county; though no statute is to be found expresly excluding them.

13. To constitute a Baron in the strict law-sense, his lands must have been erected, or at least confirmed by the King, *in liberam baroniam:* and such Baron had a certain jurisdiction, both civil and criminal, which he might have exercised, either in his own person, or by his bailie.

14. By the late jurisdiction-act, the civil jurisdiction of a Baron is reduced to the power of recovering, from his vassals and tenants, the rents of his lands, and of condemning them in mill-services; and of judging in causes where the debt and damages do not exceed 40 s. Sterling. His criminal jurisdiction is, by the same statute, limited to assaults, batteries, and other smaller offences, which may be punished by a fine not exceeding 20 s. Sterling, or by setting the offender in the stocks in the day-time not above three hours; the fine to be levied by poinding, or one month's imprisonment. The jurisdiction formerly competent to proprietors of mines, and coal or salt works, over their workmen, is reserved; and also that which was competent to proprietors who had the right of fairs or markets, for correcting the disorders that might happen during their continuance; provided they shall exercise no jurisdiction inferring the loss of life or demembration.

Constabularies.

15. The High Constable of Scotland had no fixed territorial jurisdiction, but followed the court; and had, jointly with the Marischal, the cognisance of all crimes committed within two leagues of it. All other constabularies were dependant on him: These had castles, and sometimes boroughs subject to their jurisdiction, as Dundee, Montrose, *&c.* and amongst other powers, now little known, they had the right of exercising criminal jurisdiction within their respective territories during the continuance of fairs. By the late jurisdiction-act, all jurisdictions of constabulary are dissolved, except that of High Constable.

Lyon King of Arms.

16. The office of the Lyon King of Arms was chiefly ministerial, to denounce war, proclaim peace, carry public messages, *&c.* But he has also a right of jurisdiction, whereby he can punish all who usurp arms contrary to the law of arms, and deprive or suspend messengers, heralds, or pursuivants, (who are officers named by himself;) but he has no cognisance of the damage arising to the private party through the messenger's fault. Messengers are subservient to the supreme courts of session and justiciary; and their proper business is to execute all the King's letters either in civil or criminal causes.

17. Our judges had, for a long time, no other salaries or appointments than what arose from the setences they pronounced. Our criminal judges applied to their own use the fines or issues of their several courts; and regalities had a right to the single escheat of all persons denounced, who resided within their jurisdiction; and our civil judges got a certain proportion of the sum contained in the decree pronounced. But these were all prohibited upon regular salaries being settled upon our judges.

Tit. 5. *Of Ecclesiastical Persons.*

The Pope, or bishop of Rome, was long acknowledged, over the western part of Christendom, for the head of the Christian church. The papal jurisdiction was abolished in Scotland *anno* 1560. The King was, by act 1669, declared to have supreme authority over all persons,

perſons, and in all cauſes eccleſiaſtical; but this act was repealed by 1690, as inconſiſtent with Preſbyterian church-government, which was then upon the point of being eſtabliſhed.

2. Before the reformation from Popery, the clergy was divided into ſecular and regular. The ſecular had a particular tract of ground given them in charge, within which they exerciſed the paſtoral office of biſhop, preſbyter, or other church officer. The regular clergy had no cure of ſouls, but were tied down to reſidence in their abbacies, priories, or other monaſteries: And they got the name of regular, from the rules of mortification to which they were bound, according to the inſtitution of their ſeveral orders. Upon the vacancy of any benefice, whether ſecular or regular, Commendators were frequently appointed to levy the fruits, as factors or ſtewards during the vacancy. The Pope alone could give the higheſt benefices *in commendam*; and at laſt, from the plenitude of his power, he came to name commendators for life, and without any obligation to account. After the reformation, ſeveral abbacies and priories were given by James VI. *in perpetuam commendam*, to laics.

3. Upon aboliſhing the Pope's authority, the regular clergy was totally ſuppreſſed; and, in place of all the different degrees which diſtinguiſhed the ſecular clergy, we had at firſt only parochial Preſbyters or Miniſters, and ſuperintendants, who had the overſight of the church within a certain diſtrict. Soon thereafter the church-government became epiſcopal, by Archbiſhops, Biſhops, *&c.* and after ſome intermediate turns, is now Preſbyterian by kirk-ſeſſions, preſbyteries, ſynods, and general aſſemblies.

4. Prelate, in our ſtatutes, ſignifies a Biſhop, Abbot, or other dignified clergyman, who in virtue of his office had a ſeat in parliament. Every Biſhop had his Chapter, which conſiſted of a certain number of the miniſters of the dioceſe, by whoſe aſſiſtance he managed the affairs of the church within that diſtrict. The nomination of Biſhops to vacant ſees has been in the crown ſince 1540, though under the appearance of continuing the ancient right of election, which was in the Chapter. The confirmation by the Crown under the great ſeal, of the Chapter's election, confirmed a right to the ſpirituality of the benefice; and a ſecond grant, upon the conſecration of the Biſhop-elect, gave a title to the temporality; but this ſecond grant fell ſoon into diſuſe.

5. He who founded or endowed a church was intitled to the right of patronage thereof, or *advocatio eccleſiæ*; whereby, among other privileges, he might preſent a churchman to the cure, in caſe of a vacancy. The preſentee, after he was received into the church, had a right to the benefice *proprio jure*; and if the church was parochial, he was called a parſon. The Pope claimed the right of patronage of every kirk, to which no third party could ſhew a ſpecial title; and ſince the reformation, the Crown, as coming in place of the Pope, is conſidered as univerſal patron, where no right of patronage appears in a ſubject. Where two churches are united, which had different patrons, each patron preſents by turns.

6. Gentlemen of eſtates frequently founded colleges or collegiate churches, the head of which got the name of Provoſt, under whom were certain Prebendaries or Canons, who had their ſeveral ſtalls in the church, where they ſung maſſes. Others of leſſer fortunes founded chaplainries, within the precincts of a parochial church; or altarages, which were donations granted for the ſinging of maſſes for deceaſed friends at particular altars in a church. Though all theſe were ſuppreſſed upon the reformation, their founders continued patrons of the endowments; out of which they were allowed to provide burſars, to be educated in any of the univerſities.

7. Where a fund is gifted for the eſtabliſhment of a ſecond miniſter in a pariſh where the cure is thought too heavy for one, the patronage of ſuch benefice does not belong to the donor, but to him who was patron of the church, unleſs either where the donor has reſerved to himſelf the right of patronage in the donation, or where he and his ſucceſſors have been in the conſtant uſe of preſenting the ſecond miniſter, without challenge from the patron. The right of preſenting incumbents was by 1690, *c.* 23. taken from patrons, and veſted in the heritors and elders of the pariſh, upon payment to be made by the heritors to the patron of 600 merks; but it was again reſtored to patrons, 10. *An. c.* 12. with the exception of the preſentations ſold in purſuance of the former act.

8. Patrons were not ſimply adminiſtrators of the church; for they held the fruits of the vacant benefice as their own, for ſome time after the reformation. But that right is now no more than a truſt in the patron, who muſt apply them to pious uſes within the pariſh, at the ſight of the heritors, yearly as they fall due. If he fail, he loſes his right of adminiſtring the vacant ſtipend for that and the next vacancy. The king, who is exempted from this rule, may apply the vacant ſtipend of his churches to any pious uſe, though not within the pariſh. If one ſhould be ordained to a church, in oppoſition to the preſentee, the patron, whoſe civil right cannot be affected by any ſentence of a church court, may retain the ſtipend as vacant. Patrons are to this day intitled to a ſeat and burial-place in the churches of which they are patrons; and to the right of all the teinds of the pariſh not heritably diſponed.

9. That kirks may not continue too long vacant, the patron muſt preſent to the preſbytery, (formerly to the Biſhop), a fit perſon for ſupplying the cure, within ſix months from his knowledge of the vacancy, otherwiſe the right of preſentation accrues to the preſbytery *jure devoluto*. Upon preſentation by the patron, the Biſhop collated or conferred the benefice upon the preſentee by a writing, in which he appointed certain miniſters of the dioceſe to induce or inſtitute him into the church; which induction completed his right, and was performed by their placing him in the pulpit, and delivering him the bible and the keys of the church. The biſhop collated to the churches of which himſelf was patron, *pleno jure*, or without preſentation; which he alſo did in menſal churches, whoſe patronages were ſunk, by the churches being appropriated to him, as part of his patrimony. Since the revolution, a judicial act of admiſſion by the preſbytery, proceeding either upon a preſentation, or up-

on a call from the heritors and elders, or upon their own *jus devolutum*, compleats the minister's right to the benefice.

10. Soon after the reformation, the Popish churchmen were prevailed upon to resign in the sovereign's hands, a third of their benefices, which was appropriated, in the first place, for the subsistence of the reformed clergy. To make this fund effectual, particular localities were assigned in every benefice, to the extent of a third, called the assumption of thirds; and for the farther support of ministers, Queen Mary made a grant in their favour of all the small benefices not exceeding 300 merks. Bishops, by the act which restored them to the whole of their benefices, were obliged to maintain the ministers within their dioceses, out of the thirds; and in like manner, the lay titulars, who got grants of the teinds, became bound, by their acceptation thereof, to provide the kirks within their erections in competent stipends.

11. But all these expedients for the maintenance of the clergy having proved ineffectual, a commission of parliament was appointed in the reign of James VI. for planting kirks, and modifying stipends to ministers out of the teinds; and afterwards several other commissions were appointed, with the more ample powers of dividing large parishes, erecting new ones, *&c.* all of which were, in 1707, transferred to the court of Session, with this limitation, that no parish should be disjoined, nor new church erected, nor old one removed to a new place, without the consent of three fourths of the heritors, computing the votes, not by their numbers, but by the valuation of their rents within the parish. The Judges of Session, when sitting in that court, are considered as a commission of Parliament, and have their proper clerks, macers, and other officers of court, as such.

12. The lowest stipend that could be modified to a minister by the first commission was 500 merks, or five chalders of victual, unless where the whole teinds of the parish did not extend so far. And the highest was 1000 merks, or ten chalders. The parliament 1633 raised the *minimum* to eight chalders of victual, and proportionably in silver; but as neither the commission appointed by that act, nor any of the subsequent ones, was limited as to the *maximum*, the commissioners have been in use to augment stipends considerably above the old *maximum*, where there is sufficiency of free teinds, and the cure is burdensome, or living expensive.

13. Where a certain quantity of stipend is modified to a minister out of the teinds of a parish without proportioning that stipend among the several heritors, the decree is called *a decree of modification*: But where the commissioners also fix the particular proportions payable by each heritor, it is a decree of *modification and locality*. Where a stipend is only modified, it is secured on the whole teinds of the parish; so that the minister can insist against any one heritor to the full extent of his teinds, such heritor being always entitled to relief against the rest, for what he shall have paid above his just share: But where the stipend is also localled, each heritor is liable in no more than his own proportion.

14. Few of the reformed ministers were, at first, provided with dwelling houses: most of the Popish clergy having, upon the first appearance of the reformation, let their manses in feu, or in long tacks: Ministers therefore got a right, by 1563, to as much of these manses as would serve them, notwithstanding such feus or tacks. Where there was no parson's nor vicar's manse, one was to be built by the heritors, at the sight of the bishop, (now the Presbytery), the charge not exceeding L. 1000 Scots, nor below 500 merks. Under a manse are comprehended stable, barn, and byre, with a garden; for all which, it is usual to allow half an acre of ground.

15. Every incumbent is intitled at his entry to have his manse put into good condition; for which purpose, the presbytery may appoint a visitation by tradesmen, and order estimates to be laid before them of the sums necessary for the repairing, which they may proportion among the heritors according to their valuations. The presbytery, after the manse is made sufficient, ought, upon application of the heritors, to declare it a free manse, which lays the incumbent under an obligation to uphold it in good condition during his incumbency; otherwise, he or his executors shall be liable in damages. But they are not bound to make up the loss arising from the necessary decay of the building by the waste of time.

16. All ministers, where there is any landward or country parish, are, over and above their stipend, intitled to a glebe, which comprehends four acres of arable land, or sixteen sowms of pasture-ground where there is no arable land, (a sowm is what will graze ten sheep or one cow), and is to be designed or marked by the bishop or presbytery out of such kirk-lands within the parish as lie nearest to the kirk, and, in default of kirk-lands, out of temporal lands.

17. A right of relief is competent to the heritors, whose lands are set off for the manse or glebe, against the other heritors of the parish. Manses and glebes, being once regularly designed, cannot be feued or sold by the incumbent in prejudice of his successors; which is in practice extended even to the case where such alienation evidently appears profitable to the benefice.

18. Ministers, besides their glebe, are intitled to grass for a horse and two cows. And, if the lands out of which the grass may be designed, either lie at a distance, or are not fit for pasture, the heritors are to pay to the minister L. 20 Scots yearly as an equivalent. Ministers have also freedom of foggage, pasturage, fewel, feal, divot, loaning, and free ish and entry, according to use and wont: What these privileges are, must be determined by the local custom of the several parishes.

19. The legal terms at which stipends become due to ministers, are Whitsunday and Michaelmas. If the incumbent be admitted to his church before Whitsunday, till which term the corns are not presumed to be fully sown, he has right to that whole year's stipend; and, if he is received after Whitsunday, and before Michaelmas, he is intitled to the half of that year; because, tho' the corns were sown before his entry, he was admitted before the term at which they are presumed to be reaped. By the same reason, if he dies or is transported before Whitsunday, he has right to no part of that year; if before Michaelmas, to the half; and if not till after Michaelmas, to the whole.

20. After the miniſter's death, his executors have right to the annat; which, in the ſenſe of the canon law, was a right reſerved to the Pope, of the firſt year's fruits of every benefice. Upon a threatened invaſion from England *anno* 1547, the annat was given by our Parliament, notwithſtanding this right in the Pope, to the executors of ſuch churchmen as ſhould fall in battle in defence of their country: But the word annat or ann, as it is now underſtood, is the right which law gives to the executors of miniſters, of half a year's benefice, over and above what was due to the miniſter himſelf for his incumbency.

21. The executors of a miniſter need make up no title to the ann by confirmation: Neither is the right aſſignable by the miniſter, or affectable with his debts; for it never belonged to him, but is a mere gratuity given by law to thoſe whom it is preſumed the deceaſed could not ſufficiently provide; and law has given it expreſsly to *executors*: And if it were to be governed by the rules of ſucceſſion in executory, the widow, in caſe of no children, would get one half, the other would go to the next of kin; and where there are children, ſhe would be intitled to a third, and the other two thirds would fall equally among the children. But the court of Seſſion, probably led by the general practice, have in this laſt caſe divided the ann into two equal parts, of which one goes to the widow, and the other among the children *in capita*.

22. From the great confidence that was, in the firſt ages of Chriſtianity, repoſed in churchmen, dying perſons frequently committed to them the care of their eſtates, and of their orphan children: but theſe were ſimply rights of truſt, not of juriſdiction. The clergy ſoon had the addreſs to eſtabliſh to themſelves a proper juriſdiction, not confined to points of eccleſiaſtical right, but extending to queſtions that had no concern with the church. They judged, not only in teinds, patronages, teſtaments, breach of vow, ſcandal, *&c.*; but in queſtions of marriage and divorce, becauſe marriage was a ſacrament; in tochers, becauſe theſe were given in conſideration of marriage; in all queſtions where an oath intervened, on pretence that oaths were a part of religious worſhip, *&c.* As churchmen came, by the means of this extenſive juriſdiction, to be diverted from their proper functions, they committed the exerciſe of it to their officials or commiſſaries: Hence the Commiſſary-court was called the Biſhops court, and *Curia Chriſtianitatis*; it is alſo ſtyled the Conſiſtorial Court, from *Conſiſtory*, a name firſt given to the court of appeals of the Roman Emperors and afterwards to the courts of judicature held by churchmen.

23. At the reformation, all epiſcopal juriſdiction, exerciſed under the authority of the Biſhop of Rome, was aboliſhed. As the courſe of juſtice in conſiſtorial cauſes was thereby ſtopped, Q. Mary, beſides naming a Commiſſary for every dioceſe, did, by a ſpecial grant, eſtabliſh a new Commiſſary-court at Edinburgh, conſiſting of four judges or commiſſaries. This court is veſted with a double juriſdiction; one dioceſan, which is exerciſed in the ſpecial territory contained in the grant, *viz.* the counties of Edinburgh, Haddington, Linlithgow, Peebles, and a part part of Stirling-ſhire; and another univerſal, by which the judges confirm the teſtaments of all who die in foreign parts, and may reduce the decrees of all inferior Commiſſaries, provided the reduction be purſued within a year after the decree: Biſhops, upon their re-eſtabliſhment in the reign of James VI. were reſtored to the right of naming their ſeveral Commiſſaries.

24. As the clergy, in times of Popery, aſſumed a juriſdiction independent of the civil power or any ſecular court, their ſentences could be reviewed only by the Pope, or judges delegated by him; ſo that, with regard to the courts of Scotland, their juriſdiction was ſupreme. But by an act 1560, the appeals from our Biſhops courts, that were then depending before the Roman conſiſtories, were ordained to be decided by the court of Seſſion: And by a poſterior act 1609, the Seſſion is declared the King's great Conſiſtory, with power to review all ſentences pronounced by the Commiſſaries. Nevertheleſs, ſince that court had no inherent juriſdiction in conſiſtorial cauſes, prior to this ſtatute; and ſince the ſtatute gives them a power of judging only by way of advocation, they have not, to this day, any proper conſiſtorial juriſdiction in the firſt inſtance: neither do they pronounce ſentence, in any conſiſtorial cauſe brought from the Commiſſaries, but remit it back to them with inſtructions. By the practice immediately ſubſequent to the act before quoted, they did not admit advocations from the inferior Commiſſaries, till the cauſe was brought before the Commiſſaries of Edinburgh; but that practice is now in diſuſe.

25. The Commiſſaries retain to this day an excluſive power of judging in declarators of marriage, and of the nullity of marriage; in actions of divorce and of non-adherence, of adultery, baſtardy, and confirmation of teſtaments; becauſe all theſe matters are ſtill conſidered to be properly conſiſtorial. Inferior Commiſſaries are not competent to queſtions of divorce, under which are comprehended queſtions of baſtardy and adherence, when they have a connection with the lawfulneſs of marriage, or with adultery.

26. Commiſſaries have now no power to pronounce decrees in abſence for any ſum above L. 40 Scots, except in cauſes properly conſiſtorial: but they may authenticate tutorial and curatorial inventories; and all bonds, contracts, *&c.* which contain a clauſe for regiſtration in the books of any judge competent, and proteſts on bills, may be regiſtred in their books.

Tit. 6. *Of Marriage.*

PERSONS, when conſidered in a private capacity, are chiefly diſtinguiſhed by their mutual relations; as huſband and wife, tutor and minor, father and child, maſter and ſervant. The relation of huſband and wife is conſtituted by marriage; which is the conjunction of man and wife, vowing to live inſeparably till death.

2. Marriage is truly a contract, and ſo requires the conſent of parties. Ideots, therefore, and furious perſons cannot marry. As no perſon is preſumed capable of conſent within the years of pupillarity, which, by our law, laſts till the age of fourteen in males, and twelve in females, marriage cannot be contracted by pupils; but if the married pair ſhould cohabit after puberty, ſuch acquieſcence

acquiescence gives force to the marriage. Marriage is fully perfected by consent; which, without consummation, founds all the conjugal rights and duties. The consent requisite to marriage must be *de præsenti*. A promise of marriage, (*stipulatio sponsalitia*,) may be resiled from, as long as matters are entire; but if any thing be done by one of the parties, whereby a prejudice arises from the non-performance, the party resiling is liable in damages to the other. The canonists, and after them our courts of justice, explain a *copula* subsequent to a promise of marriage into actual marriage.

3. It is not necessary, that marriage should be celebrated by a clergymen. The consent of parties may be declared before any magistrate, or simply before witnesses: And though no formal consent should appear, marriage is presumed from the cohabitation, or living together at bed and board, of a man and woman who are generally reputed husband and wife. One's acknowledgment of his marriage to the midwife whom he called to his wife, and to the minister who baptized his child, was found sufficient presumptive evidence of marriage, without the aid, either of cohabitation, or of *habite and repute*. The father's consent was, by the Roman law, essential to the marriage of children *in familia*: But, by our law, children may enter into marriage, without the knowledge, and even against the remonstrances of a father.

4. Marriage is forbidden within certain degrees of blood. By the law of Moses, *Levit. c.* 18. which is made ours, seconds in blood, and all remoter degrees, may lawfully marry. By seconds in blood are meant first cousins. Marriage in the direct line is forbidden *in infinitum*; as it is also in the collateral line, in the special case where one of the parties is *loco parentis* to the other, as grand uncle, great grand-uncle, *&c.* with respect to his grand-niece, *&c.* The same degrees that are prohibited in consanguinity, are prohibited in affinity; which is the tie rising from marriage, betwixt one of the married pair and the blood-relations of the other. Marriage also, where either of the parties is naturally unfit for generation, or stands already married to a third person, is *ipso jure* null.

5. To prevent bigamy and incestuous marriages, the church has introduced proclamation of banns; which is the ceremony of publishing the names and designations of those who intend to intermarry, in the churches where the bride and bridegroom reside, after the congregation is assembled for divine service; that all persons who know any objection to the marriage, may offer it. When the order of the church is observed, the marriage is called regular; when otherwise, clandestine.

6. By marriage, a society is created between the married pair, which draws after it a mutual communication of their civil interests, in as far as is necessary for maintaining it. As the society lasts only for the joint lives of the *socii*; therefore rights that have the nature of a perpetuity, which our law styles heritable, are not brought under the partnership or communion of goods; as a land-estate, or bonds bearing a yearly interest: It is only moveable subjects, or the fruits produced by heritable subjects during the marriage, that become common to man and wife.

7. The husband, as the head of the wife, has the sole right of managing the goods in communion, which is called *jus mariti*. This right is so absolute, that it bears but little resemblance to a right of administring a common subject; for the husband can, in virtue thereof, sell, or even gift at pleasure, the whole goods falling under communion; and his creditors may affect them for the payment of his proper debts: So that the *jus mariti* carries all the characters of an assignation by the wife to the husband, of her moveable estate. It arises *ipso jure* from the marriage; and therefore needs no other constitution. But a stranger may convey an estate to a wife, so as it shall not be subject to the husband's administration; or the husband himself may, in the marriage-contract, renounce his *jus mariti* in all or any part of his wife's moveable estate.

8. From this right are excepted paraphernal goods, which, as the word is understood in our law, comprehends the wife's wearing apparel, and the ornaments proper to her person, as necklaces, ear-rings, breast or arm jewels, buckles, &c. These are neither alienable by the husband, nor affectable by his creditors. Things of promiscuous use to husband and wife, as plate, medals, &c. may become paraphernal, by the husband's giving them to the wife, at or before marriage; but they are paraphernal only in regard to that husband who gave them as such, and are esteemed common moveables, if the wife, whose *paraphernalia* they were, be afterwards married to a second husband; unless he shall in the same manner appropriate them to her.

9. The right of the husband to the wife's moveable estate, is burdened with the moveable debts contracted by her before marriage: And as his right is universal, so is his burden; for it reaches to her whole moveable debts, though they should far exceed her moveable estate. Yet the husband is not considered as the true debtor in his wife's debts. In all actions for payment, she is the proper defender: the husband is only cited for his interest, that is, as curator to her, and administrator of the society-goods. As soon therefore as the marriage is dissolved, and the society goods thereby suffer a division, the husband is no farther concerned in the share belonging to his deceased wife; and consequently is no longer liable to pay her debts, which must be recovered from her representatives, or her separate estate.

10. This obligation upon the husband is perpetuated against him 1. Where his proper estate, real or personal, has been affected, during the marriage, by complete legal diligence; in which case, the husband must, by the common rules of law, relieve his property from the burden with which it stands charged: But the utmost diligence against his person, is not sufficient to perpetuate the obligation; nor even incomplete diligence against his estate. 2. The husband continues liable. even after the wife's death, in so far as he is *lucratus* or profited by her estate. As he was at no time the proper debtor in his wife's moveable debts; therefore, though he should be *lucratus*, he is, after the dissolution, only liable for them

them *subsidiarie*, i. e. if her own separate estate is not sufficient to pay them off.

11. Where the wife is debtor in that sort of debt, which, if it had been due to her, would have excluded the *jus mariti*, *e. g.* in bonds bearing interest, the husband is liable only for the bygone interests, and those that may grow upon the debt during the marriage; because his obligations for her debts must be commensurated to the interest he has in her estate. It is the husband alone who is liable in personal diligence for his wife's debts, while the marriage subsists: The wife, who is the proper debtor, is free from all personal execution upon them while she is *vestita viro*.

12. The husband by marriage becomes the perpetual curator of the wife. From this right it arises, 1. That no suit can proceed against the wife, till the husband be cited for his interest. 2. All deeds, done by a wife without the husband's consent, are null; neither can she sue in any action without the husband's concurrence. Where the husband refuses, or by reason of forfeiture, *&c.* cannot concur; or where the action is to be brought against the husband himself, for performing his part of the marriage articles; the judge will authorise her to sue in her own name. The effects arising from this curatorial power discover themselves even before marriage, upon the publication of banns; after which the bride, being no longer *sui juris*, can contract no debt, nor do any deed, either to the prejudice of her future husband, nor even to her own.

13. If the husband should either withdraw from his wife, or turn her out of doors; or if, continuing in family with her, he should by severe treatment endanger her life; the Commissaries will authorise a separation *a mensa et toro*, and give a separate alimony to the wife, suitable to her husband's estate, from the time of such separation, until either a reconciliation or a sentence of divorce.

14. Certain obligations of the wife are valid, notwithstanding her being *sub cura mariti*; *ex. gr.* obligations arising from delict; for wives have no privilege to commit crimes. But if the punishment resolves into a pecuniary mulct, the execution of it must, from her incapacity to fulfil, be suspended till the dissolution of the marriage, unless the wife has a separate estate exempted from the *jus mariti*.

15. Obligations arising from contract, affect either the person or the estate. The law has been so careful to protect wives, while *sub cura mariti*, that all personal obligations granted by a wife, though with the husband's consent, as bonds, bills, *&c.* are null; with the following exceptions: 1. Where the wife gets a separate *peculium* or stock, either from her father or a stranger, for her own or her children's alimony, she may grant personal obligations in relation to such stock; and by stronger reason, personal obligations granted by a wife are good, when her person is actually withdrawn from her husband's power, by a judicial separation. 2. A wife's personal obligation, granted in the form of a deed *inter vivos*, is valid, if it is not to take effect till her death. 3. Where the wife is by the husband *præposita negotiis*, entrusted with the management, either of a particular branch of business, or of his whole affairs, all the contracts she enters into in the exercise of her *præpositura*, are effectual, even though they be not reduced to writing, but should arise merely *ex re*, from furnishings made to her: But such obligations have no force against the wife; it is the husband only, by whose commission she acts, who is thereby obliged.

16. A wife, while she remains in family with her husband, is considered as *præposita negotiis domesticis*; and consequently may provide things proper for the family, for the price whereof the husband is liable, though they should be misapplied, or though the husband should have given her money to provide them elsewhere. A husband, who suspects that his wife may hurt his fortune by high living, may use the remedy of inhibition against her; by which all persons are interpelled from contracting with her, or giving her credit. After the completing of this diligence, whereby the *præpositura* falls, the wife cannot bind the husband, unless for such reasonable furnishings as he cannot instruct that he provided her with *aliunde*. As every man, and consequently every husband, has a right to remove his managers at pleasure, inhibition may pass at the suit of the husband against the wife, though he should not offer to justify that measure by an actual proof of the extravagance or profuseness of her temper.

17. As to rights granted by the wife affecting her estate; she has no moveable estate, except her *paraphernalia*; and these she may alien or impignorate, with consent of the husband. She can, without the husband, bequeath by testament her share of the goods in communion; but she cannot dispose of them *inter vivos*. A wife can lawfully oblige herself, in relation to her heritable estate, with consent of her husband; for though her person is in some sense sunk by the marriage, she continues capable of holding a real estate; and in such obligations, her estate is considered, and not her person. A husband, though he be curator to his wife, can, by his acceptance or intervention, authorise rights granted by her in his own favour: for a husband's curatory is not intended only for the wife's advantage, but is considered as a mutual benefit to both.

18. All donations, whether by the wife to the husband, or by the husband to the wife, are revocable by the donor; but if the donor dies without revocation, the right becomes absolute. Where the donation is not pure, it is not subject to revocation: Thus, a grant made by the husband, in consequence of the natural obligation that lies upon him to provide for his wife, is not revocable, unless in so far as it exceeds the measure of a rational settlment; neither are remuneratory grants revocable, where mutual grants are made in consideration of each other, except where an onerous cause is simulated, or where what is given *hinc inde* bears no proportion to each other. All voluntary contracts of separation, by which the wife is provided in an yearly alimony, are effectual as to the time past, but revocable either by the husband or wife.

19. As wives are in the strongest degree subject to the influence of their husbanda, third parties, in whose favours they had made grants, were frequently vexed with actions of reduction, as if the grant had been extorted from the wife, through the force or fear of the husband.

husband. To secure the grantees against this danger, ratifications were introduced, whereby the wife, appearing before a judge, declares upon oath, her husband not present, that she was not induced to grant the deed *ex vi aut metu*. A wife's ratification is not absolutely necessary for securing the grantee: Law indeed allows the wife to bring reduction of any deed she has not ratified, upon the head of force or fear; of which, if she brings sufficient evidence, the deed will be set aside; but if she fails in the proof, it will remain effectual to the receiver.

20. Marriage, like other contracts, might, by the Roman law, be dissolved by the contrary consent of parties; but, by the law of Scotland, it cannot be dissolved till death, except by divorce, proceeding either upon the head of adultery, or of wilful desertion.

21. Marriage is dissolved by death, either within year and day from its being contracted, or after year and day. If it is dissolved within year and day, all rights granted in consideration of the marriage (unless guarded against in the contract) become void, and things return to the same condition in which they stood before the marriage; with this restriction, that the husband is considered as a *bona fide* possessor, in relation to what he has consumed upon the faith of his right; but he is liable to repay the tocher, without any deduction in consideration of his family expence during the marriage. If things cannot be restored on both sides, equity hinders the restoring of one party, and not the other.

22. Upon the dissolution of a marriage, after year and day, the surviving husband becomes the irrevocable proprietor of the tocher and the wife, where she survives, is intitled to her jointure, or to her legal provisions. She has also right to mournings, suitable to the husband's quality; and to alimony from the day of his death, till the term at which her liferent provision, either legal or conventional, commences. If a living child be procreated of the marriage, the marriage has the same effect as if it had subsisted beyond the year. A day is adjected to the year, *in majorem evidentiam*, that it may clearly appear that the year itself is elapsed; and therefore, the running of any part of the day, after the year, has the same effect as if the whole were elapsed. The legal right of courtesy competent to the surviving husband is explained below, Tit. xvi 28.

23. Divorce is such a separation of married persons, during their lives, as looses them from the nuptial tie, and leaves them at freedom to intermarry with others. But neither adultery, nor wilful desertion, are grounds which must necessarily dissolve marriage; they are only handles, which the injured party may take hold of, to be free. Cohabitation, therefore, by the injured party, after being in the knowledge of the acts of adultery, implies a passing from the injury; and no divorce can proceed, which is carried on by collusion betwixt the parties, lest, contrary to the first institution of marriage, they might disengage themselves by their own consent: and though after divorce, the guilty person, as well as the innocent, may contract second marriages; yet in the case of divorce upon adultery, marriage is by special statute prohibited betwixt the two adulterers.

24. Where either party has deserted from the other for four years together, that other may sue for adherence. If this has no effect, the church is to proceed, first by admonition, then by excommunication; all which previous steps are declared to be a sufficient ground for pursuing a divorce. *De praxi*, the Commissaries pronounce sentence in the adherence, after one year's desertion; but four years must intervene between the first desertion and the decree of divorce.

25. The legal effects of divorce on the head of desertion are, that the offending husband shall restore the tocher, and forfeit to the wife all her provisions, legal and conventional; and on the other hand, the offending wife shall forfeit to the husband her tocher, and all the rights that would have belonged to her, in the case of her survivance. This was also esteemed the rule in divorces upon adultery. But by a decision of the court of Session 1762, founded on a tract of ancient decisions recovered from the records, the offending husband was allowed to retain the tocher.

Tit. 7. *Of Minors, and their Tutors and Curators.*

1. The stages of life principally distinguished in law are, *pupillarity*, *puberty* or *minority*, and *majority*. A child is under pupillarity, from the birth till fourteen years of age, if a male, and till twelve, if a female. Minority begins where pupillarity ends, and continues till majority, which, by the law of Scotland, is the age of twenty-one years complete, both in males and females: But minority, in a large sense, includes all under age, whether pupils, or *puberes*. Because pupils cannot in any degree act for themselves, and minors seldom with discretion, pupils are put by law under the power of tutors, and minors may put themselves under the direction of curators. Tutory is a power and faculty to govern the person, and administer the estate of a pupil. Tutors are either nominate, of law, or dative

2. A tutor nominate is he who is named by a father, in his testament or other writing, to a lawful child. Such tutor is not obliged to give caution for the faithful discharge of his office; because his fidelity is presumed to have been sufficiently known to the father.

3. If there be no nomination by the father, or if the tutors nominate do not accept, or if the nomination falls by death or otherwise, there is place for a tutor of law. This sort of tutory devolves upon the next agnate; by which we understand he who is nearest related by the father, though females intervene.

4. Where there are two or more agnates equally near to the pupil, he who is intitled to the pupil's legal succession falls to be preferred to the others. But as the law suspects, that he may not be over careful to preserve a life which stands in the way of his own interest, this sort of tutor is excluded from the custody of the pupil's person, which is commonly committed to the mother, while a widow, until the pupil be seven years old; and, in default of the mother, to the next cognate, *i. e.* the nighest relation by the mother. The tutor of law must be at least twenty-five years of age. He is served or declared by a jury of sworn men, who are called upon a brief issuing

ing from the Chancery, which is directed to any judge having jurisdiction. He must give security before he enters upon the management.

5. If no tutor of law demands the office, any person, even a stranger, may apply for a tutory-dative. But because a tutor in law ought to be allowed a competent time to deliberate whether he will serve or not, no tutory-dative can be given till the elapsing of a year from the time at which the tutor of law had first a right to serve. It is the king alone, as the father of his country, who gives tutors-dative, by his court of exchequer; and no gift of tutory can pass in exchequer, without the citation or consent of the next of kin to the pupil, both by the father and mother, nor till the tutor give security, recorded in the books of exchequer. There is no room for a tutor of law, or tutor dative, while a tutor nominate can be hoped for: and tutors of law, or dative, even after they have begun to act, may be excluded by the tutor nominate, as soon as he offers to accept, unless he has expressly renounced the office. If a pupil be without tutors of any kind, the court of Session will, at the suit of any kinsman, name a factor (steward) for the management of the pupil's estate.

6. After the years of pupillarity are over, the minor is considered as capable of acting by himself, if he has confidence enough of his own capacity and prudence. The only two cases in which curators are imposed upon minors are, first, where they are named by the father, in a state of health. 2. Where the father is himself alive; for a father is *ipso jure*, without any service, administrator, that is, both tutor and curator of law to his children, in relation to whatever estate may fall to them during their minority. This right in the father does not extend to grand-children, nor to such even of his immediate children as are forisfamiliated. Neither has it place in subjects which are left by a stranger to the minor, exclusive of the father's administration. If the minor chuses to be under the direction of curators, he must raise and execute a summons, citing at least two of his next of kin, to appear before his own judge-ordinary, upon nine days warning. At the day and place of appearance, he offers to the judge a list of those whom he intends for his curators: such of them as resolve to undertake the office, must sign their acceptance, and give caution; upon which an act of curatory is extracted.

7. These curators are styled *ad negotia*, to distinguish them from another sort called curators *ad lites*, who are authorised by the judge to concur with a pupil or minor in actions of law, either where he is without tutors and curators, or where his tutors or curators are parties to the suit. This sort is not obliged to give caution, because they have no intermeddling with the minor's estate: they are appointed for a special purpose; and when that is over, their office is at an end. Women are capable of being tutors and curators, under the following restrictions; 1. The office of a female tutor or curator falls by her marriage, even though the nomination should provide otherwise; 2. No woman can be tutor of law. Papists are declared incapable of tutory or curatory. Where the minor has more tutors and curators than one, who are called in the nomination to the joint management, they must all concur in every act of administration: where a certain number is named for a quorum, that number must concur: where any one is named *sine quo non*, no act is valid without that one's special concurrence. But if they are named without any of these limitations, the concurrence of the majority of the nominees then alive is sufficient.

8. In this, tutory differs from curatory, that as pupils are incapable of consent, they have no person capable of acting; which defect the tutor supplies: but a minor *pubes* can act for himself. Hence, the tutor subscribes alone all deeds of administration: but in curatory, it is the minor who subscribes as the proper party; the curator does no more than consent. Hence also, the persons of pupils are under the power, either of their tutors or of their nearest cognates; but the minor, after pupillarity, has the disposal of his own person, and may reside where he pleases. In most other particulars, the nature, the powers, and the duties of the two offices coincide. Both tutors and curators must, previous to their administration, make a judicial inventory, subscribed by them and the next of kin, before the minor's judge-ordinary, of his whole estate, personal and real; of which, one subscribed duplicate is to be kept by the tutors or curators themselves; another, by the next of kin on the father's side; and a third, by the next of kin on the mother's. If any estate belonging to the minor shall afterwards come to their knowledge, they must add it to the inventory within two months after their attaining possession thereof. Should they neglect this, the minor's debtors are not obliged to make payment to them; they may be removed from their offices as suspected, and they are intitled to no allowance for the sums disbursed by them in the minor's affairs, except the expence laid out upon the minor's entertainment, upon his lands and houses, and upon completing his titles.

9. Tutors and curators cannot grant leases of the minor's lands, to endure longer than their own office; nor under the former rental, without either a warrant from the court of Session, or some apparent necessity.

10. They have power to sell the minor's moveables; but cannot sell their pupil's land estate, without the authority of a judge. But the alienation of heritage by a minor, with consent of his curators, is valid.

11. Tutors and curators cannot, contrary to the nature of their trust, authorise the minor to do any deed for their own benefit; nor can they acquire any debt affecting the minor's estate: and, where a tutor or curator makes such acquisition, in his own name, for a less sum than the right is intitled to draw, the benefit thereof accrues to the minor.

12. By the Roman law, tutory and curatory, being *munera publica*, might be forced upon every one who had not a relevant ground of excuse; but, with us, the persons named to these offices may either accept or decline: and where a father, in *liege poustie*, names certain persons both as tutors and curators to his children, though they have acted as tutors, they may decline the office of curatory. Tutors and curators having once accepted, are liable *in diligence*, that is, are accountable for the consequences of their neglect in any part of their duty

duty from the time of their acceptance. They are accountable *ſinguli in ſolidum*; i. e. every one of them is anſwerable, not only for his own diligence, but for that of his co-tutors; and any one may be ſued without citing the reſt: But he who is condemned in the whole, has action of relief againſt his co-tutors.

13 From this obligation to diligence, we may except, 1. Fathers or adminiſtrators in law, who, from the preſumption that they act to the beſt of their power for their children, are liable only for actual intromiſſions. 2. Tutors and curators named by the father, with the ſpecial proviſos, that they ſhall be liable barely for intromiſſions, not for omiſſions; and that each of them ſhall be liable only for himſelf, and not *in ſolidum* for the co-tutors: But this power of exemption from diligence, is limited to the eſtate deſcending from the father himſelf. Tutors or curators are not intitled to any ſalary or allowance for pains, unleſs a ſalary has been expreſsly contained in the teſtator's nomination; for their office is preſumed gratuitous.

14. Though no perſon is obliged to accept the office of tutor or curator, yet having once accepted, he cannot throw it up or renounce it, without ſufficient cauſe; but, if he ſhould be guilty of miſapplying the minor's money, or fail in any other part of his duty, he may be removed at the ſuit of the minor's next in kin, or by a co-tutor, or co-curator. Where the miſconduct proceeds merely from indolence, or inattention, the court, in place of removing the tutor, either join a curator with him, or, if he be a tutor-nominate, they oblige him to give caution for his paſt and future management.

15 The offices of tutory and curatory expire by the pupil's attaining the age of puberty, or the minor's attaining the age of twenty-one years complete; and by the death either of the minor, or of his tutor or curator.

16. Deeds either by pupils, or by minors having curators without their conſent, are null; but they oblige the granters, in as far as relates to ſums profitably applied to their uſe. A minor under curators can indeed make a teſtament by himſelf; but whatever is executed in the form of a deed *inter vivos*, requires the curator's conſent. Deeds by a minor who has no curators, are as effectual as if he had curators, and ſigned them with their conſent; he may even alien his heritage, without the interpoſition of a judge.

17. Minors may be reſtored againſt all deeds granted in their minority, that are hurtful to them. Deeds, in themſelves void, need not the remedy of reſtitution; but where hurtful deeds are granted by a tutor in his pupil's affairs, or by a minor who has no curators, as theſe deeds ſubſiſt in law, reſtitution is neceſſary: And even where a minor, having curators, executes a deed hurtful to himſelf with their conſent, he has not only action againſt the curators, but he has the benefit of reſtitution againſt the deed itſelf. The minor cannot be reſtored, if he does not raiſe and execute a ſummons for reducing the deed, *ex capite minorennitatis et læſionis*, before he be twenty-five years old. Theſe four years, between the age of twenty-one and twenty-five, called *quadriennium utile*, are indulged to the minor, that he may have a reaſonable time, from that period, when he is firſt preſumed to have the perfect uſe of his reaſon, to conſider with himſelf what deeds done in his minority have been truly prejudicial to him.

18. Queſtions of reſtitution are proper to the court of Seſſion. Two things muſt be proved by the minor, in order to the reduction of the deed; 1. That he was minor when it was ſigned; 2. That he is hurt or leſed by the deed. This leſion muſt not proceed merely from accident; for the privilege of reſtitution was not intended to exempt minors from the common misfortunes of life; it muſt be owing to the imprudence or negligence of the minor, or his curator.

19 A minor cannot be reſtored againſt his own delict or fraud. 2. Reſtitution is excluded, if the minor, at any time after majority, has approved of the deed, either by a formal ratification, or tacitly by payment of intereſt, or by other acts inferring approbation. 3. A minor, who has taken himſelf to buſineſs, as a merchant ſhopkeeper, *&c* cannot be reſtored againſt any deed granted by him, in the courſe of that buſineſs, eſpecially if he was *proximus majorennitati* at ſigning the deed. 4. According to the more common opinion, a minor cannot be reſtored in a queſtion againſt a minor, unleſs ſome groſs unfairneſs ſhall be qualified in the bargain.

20. The privilege of reſtitution does not always die with the minor himſelf. 1 If a minor ſucceeds to a minor, the time allowed for reſtitution is governed by the minority of the heir, not of the anceſtor. 2. If a minor ſucceeds to a major, who was not full twenty-five, the privilege continues with the heir during his minority; but he cannot avail himſelf of the *anni utiles*, except in ſo far as they were unexpired at the anceſtor's death. 3. If a major ſucceeds to a minor, he has only the *quadriennium utile* after the minor's death; and if he ſucceeds to a major dying within the *quadriennium*, no more of it can be profitable to him than what remained when the anceſtor died,

21. No minor can be compelled to ſtate himſelf as a defender, in any action, whereby his heritable eſtate flowing from aſcendants may be evicted from him, by one pretending a preferable right.

22 This privilege is intended merely to ſave minors from the neceſſity of diſputing upon queſtions of preference; it does not therefore take place, 1. Where the action is purſued on the father's falſhood or delict. 2. Upon his obligation to convey heritage. 3. On his liquid bond for a ſum of money, though ſuch action ſhould have the effect to carry off the minor's eſtate by adjudication 4. Nor in actions purſued by the minor's ſuperior, upon feudal caſualties. 5. This privilege cannot be pleaded in bar of an action which had been firſt brought againſt the father and is only continued againſt the minor; nor where the father was not in the peaceable poſſeſſion of the heritable ſubject at his death Before the minor can plead it, he muſt be ſerved heir to his father. The perſons of pupils are protected from impriſonment on civil debts.

23. Curators are given, not only to minors, but in general to every one who, either through defect of judgment, or unfitneſs of diſpoſition, is incapable of rightly

rightly managing his own affairs. Of the first sort, are idiots and furious persons. Idiots, or *fatui*, are entirely deprived of the faculty of reason. The distemper of the furious person does not consist in the defect of reason, but in an overheated imagination, which obstructs the application of reason to the purposes of life. Curators may be also granted to lunatics, and even to persons dumb and deaf, though they are of sound judgment, where it appears that they cannot exert it in the management of business. Every person, who is come of age, and is capable of acting rationally, has a natural right to conduct his own affairs. The only regular way, therefore, of appointing this sort of curators, is by a jury summoned upon a brief from the chancery; which is not, like the brief of common tutory, directed to any judge-ordinary, but to the judge of the special territory where the person alledged to be fatuous or furious resides; that if he is truly of sound judgment, he may have an opportunity to oppose it: And, for this reason, he ought to be made a party to the brief. The curatory of idiots and furious persons belongs to the nearest agnate; but a father is preferred to the curatory of his fatuous son, and the husband to that of his fatuous wife, before the agnate.

24. A clause is inserted in the brief, for inquiring how long the fatuous or furious person has been in that condition; and the verdict to be pronounced by the inquest, is declared a sufficient ground, without farther evidence, for reducing all deeds granted after the period at which it appeared by the proof that the fatuity or furiosity began. But, as fatuous and furious persons are, by their very state, incapable of being obliged, all deeds done by them may be declared void, upon proper evidence of their fatuity at the time of signing, though they should never have been cognosced idiots by an inquest.

25. We have some few instances of the Sovereign's giving curators to idiots, where the next agnate did not claim; but such gifts are truly deviations from our law, since they pass without an inquiry into the state of the person upon whom the curatory is imposed. Hence the curator of law to an idiot, serving *quandocunque*, is preferred as soon as he offers himself, before the curator-dative. This sort of curatory does not determine by the lucid intervals of the person *sub cura*; but it expires by his death, or perfect return to a sound judgment; which last ought regularly to be declared by the sentence of a judge.

26. Persons, let them be ever so profuse, or liable to be imposed upon, if they have the exercise of reason, can effectually oblige themselves, till they are fettered by law. Interdiction is a legal restraint laid upon such persons from signing any deed to their own prejudice, without the consent of their curators or interdictors.

27. There could be no interdiction, by our ancient practice, without a previous inquiry into the person's condition. But as there were few who could bear the shame that attends judicial interdiction, however necessary the restraint might have been, voluntary interdiction has received the countenance of law; which is generally executed in the form of a bond, whereby the granter obliges himself to do no deed that may affect his estate, without the consent of certain friends therein mentioned. Though the reasons inductive of the bond should be but gently touched in the recital, the interdiction stands good. Voluntary interdiction, though it be imposed by the sole act of the person interdicted, cannot be recalled at his pleasure: But it may be taken off, 1. By a sentence of the court of Session, declaring, either that there was, from the beginning, no sufficient ground for the restraint; or that the party is, since the date of the bond, become *rei suæ providus*. 2. It falls, even without the authority of the Lords, by the joint act of the person interdicted, and his interdictors, concurring to take it off 3. Where the bond of interdiction requires a certain number as a quorum, the restraint ceases, if the interdictors shall be by death reduced to a lesser number.

28. Judicial interdiction is imposed by a sentence of the court of Session. It commonly proceeds on an action brought by a near kinsmen to the party; and sometimes from the *nobile officium* of the court, when they perceive, during the pendency of a suit, that any of the litigants is, from the facility of his temper, subject to imposition. This sort must be taken off by the authority of the same court that imposed it.

29. An interdiction need not be served against the person interdicted; but it must be executed, or published by a messenger, at the market-cross of the jurisdiction where he resides, by publicly reading the interdiction there, after three oyesses made for convocating the lieges. A copy of this execution must be affixed to the cross; and thereafter, the interdiction, with its execution, must be registred in the books, both of the jurisdiction where the person interdicted resides, and where his lands lie, or in the general register of the session, within forty days from the publication. An interdiction, before it is registred, has no effect against third parties, though they should be in the private knowledge of it; but it operates against the interdictors themselves, as soon as it is delivered to them.

30. An interdiction, duly registred, has this effect, that all deeds, done thereafter, by the person interdicted, without the consent of his interdictors, affecting his heritable estate, are subject to reduction. Registration, in the general register, secures all his lands from alienation, where-ever they lie; but where the interdiction is recorded in the register of a particular shire, it covers no lands, except those situated in that shire. But persons interdicted have full power to dispose of their moveables, not only by testament, but by present deeds of alienation: And creditors, in personal bonds granted after interdiction, may use all execution against their debtor's person and moveable estate; such bonds being only subject to reduction, in so far as diligence against the heritable estate may proceed upon them.

31. All onerous or rational deeds granted by the person interdicted, are as effectual, even without the consent of the interdictor, as if the granter had been laid under no restraint; but he cannot alter the succession of his heritable estate, by any settlement, let it be ever so rational. No deed, granted with consent of the interdictors, is reducible, though the strongest lesion or prejudice to the granter should appear: The only remedy competent, in such case, is an action by the granter against his interdictors,

tors, for making up to him what he has loſt through their undue conſent. It is no part of the duty of interdictors, to receive ſums, or manage any eſtate; they are given merely *ad auctoritatem præſtandam*, to interpoſe their authority to reaſonable deeds; and ſo are accountable for nothing but their fraud or fault, in conſenting to deeds hurtful to the perſon under their care.

32. The law concerning the ſtate of children falls next to be explained. Children are either born in wedlock, or out of it. All children, born in lawful marriage or wedlock, are preſumed to be begotten by the perſon to whom the mother is married; and conſequently to be lawful children. This preſumption is ſo ſtrongly founded, that it cannot be defeated but by direct evidence that the mother's huſband could not be the father of the child, *e.g.* where he is impotent, or was abſent from the wife till within ſix lunar months of the birth. The canoniſts indeed maintain, that the concurring teſtimony of the huſband and wife that the child was not procreated by the huſband, is ſufficient to elide this legal preſumption for legitimacy: but it is an agreed point, that no regard is to be paid to ſuch teſtimony, if it be made after they have owned the child to be theirs. A father has the abſolute right of diſpoſing of his childrens perſon, of directing their education, and of moderate chaſtiſement; and even after they become *puberes*, he may compel them to live in family with him, and to contribute their labour and induſtry, while they continue there, towards his ſervice. A child who gets a ſeparate ſtock from the father for carrying on any trade or employment, even though he ſhould continue in the father's houſe, may be ſaid to be emancipated or foriſfamiliated, in ſo far as concerns that ſtock; for the profits ariſing from it are his own. Foriſfamiliation, when taken in this ſenſe, is alſo inferred by the child's marriage, or by his living in a ſeparate houſe, with his father's permiſſion or goodwill. Children, after their full age of twenty-one years, become, according to the general opinion, their own maſters; and from that period are bound to the father only by the natural ties of duty, affection, and gratitude. The mutual obligations between parents and children to maintain each other, are explained afterwards, Tit. 20.

33. Children, born out of wedlock, are ſtyled natural children, or baſtards. Baſtards may be legitimated or made lawful, either, 1. By the ſubſequent intermarriage of the mother of the child with the father. And this ſort of legitimation, intitles the child to all the rights of lawful children. The ſubſequent marriage, which produces legitimation, is conſidered by the law to have been entered into when the child legitimated was begotten; and hence, if he be a male he excludes, by his right of primogeniture, the ſons procreated after the marriage, from the ſucceſſion of the father's heritage, though theſe ſons were lawful children from the birth. Hence alſo, thoſe children only can be thus legitimated, who are begotten of a woman whom the father might at that period have lawfully married. 2. Baſtards are legitimated by letters of legitimation from the ſovereign. See Tit. 29.

34. As to the power of maſters over their ſervants: All ſervants now enjoy the ſame rights and privileges with other ſubjects, unleſs in ſo far as they are tied down by their engagements of ſervice. Servants are either neceſſary or voluntary. Neceſſary are thoſe whom law obliges to work without wages, of whom immediately. Voluntary ſervants engage without compulſion, either for mere ſubſiſtence, or alſo for wages. Thoſe who earn their bread in this way, if they ſhould ſtand off from engaging, may be compelled to it by the Juſtices of the peace, who have power to fix the rate of their wages.

35. Colliers, coal-bearers, and ſalters, and other perſons neceſſary to collieries and ſaltworks, as they are particularly deſcribed by act 1661, are tied down to perpetual ſervice at the works to which they have once entered. Upon a ſale of the works, the right of their ſervice is transferred to the new proprietor. All perſons are prohibited to receive them into their ſervice, without a teſtimonial from their laſt maſter; and if they deſert to another work, and are redemanded within a year thereafter, he who has received them is obliged to return them within twenty-four hours, under a penalty. But though the proprietor ſhould neglect to require the deſerter within the year, he does not, by that ſhort preſcription, loſe his property in him. Colliers, *&c.* where the colliery to which they are aſtricted, is either given up, or not ſufficient for their maintenance, may lawfully engage with others; but if that work ſhall be again ſet a going, the proprietor may reclaim them back to it.

36. The poor make the loweſt claſs or order of perſons. Indigent children may be compelled to ſerve any of the king's ſubjects without wages, till their age of thirty years. Vagrants and ſturdy beggars may be alſo compelled to ſerve any manufacturer. And becauſe few perſons were willing to receive them into their ſervice, public work-houſes are ordained to be built for ſetting them to work. The poor who cannot work, muſt be maintained by the pariſhes in which they were born; and where the place of their nativity is not known, that burden falls upon the pariſhes where they have had their moſt common reſort, for the three years immediately preceeding their being apprehended, or their applying for the public charity. Where the contributions collected at the churches to which they belong, are not ſufficient for their maintenance, they are to receive badges from the miniſter and kirk ſeſſion, in virtue of which they may aſk alms at the dwelling houſes of the inhabitants of the pariſh.

Tit. 8. *Of the Diviſion of Rights, and the ſeveral ways by which a Right may be acquired.*

The things or ſubjects to which perſons have right, are the ſecond object of law. The right of enjoying and diſpoſing of a ſubject at one's pleaſure, is called property. Proprietors are reſtrained by law from uſing their property emulouſly to their neighbour's prejudice. Every ſtate or ſovereign has a power over private property, called, by ſome lawyers, *dominium eminens*, in virtue of which, the proprietor may be compelled to ſell his property for an adequate price, where an evident utility on the part of the public demands it.

2. Certain things are by nature itſelf incapable of appropriation, as the air, the light, the ocean, *&c.*; none of

of which can be brought under the power of any one perſon, though their uſe be common to all: Others are by law exempted from private commerce, in reſpect of the uſes to which they are deſtined. Of this laſt kind are, 1. *Res publicæ*, as navigable rivers, highways, bridges, *&c.*: the right of theſe is veſted in the King, chiefly for the benefit of his people, and they are called *regalia*. 2. *Res univerſitatis*, things which belong in property to a particular corporation or ſociety, and whoſe uſe is common to every individual in it; but both property and uſe are ſubject to the regulations of the ſociety; as town-houſes, corporation-halls, market-places, church yards, *&c.* The lands or other revenue belonging to a corporation do not fall under this claſs, but are *juris privati*.

3. Property may be acquired, either by occupation or acceſſion; and transferred by tradition or preſcription: But preſcription, being alſo a way of loſing property, falls to be explained under a ſeparate title. OCCUPATION, or occupancy, is the appropriating of things which have no owner, by apprehending them, or ſeizing their poſſeſſion. This was the original method of acquiring property, and continued, under certain reſtrictions, the doctrine of the Roman law, *Quod nullius eſt, fit occupantis;* but it can have no room in the feudal plan, by which the King is looked on as the original proprietor of all the lands within his dominions.

4. Even in that ſort of moveable goods which are preſumed to have once had an owner, this rule obtains by the law of Scotland, *Quod nullius eſt, fit domini regis*. Thus, the right of treaſures hid under ground, is not acquired by occupation, but accrues to the King. Thus alſo, where one finds ſtrayed cattle or other moveables, which have been loſt by the former owner, the finder acquires no right in them, but muſt give public notice thereof; and if within year and day after ſuch notice, the proprietor does not claim his goods, they fall to the King, Sheriff, or other perſon, to whom the King has made a grant of ſuch eſcheats.

5. In that ſort of moveables which never had an owner, as wild beaſts, fowls, fiſhes, or pearls found on the ſhore, the original law takes place, that he who firſt apprehends, becomes proprietor; in ſo much, that though the right of hunting, fowling, and fiſhing, be reſtrained by ſtatute, under certain penalties, yet all game, even what is catched in contravention of the law, becomes the property of the catcher, unleſs where the confiſcation thereof is made part of the penalty: But whales thrown in or killed on our coaſts, belong neither to thoſe who kill them, nor to the proprietor of the grounds on which they are caſt, but to the King, providing they are ſo large as that they cannot be drawn by a wane with ſix oxen.

6. ACCESSION is that way of acquiring property, by which, in two things which have a connection with, or dependence on one another, the property of the principal thing draws after it the property of its acceſſory. Thus the owner of a cow becomes the owner of the calf; a houſe belongs to the owner of the ground on which it ſtands, though built with materials belonging to, and at the charge of another. The Romans excepted from this rule the caſe of paintings drawn on another man's board or canvas, in conſideration of the excellency of the art; which exception our practice has for a like reaſon extended to ſimilar caſes.

7. Under acceſſion is comprehended SPECIFICATION; by which is meant, a perſon's making a new ſpecies or ſubject, from materials belonging to another. Where the new ſpecies can be again reduced to the matter of which it was made, law conſiders the former maſs as ſtill exiſting; and therefore, the new ſpecies, as an acceſſory to the former ſubject, belongs to the proprietor of that ſubject: But where the thing made cannot be ſo reduced, as in the caſe of wine, which cannot be again turned into grapes, there is no place for the *fictio juris*; and therefore the workmanſhip draws after it the property of the materials.

8. Though the new ſpecies ſhould be produced from the COMMIXTION or confuſion of different ſubſtances belonging to different proprietors, the ſame rule holds; but where the mixture is made by the common conſent of the owners, ſuch conſent makes the whole a common property, according to the ſhares that each proprietor had formerly in the ſeveral ſubjects. Where things of the ſame ſort are mixed without the conſent of the proprietors, which cannot again be ſeparated, *e. g.* two hogſheads of wine, the whole likewiſe becomes a common property; but in the after diviſion, regard ought to be had to the different quality of the wines: If the things ſo mixed admit of a ſeparation, *e. g.* two flocks of ſheep, the property continues diſtinct.

9. Property is carried from one to another by TRADITION; which is the delivery of poſſeſſion by the proprietor, with an intention to transfer the property to the receiver. Two things are therefore requiſite, in order to the tranſmitting of property in this way: 1. The intention or conſent of the former owner to transfer it on ſome proper title of alienation, as ſale, exchange, gift, *&c.* 2. The actual delivery in purſuance of that intention. The firſt is called the *cauſa*, the other the *modus transferendi dominii:* Which laſt is ſo neceſſary to the acquiring of property, that he who gets the laſt right, with the firſt tradition, is preferred, according to the rule, *Traditionibus, non nudis pactis, transferuntur rerum dominia*.

10. Tradition is either real, where the *ipſa corpora* of moveables are put into the hands of the receiver; or ſymbolical, which is uſed where the thing is incapable of real delivery, or even when actual delivery is only inconvenient. Where the poſſeſſion or cuſtody of the ſubject has been before with him to whom the property is to be transferred, there is no room for tradition.

11. Poſſeſſion, which is eſſential both to the acquiſition and enjoyment of property, is defined, the detention of a thing, with a deſign or *animus* in the detainer of holding it as his own. It cannot be acquired by the ſole act of the mind, without real detention; but. being once acquired, it may be continued *ſolo animo*. Poſſeſſion is either natural, or civil. Natural poſſeſſion is, when one poſſeſſes by himſelf: Thus, we poſſeſs lands by cultivating them and reaping their fruits, houſes by inhabiting them, moveables by detaining them in our hands. Civil poſſeſſion is our holding the thing, either by the ſole act of

of the mind, or by the hands of another who holds it in our name: Thus, the owner of a thing lent possesses it by the borrower; the proprietor of lands, by his tacksman, trustee, or steward; *&c.* The same subject cannot be possessed entirely, or *in solidum*, by two different persons at one and the same time; and therefore possession by an act of the mind ceases, as soon as the natural possession is so taken up by another, that the former possessor is not suffered to re-enter. Yet two persons may, in the judgment of law, possess the same subject, at the same time, on different rights: thus, in the case of a pledge, the creditor possesses it in his own name, in virtue of the right of impignoration; while the proprietor is considered as possessing, in and through the creditor, in so far as is necessary for supporting his right of property. The same doctrine holds in liferenters, tacksmen, and, generally, in every case where there are rights affecting a subject, distinct from the property.

12. A *bona fide* possessor is he, who, though he is not really proprietor of the subject, yet believes himself proprietor on probable grounds. A *mala fide* possessor knows, or is presumed to know, that what he possesses is the property of another. A possessor *bona fide* acquired right, by the Roman law, to the fruits of the subject possessed, that had been reaped and consumed by himself, while he believed the subjects his own. By our customs, perception alone, without consumption, secures the possessor: Nay, if he has sown the ground, while his *bona fides* continued, he is intitled to reap the crop, *propter curam et culturam*. But this doctrine does not reach to civil fruits, *e. g.* the interest of money, which the *bona fide* receiver must restore, together with the principal, to the owner.

13. *Bona fides* necessarily ceaseth by the *conscientia rei alienæ* in the possessor, whether such consciousness should proceed from legal interpellation, or private knowledge. *Mala fides* is sometimes induced, by the true owner's bringing his action against the possessor, sometimes not till litiscontestation, and, in cases uncommonly favourable, not till sentence be pronounced against the possessor.

14. The property of moveable subjects is presumed by the bare effect of possession, until the contrary be proved; but possession of an immoveable subject, though for a century of years together, if there is no seisin, does not create even a presumptive right to it: *Nulla sasina, nulla terra*. Such subject is considered as caduciary, and so accrues to the sovereign. Where the property of a subject is contested, the lawful possessor is intitled to continue his possession, till the point of right be discussed; and, if he has lost it by force or stealth, the judge will, upon summary application, immediately restore it to him.

15. Where a possessor has several rights in his person, affecting the subject possessed, the general rule is, that he may ascribe his possession to which of them he pleases; but one cannot ascribe his possession to a title other than that on which it commenced, in prejudice of him from whom his title flowed.

Tit. 9. *Of heritable and moveable Rights.*

For the better understanding the doctrine of this title, it must be known, that by the law of Scotland, and indeed of most nations of Europe, since the introduction of feus, where ever there are two or more in the same degree of consanguinity to one who dies intestate, and who are not all females, such rights belonging to the deceased as are either properly feudal, or have any resemblance to feudal rights, descend wholly to one of them, who is considered as his proper heir; the others, who have the name of next of kin or executors, must be contented with that portion of the estate which is of a more perishable nature. Hence has arisen the division of rights to be explained under this title: the subjects descending to the heir, are styled heritable; and those that fall to the next of kin, moveable.

2. All rights of, or affecting lands, under which are comprehended houses, mills, fishings, teinds; and all rights of subjects that are *fundo anexa*, whether compleated by seisin or not, are heritable *ex sua natura*. On the other hand, every thing that moves itself, or can be moved, and in general whatever is not united to land, is moveable; as household-furniture, corns, cattle, cash, arrears of rent and of interest, even though they should be due on a right of annualrent: For though the arrears last mentioned are secured on land, yet being presently payable, they are considered as cash.

3. Debts, *(nomina debitorum)*, when due by bill, promissory note, or account, are moveable. When constituted by bond, they do not all fall under any one head; but are divided into heritable and moveable, by the following rules. All debts constituted by bond bearing an obligation to infeft the creditor in any heritable subject in security of the principal sum and annualrent, or annualrent only, are heritable; for they not only carry a yearly profit, but are secured upon land.

4. Bonds merely personal, though bearing a clause of interest, are moveable as to succession; i. e. they go not to the heir, but to the next of kin or executors: but they are heritable with respect to the fisk, and to the rights of husband and wife; that is, though, by the general rule, moveable rights fall under the communion of goods consequent upon marriage, and the moveables of denounced persons fall to the crown or fisk, by single escheat, yet such bonds do neither, but are heritable in both respects

5. Bonds taken payable to heirs and assignees, secluding executors, are heritable in all respects, from the destination of the creditor. But a bond, which is made payable to heirs, without mention of executors, descends, not to the proper heir in heritage, though heirs are mentioned in the bond, but to the executor; for the word *heir*, which is a generic term, points out him who is to succeed by law in the right; and the executor, being the heir *in mobilibus*, is considered as the person to whom such bond is taken payable. But where a bond is taken to heirs male, or to a series of heirs, one after another, such bond is heritable, because its destination necessarily excludes executors.

6 Subjects originally moveable become heritable: 1. By the proprietor's destination. Thus, a jewel, or any other moveable subject, may be provided to the heir, from the right competent to every proprietor to settle his property on whom he pleases. 2. Moveable rights

rights may become heritable, by the ſupervening of an heritable ſecurity: Thus, a ſum due by a perſonal bond becomes heritable, by the creditor's accepting an heritable right for ſecuring it, or by adjudging upon it,

7. Heritable rights do not become moveable by acceſſory moveable ſecurities, the heritable right being in ſuch caſe the *jus nobilius*, which draws the other after it.

8. Certain ſubjects partake, in different reſpects, of the nature both of heritable and moveable. Perſonal bonds are moveable in reſpect of ſucceſſion, but heritable as to the fiſk, and huſband and wife. All bonds, whether merely perſonal, or even heritable, on which no ſeiſin has followed, may be affected at the ſuit of creditors, either by adjudication, which is a diligence proper to heritage; or by arreſtment, which is peculiar to moveables. Bonds ſecluding executors, though they deſcend to the creditor's heir, are payable by the debtor's executors, without relief againſt the heir; ſince the debtor's ſucceſſion cannot be affected by the deſtination of the creditor.

9. All queſtions, whether a right be heritable or moveable, muſt be determined according to the condition of the ſubject at the time of the anceſtor's death. If it was heritable at that period, it muſt belong to the heir; if moveable, it muſt fall to the executor; without regard to any alterations that may have affected the ſubject in the intermediate period between the anceſtor's death and the competition.

Tit. 10. *Of the Conſtitution of heritable Rights by Charter and Seiſin.*

Heritable rights are governed by the feudal law, which owed its origin, or at leaſt its firſt improvements, to the Longobards; whoſe kings, upon having penetrated into Italy, the better to preſerve their conqueſts, made grants to their principal commanders of great part of the conquered provinces, to be again ſubdivided by them among the lower officers, under the conditions of fidelity and military ſervice.

2. The feudal conſtitutions and uſages were firſt reduced into writing, about the year 1150, by two lawyers of Milan, under the title of *Conſuetudines Feudorum*. None of the German Emperors appear to have expreſsly confirmed this collection by their authority; but it is generally agreed, that it had their tacit approbation, and was conſidered as the cuſtomary feudal law of all the countries ſubject to the empire. No other country has ever acknowledged theſe books for their law; but each ſtate has formed to itſelf ſuch a ſyſtem of feudal rules, as beſt agreed with the genius of its own conſtitution. In feudal queſtions, therefore, we are governed, in the firſt place, by our own ſtatutes and cuſtoms; where theſe fail us, we have regard to the practice of neighbouring countries, if the genius of their law appears to be the ſame with ours; and ſhould the queſtion ſtill remain doubtful, we may have recourſe to thoſe written books of the feus, as to the original plan on which all feudal ſyſtems have proceeded.

3. This military grant got the name, firſt of *beneficium*, and afterwards of *feudum*; and was defined a gratuitous right to the property of lands, made under the conditions of fealty and military ſervice, to be performed to the granter by the receiver; the radical right of the lands ſtill remaining in the granter. Under lands, in this definition, are comprehended all rights or ſubjects ſo connected with land, that they are deemed a part thereof; as houſes, mills, fiſhings, juriſdictions, patronages, *&c.* Though feus in their original nature were gratuitous, they ſoon became the ſubject of commerce; ſervices of a civil or religious kind were freqeuntly ſubſtituted in place of military; and now, of a long time, ſervices of every kind have been entirely diſpenſed with, in certain feudal tenures. He who makes the grant is called the ſuperior, and he who receives it the vaſſal. The ſubject of the grant is commonly called the feu; though that word is at other times, in our law, uſed to ſignify one particular tenure. See Tit. 11. The intereſt retained by the ſuperior in the feu is ſtyled *dominium directum*, or the ſuperiority; and the intereſt acquired by the vaſſal, *dominium utile*, or the property. The word *fee* is promiſcuouſly applied to both.

4. Allodial goods are oppoſed to feus; by which are underſtood, goods enjoyed by the owner, independent of a ſuperior. All moveable goods are allodial; lands only are ſo, when they are given without the condition of fealty or homage. By the feudal ſyſtem, the ſovereign, who is the fountain of feudal rights, reſerves to himſelf the ſuperiority of all the lands of which he makes the grant; ſo that, with us, no lands are allodial, except thoſe of the King's own property, the ſuperiorities which the King reſerves in the property-lands of his ſubjects, and manſes and glebes, the right of which is compleated by the preſbytery's deſignation, without any feudal grant.

5. Every perſon who is in the right of an immoveable ſubject, provided he has the free adminiſtration of his eſtate, and is not debarred by ſtatute, or by the nature of his right, may diſpoſe of it to another. Nay, a vaſſal, though he has only the *dominium utile*, can ſubfeu his property to a ſubvaſſal by a ſubaltern right, and thereby raiſe a new *dominium directum* in himſelf, ſubordinate to that which is in his ſuperior; and ſo *in infinitum*. The vaſſal who thus ſubfeus, is called the ſubvaſſal's immediate ſuperior, and the vaſſal's ſuperior is the ſubvaſſal's mediate ſuperior.

6. All perſons who are not diſabled by law, may acquire and enjoy feudal righs. Papiſts cannot purchaſe a land eſtate by any voluntary deed. Aliens, who owe allegiance to a foreign prince, cannot hold a feudal right without naturalization; and therefore, where ſuch privilege was intended to be given to favoured nations or perſons, ſtatutes of naturalization were neceſſary, either general, or ſpecial; or at leaſt, letters of naturalization by the ſovereign.

7. Every heritable ſubject, capable of commerce, may be granted in feu. From this general rule is excepted, 1. The annexed property of the Crown, which is not alienable without a previous diſſolution in parliament. 2. Tailzied lands, which are deviſed under condition that they ſhall not be aliened. 3. An eſtate *in hereditate jacente* cannot be effectually aliened by the heir-apparent (*i. e.* not entered); but ſuch alienation becomes

becomes effectual upon his entry, the supervening right accruing in that case to the purchaser; which is a rule applicable to the alienation of all subjects not belonging to the vender at the time of the sale.

8. The feudal right, or, as it is called, investiture, is constituted by charter and seisin. By the charter, we understand that writing which contains the grant of the feudal subject to the vassal, whether it be executed in the proper form of a charter, or of a disposition. Charters by subject-superiors are granted, either, 1. *A me de superiore meo*, when they are to be holden, not of the granter himself, but of his superior. This sort is called a public holding, because vassals were in ancient times publicly received in the superior's court before the *pares curiæ* or co-vassals. Or, 2. *De me*, where the lands are to be holden of the granter. These were called sometimes base rights, from *bas*, *lower*; and sometimes private, because, before the establishment of our records, they were easily concealed from third parties; the nature of all which will be more fully explained, Tit. 14. An original charter is that by which the fee is first granted: A charter by progress is a renewed disposition of that fee to the heir or assigney of the vassal. All doubtful clauses in charters by progress ought to be construed agreeably to the original grant; and all clauses in the original charter are understood to be implied in the charters by progress, if there be no express alteration.

9. The first clause in an original charter, which follows immediately after the name and designation of the granter, is the narrative or recital, which expresses the causes inductive of the grant. If the grant be made for a valuable consideration, it is said to be onerous; if for love and favour, gratuitous. In the dispositive clause of a charter, the subjects made over are described either by special boundaries or march-stones, (which is called a bounding charter), or by such other characters as may sufficiently distinguish them. A charter regularly carries right to no subjects but what are contained in this clause, though they should be mentioned in some other clause of the charter.

10. The clause of *tenendas* (from its first words, *tenendas prædictas terras*) expresses the particular tenure by which the lands are to be holden. The clause of *reddendo* (from the words, *reddendo inde annuatim*) specifies the particular duty or service which the vassal is to pay or perform to the superior.

11. The clause of warrandice is that by which the granter obliges himself that the right conveyed shall be effectual to the receiver. Warrandice is either personal or real. Personal warrandice, where the granter is only bound personally, is either, 1. Simple, that he shall grant no deed in prejudice of the right; and this sort, which is confined to future deeds, is implied even in donations. 2. Warrandice from fact and deed, by which the granter warrants that the right neither has been, nor shall be hurt by any fact of his. Or, 3. Absolute warrandice *contra omnes mortales*, whereby the right is warranted against all legal defects in it, which may carry it off from the receiver, either wholly or in part. Where a sale of lands proceeds upon an onerous cause, the granter is liable in absolute warrandice, though no warrandice be expressed; but in assignations to debts or decrees, no higher warrandice than from fact and deed is implied.

12. Gratuitous grants by the Crown imply no warrandice; and though warrandice should be expressed, the clause is ineffectual, from a presumption, that it has crept in by the negligence of the Crown's officers. But where the Crown makes a grant, not *jure coronæ*, but for an adequate price, the sovereign is in the same case with his subjects.

13. Absolute warrandice, in case of eviction, affords an action to the grantee, against the granter, for making up to him all that he shall have suffered through the defect of the right; and not simply for his indemnification, by the granter's repayment of the price to him. But as warrandice is penal, and consequently *stricti juris*, it is not easily presumed, nor is it incurred from every light servitude that may affect the subject, far less does it extend to burdens which may affect the subject posterior to the grant, nor to those imposed by public statute, whether before or after, unless specially warranted against.

14. Real warrandice is either, 1. Express, whereby, in security of the lands principally conveyed, other lands, called warrandice-lands, are also made over, to which the receiver may have recouse in case the principal lands be evicted. Or, 2. Tacit, which is constituted by the exchange or excambion of one piece of ground with another; for, if the lands exchanged are carried off from either of the parties, the law itself, without any paction, gives that party immediate recourse upon his own first lands, given in exchange for the lands evicted.

15. The chapter concludes with a precept of seisin, which is the command of the superior granter of the right to his bailie, for giving seisin or possession to the vassal, or his attorney, by delivering to him the proper symbols. Any person, whose name may be inserted in the blank, left in the precept for that purpose, can execute the precept as bailie; and whoever has the precept of seisin in his hands, is presumed to have a power of attorney from the vassal, for receiving possession in his name.

16. A seisin is the instrument or attestation of a notary, that possession was actually given by the superior or his bailie, to the vassal or his attorney; which is considered as so necessary a solemnity, as not to be suppliable, either by a proof of natural possession, or even of the special fact that the vassal was duly entered to the possession by the superior's bailie.

17. The symbols, by which the delivery of possession is expressed, are, for lands, earth and stone; for rights of annualrent payable forth of land, it is also earth and stone, with the addition of a penny money; for parsonage-teinds, a sheaf of corn; for jurisdictions, the book of the court; for patronages, a psalm book, and the keys of the church; for fishings, net and coble; for mills, clap and happer, *&c.* The seisin must be taken upon the ground of the lands, except where there is a special dispensation in the charter from the Crown.

18. All seisins must be registred within sixty days after their date, either in the general register of seisins at Edinburgh; or in the register of the particular shire appointed by the act 1617; which, it must be observed, is not, in every case, the shire within which the lands lie. Burgage-

gage seisins are ordained to be registred in the books of the borough.

19. Unregistred seisins are ineffectual against third parties, but they are valid against the granters and their heirs. Seisins regularly recorded, are preferable, not according to their own dates, but the dates of their registration.

20. Seisin necessarily supposes a superior by whom it is given; the right therefore which the sovereign, who acknowledges no superior, has over the whole lands of Scotland, is constituted, *jure coronæ*, without seisin. In several parcels of land, that lie contiguous to one another, one seisin serves for all, unless the right of the several parcels be either holden of different superiors, or derived from different authors, or enjoyed by different tenures under the same superior. In discontiguous lands, a separate seisin must be taken on every parcel, unless the sovereign has united them into one tenandry, by a charter of union; in which case, if there is no special place expressed, a seisin taken on any part of the united lands will serve for the whole, even though they be situated in different shires. The only effect of union is, to give the discontiguous lands the same quality as if they had been contiguous, or naturally united; union, therefore, does not take off the necessity of separate seisins, in lands holden by different tenures, or the rights of which flow from different superiors, these being incapable of natural union.

21. The privilege of barony carries a higher right than union does, and consequently includes union in it as the lesser degree. This right of barony can neither be given, nor transmitted, unless by the Crown; but the quality of simple union, being once conferred on lands by the sovereign, may be communicated by the vassal to a subvassal. Though part of the lands united or erected into a barony, be sold by the vassal to be holden *a me*, the whole union is not thereby dissolved: what remains unsold retains the quality.

22. A charter, not perfected by seisin, is a right merely personal, which does not transfer the property, (see Tit. xx. 1.) and a seisin of itself bears no faith, without its warrant: It is the charter and seisin joined together that constitutes the feudal right, and secures the receiver against the effect of all posterior seisins, even though the charters on which they proceed should be prior to his.

23. No quality which is designed as a lien or real burden on a feudal right, can be effectual against singular successors, if it be not inserted in the investiture. If the creditors in the burden are not particularly mentioned, the burden is not real; for no perpetual unknown incumbrance can be created upon lands. Where the right itself is granted with the burden of the sum therein mentioned, or where it is declared void, if the sum be not paid against a day certain, the burden is real; but where the receiver is simply obliged by his acceptance to make payment, the clause is effectual only against him and his heirs.

Tit. II. *Of the several kinds of Holding.*

Feudal subjects are chiefly distinguished by their different manners of holding, which were either ward, blanch, feu, or burgage. Ward holding, which is now abolished by 20. *Geo.* II. *c.* 50. was that which was granted for military service. Its proper *reddendo* was, *services*, or *services used and wont*; by which last was meant the performance of service whenever the superior's occasions required it. As all feudal rights were originally held by this tenure, ward-holding was *in dubio*. Hence, though the *reddendo* had contained some special service, or yearly duty, the holding was presumed ward, if another holding was not particularly expressed.

2. Feu holding is that whereby the vassal is obliged to pay to the superior a yearly rent in money or grain, and sometimes also in services proper to a farm, as ploughing, reaping, carriages for the superior's use, *&c. nomine feudi firmæ*. This kind of tenure was introduced for the encouragement of agriculture, the improvement of which was considerably obstructed by the vassal's obligation to military service. It appears to have been a tenure known in Scotland as far back as *leges burgorum*.

3. Blanch-holding is that whereby the vassal is to pay to the superior an elusory yearly duty, as a penny money, a rose, a pair of gilt spurs, *&c.* merely in acknowledgment of the superiority, *nomine albæ firmæ*. This duty, where it is a thing of yearly growth, if it be not demanded within the year, cannot be exacted thereafter; and where the words, *si petatur tantum*, are subjoined to the *reddendo*, they imply a release to the vassal, whatever the quality of the duty may be, if it is not asked within the year.

4. Burgage holding is that, by which boroughs-royal hold of the sovereign the lands which are contained in their charters of erection. This, in the opinion of *Craig*, does not constitute a separate tenure, but is a species of ward-holding; with this speciality, that the vassal is not a private person, but a community: And indeed, watching and warding, which is the usual service contained in the *reddendo* of such charters, might be properly enough said, some centuries ago, to have been of the military kind. As the royal borough is the King's vassal, all burgage-holders hold immediately of the Crown: The magistrates therefore, when they receive the resignations of the particular burgesses, and give seisin to them, act, not as superiors, but as the King's bailies specially authorised thereto.

5. Feudal subjects, granted to churches, monasteries, or other societies for religious or charitable uses, are said to be mortified, or granted *ad manum mortuam*; either because all casualties must necessarily be lost to the superior, where the vassal is a corporation, which never dies: or because the property of these subjects is granted to a dead hand, which cannot transfer it to another. In lands mortified in times of Popery to the church, whether granted to prelates for the behoof of the church, or *in puram eleemosynam*; the only services prestable by the vassal were prayers, and singing of masses for the souls of the deceased, which approaches nearer to blanch-holding than ward. The purposes of such grants having been, upon the reformation, declared superstitious, the lands mortified were annexed to the Crown: But mortifications

to

to univerſities, hoſpitals, *&c.* were not affected by that annexation; and lands may, at this day, be mortified to any lawful purpoſe, either by blanch or by feu holding.

Tit. 12. *Of the Caſualties due to the Superior.*

THE right of the ſuperior continues unimpaired, notwithſtanding the feudal grant, unleſs in ſo far as the *dominium utile*, or property, is conveyed to his vaſſal. The ſuperiority carries a right to the ſervices and annual duties contained in the *reddendo* of the vaſſal's charter. The duty payable by the vaſſal is a *debitum fundi*; *i. e.* it is recoverable, not only by a perſonal action againſt himſelf, but by a real action againſt the lands.

2. Beſides the conſtant fixed rights of ſuperiority, there are others, which, becauſe they depend upon uncertain events, are called caſualties.

3. The caſualties proper to a ward holding, while that tenure ſubſiſted, were ward, recognition, and marriage, which it is now unneceſſary to explain, as by the late ſtatutes 20 and 25 *Geo.* II. for aboliſhing ward-holdings, the tenure of the lands holden ward of the Crown or Prince is turned into *blanch*, for payment of one penny Scots yearly, *ſi petatur tantum*; and the tenure of thoſe holden of ſubjects, into *feu*, for payment of ſuch yearly feu-duty in money, victual, or cattle, in place of all ſervices, as ſhall be fixed by the court of Seſſion. And accordingly that court, by act of ſederunt Feb. 8. 1749, laid down rules for aſcertaining the extent of theſe feu-duties.

4. The only caſualty, or rather forfeiture, proper to feu-holdings, is the loſs or tinſel of the feu-right, by the neglect of payment of the feu-duty for two full years. Yet where there is no conventional irritancy in the feu-right, the vaſſal is allowed to purge the legal irritancy at the bar; that is, he may prevent the forfeiture, by making payment before ſentence: but where the legal irritancy is fortified by a conventional, he is not allowed to purge, unleſs where he can give a good reaſon for the delay of payment.

5. The caſualties common to all holdings are, non-entry, relief, liferent-eſcheat, diſclamation, and purpreſture. NON-ENTRY is that caſualty which ariſes to the ſuperior out of the rents of the feudal ſubject, through the heir's neglecting to renew the inveſtiture after his anceſtor's death. The ſuperior is intitled to this caſualty, not only where the heir has not obtained himſelf infeft, but where his retour is ſet aſide upon nullities. The heir, from the death of the anceſtor, till he be cited by the ſuperior in a proceſs of general declarator of non-entry, loſes only the retoured duties of his lands, (ſee next parag.); and he forfeits theſe, though his delay ſhould not argue any contempt of the ſuperior, becauſe the caſualty is conſidered to fall, as a condition implied in the feudal right, and not as a penalty of tranſgreſſion: But, where the delay proceeds not from the heir, but from the ſuperior, nothing is forfeited.

6. For underſtanding the nature of retoured duties, it muſt be known, that there was anciently a general valuation of all the lands in Scotland, deſigned both for regulating the proportion of public ſubſidies, and for aſcertaining the quantity of non-entry and relief-duties payable to the ſuperior; which appears, by a contract betwixt K. R. Bruce and his ſubjects *anno* 1327, preſerved in the library of the faculty of advocates, to have been ſettled at leaſt as far back as the reign of Alexander III. This valuation became in the courſe of time, by the improvement of agriculture, and perhaps alſo by the heightning of the nominal value of our money, from the reign of Robert I. downwards to that of James III. much too low a ſtandard for the ſuperior's caſualties: Wherefore, in all ſervices of heirs, the inqueſt came at laſt to take proof likewiſe of the preſent value of the lands contained in the brief (*quantum nunc valent*) in order to fix theſe caſualties. The firſt was called the old, and the other the new extent. Though both extents were ordained to be ſpecified in all retours made to the Chancery upon brieves of inqueſt; yet by the appellation of retoured duties in a queſtion concerning caſualties, the new extent is always underſtood. The old extent continued the rule for levying public ſubſidies, till a tax was impoſed by new proportions, by ſeveral acts made during the uſurpation. By two acts of Cromwell's parliament, held at Weſtminſter 1656, impoſing taxations on Scotland, the rates laid upon the ſeveral counties are preciſely fixed. The ſubſidy granted by the act of convention 1667, was levied on the ſeveral counties, nearly in the ſame proportions that were fixed by the uſurper in 1656; and the ſums to which each county was ſubjected were ſubdivided among the individual land-holders in that county, according to the valuations already ſettled, or that ſhould be ſettled by the commiſſion appointed to carry that act into execution. The rent fixed by theſe valuations is commonly called the valued rent; according to which the land tax, and moſt of the other public burdens, have been levied ſince that time.

7. In feu-holdings, the feu-duty is retoured as the rent, becauſe the feu-duty is preſumed to be, and truly was at firſt, the rent. The ſuperior therefore of a feu-holding gets no non-entry, before citation in the general declarator; for he would have been intitled to the yearly feu-duty, though the fee had been full, *i. e.* though there had been a vaſſal infeft in the lands. The ſuperior of teinds gets the fifth part of the retoured duty as non-entry, becauſe the law conſiders teinds to be worth a fifth part of the rent. In rights of annualrent which are holden of the granter, the annualrenter becomes his debtor's vaſſal; and the annualrent contained in the right is retoured to the blanch or other duty contained in the right before declarator.

8. It is becauſe the retoured duty is the preſumed rent, that the non-entry is governed by it. If therefore no retour of the lands in non-entry can be produced, nor any evidence brought of the retoured duty, the ſuperior is intitled to the real, or at leaſt to the valued rent, even before citation. In lands formerly holden ward of the King, the heir, in place of the retoured duties, is ſubjected only to the annual payment of one *per cent.* of the valued rent.

9. The heir, after he is cited by the ſuperior in the action of general declarator, is ſubjected to the full rents till

till his entry, because his neglect is less excusable after citation. The decree of declarator, proceeding on this action, intitles the superior to the possession, and gives him right to the rents, downward from the citation. As this sort of non-entry is properly penal, our law has always restricted it to the retoured duties, if the heir had a probable excuse for not entering.

10. Non entry does not obtain in burgage-holdings, because the incorporation of inhabitants holds the whole incorporated subjects of the King; and there can be no non-entry due in lands granted to communities, because there the vassal never dies: This covers the right of particulars from non-entry; for if non-entry be excluded with regard to the whole, it cannot obtain with regard to any part. It is also excluded, as to a third of the lands, by the terce, during the widow's life; and as to the whole of them, by the courtesy, during the life of the husband. But it is not excluded by a precept of seisin granted to the heir, till seisin be taken thereon.

11. RELIEF is that casualty which intitles the superior to an acknowledgement or consideration from the heir, for receiving him as vassal. It is called relief, because, by the entry of the heir, his fee is relieved out of the hands of the superior. It is not due in feu-holdings flowing from subjects, unless where it is expressed in the charter by a special clause for doubling the feu-duty at the entry of an heir; but in feu rights, holden of the crown, it is due, though there should be no such clause in the charter. The superior can recover this casualty, either by a poinding of the ground, as a *debitum fundi*, or by a personal action against the heir. In blanch and feu-holdings, where this casualty is expresly stipulated, a year's blanch or feu-duty is due in name of relief, beside the current year's duty payable in name of blanch or feu farm.

12. ESCHEAT (from *echeoir*, *to happen* or *fall*) is that forfeiture which falls through a person's being denounced rebel. It is either single or liferent. Single escheat, though it does not accrue to the superior, must be explained in this place, because of its coincidence with liferent.

13. After a debt is constituted, either by a formal decree, or by registration of the ground of debt, which to the special effect of execution, is in law accounted a decree; the creditor may obtain letters of horning, issuing from the signet, commanding messengers to charge the debtor to pay or perform his obligation, within a day certain. Where horning proceeds on a formal decree of the Session, the time indulged by law to the debtor is fifteen days; if upon a decree of the commission of teinds or admiral, it is ten; and upon the decrees of all inferior judges, fifteen days. Where it proceeds on a registred obligation, which specifies the number of days, that number must be the rule; and, if no precise number be mentioned, the charge must be given on fifteen days, which is the term of law, unless where special statute interposes; as in bills, upon which the debtor may be charged on six days.

14. The messenger must execute these letters (and indeed all summonses) against the debtor, either personally, or at his dwelling house; and, if he get not access to the house, he must strike six knocks at the gate, and thereafter affix to it a copy of his execution. If payment be not made within the days mentioned in the horning, the messenger, after proclaiming three oyesses at the market-cross of the head borough, of the debtor's domicile, and reading the letters there, blows three blasts with a horn, by which the debtor is understood to be proclaimed rebel to the King for contempt of his authority; after which, he must affix a copy of the execution to the market-cross: This is called the publication of the diligence, or a denounciation at the horn. Where the debtor is not in Scotland, he must be charged on sixty days, and denounced at the market cross of Edinburgh, and pier and shore of Leith.

15. Denunciation, if registered within fifteen days, either in the Sheriff's books, or in the general register, drew after it the rebel's single escheat, *i. e.* the forfeiture of his moveables to the Crown. Persons denounced rebels have not a *persona standi in judicio*; they can neither sue nor defend in any action. But this incapacity, being unfavourable, is personal to the rebel, and cannot be pleaded against his assignee.

16. Persons cited to the court of Justiciary may be also denounced rebels, either for appearing there with too great a number of attendants; or, if they fail to appear, they are declared fugitives from the law. Single escheat falls without denunciation, upon sentence of death pronounced in any criminal trial; and by special statute, upon one's being convicted of certain crimes, though not capital; as perjury, bigamy, deforcement, breach of arrestment, and usury. By the late act abolishing wardholdings, the casualties both of single and liferent escheat are discharged, when proceeding upon denunciation for civil debts; but they still continue, when they arise from criminal causes. All moveables belonging to the rebel at the time of his rebellion, (whether proceeding upon denunciation, or sentence in a criminal trial), and all that shall be afterwards acquired by him until relaxation, fall under single escheat. Bonds bearing interest, because they continue heritable *quoad fiscum*, fall not under it, nor such fruits of heritable subjects as become due after the term next ensuing the rebellion, these being reserved for the liferent escheat.

17. The King never retains the right of escheat to himself, but makes it over to a donatory, whose gift is not perfected, till, upon an action of general declarator, it be declared that the rebel's escheat has fallen to the crown by his denunciation, and that the right of it is now transferred to the pursuer by the gift in his favour: Every creditor therefore of the rebel, whose debt was contracted before rebellion, and who has used diligence before declarator, is preferable to the donatory. But the escheat cannot be affected by any debt contracted, nor by any voluntary deed of the rebel after rebellion.

18. The rebel, if he either pays the debt charged for, or suspends the diligence, may procure letters of relaxation from the horn, which, if published in the same place, and registred fifteen days thereafter in the same register with the denunciation, have the effect to restore him to his former state; but they have no retrospect, as to the

moveables already fallen under escheat, without a special clause for that purpose.

19. The rebel, if he continues unrelaxed for year and day after rebellion, is construed to be civilly dead: And therefore, where he holds any feudal right, his superiors, as being without a vassal, are entitled, each of them, to the rents of such of the lands belonging to the rebel as holds of himself, during all the days of the rebel's natural life, by the casualty of LIFERENT-ESCHEAT; except where the denunciation proceeds upon treason or proper rebellion, in which case the liferent falls to the King.

20. It is that estate only, to which the rebel has a proper right of liferent in his own person, that falls under his liferent escheat.

21. Though neither the superior nor his donatory can enter into possession in consequence of this casualty, till decree of declarator; yet that decree, being truly declaratory, has a retrospect, and does not so properly confer a new right, as declare the right formerly constituted to the superior, by the civil death of his vassal. Hence, all charters or heritable bonds, though granted prior to the rebellion, and all adjudications, though led upon debts contracted before that period, are ineffectual against the liferent escheat, unless seisin be taken thereon within year and day after the granter's rebellion.

22. Here, as in single escheat, no debt contracted after rebellion can hurt the donatory, nor any voluntary right granted after that period, though in security or satisfaction of prior debts.

23. DISCLAMATION is that casualty whereby a vassal forfeits his whole feu to his superior, if he disowns or disclaims him without ground, as to any part of it. PURPRESTURE draws likewise a forfeiture of the whole feu after it, and is incurred by the vassal's incroaching upon any part of his superior's property, or attempting, by building, inclosing, or otherwise, to make it his own. In both these feudal delinquencies, the least colour of excuse saves the vassal.

24. All grants from the crown, whether charters, gifts of casualties, or others, proceed on signatures which pass the signet. When the King resided in Scotland, all signatures were superscribed by him; but, on the accession of James VI. to the crown of England, a cachet or seal was made, having the King's name engraved on it, in pursuance of an act of the Privy Council, *April* 4. 1603, with which all signatures were to be afterwards sealed, that the Lords of exchequer were impowered to pass; and these powers are transferred to the court of Exchequer, which was established in Scotland after the union of the two kingdoms in 1707. Grants of higher consequence, as remissions of crimes, gifts proceeding upon forfeiture, and charters of *novodamus*, must have the King's sign-manual for their warrant.

25. If lands holding of the Crown were to be conveyed, the charter passed, before the union of the kingdoms in 1707, by the great seal of Scotland; and now by a seal substituted in place thereof. Grants of church-dignities, during episcopacy, passed also by the great seal; and the commissions to all the principal officers of the Crown, as Justice Clerk, King's Advocate, Solicitor, *&c.* do so at this day. All rights which subjects may transmit by simple assignation, the King transmits by the privy seal; as gifts of moveables, or of casualties that require no seisin. The quarter seal, otherwise called the testimonial of the great seal, is appended to gifts of tutory, commissions of brieves issuing from the chancery, and letters of presentation to lands holding of a subject, proceeding upon forfeiture, bastardy, or *ultimus hæres*.

26. Seals are to royal grants, what subscription is to rights derived from subjects, and give them authority: They serve also as a check to gifts procured (*subreptione vel obreptione*) by concealing the truth, or expressing a falsehood; for, where this appears, the gift may be stopped before passing the seals, though the signature should have been signed by the King. All rights passing under the great or privy seal must be registered in the registers of the great or privy seal *respectivé*, before appending the seal.

Tit. 13. *Of the Right which the Vassal acquires by getting the Feu.*

UNDER the *dominium utile* which the vassal acquires by the feudal right, is comprehended the property of whatever is considered as part of the lands, whether of houses, woods, inclosures, *&c.* above ground; or of coal, limestone, minerals, *&c.* under ground. Mills have, by the generality of our lawyers, been deemed a separate tenement, and so not carried by a charter or disposition, without either a special clause conveying mills, or the erection of the lands into a barony. Yet it is certain, that, if a proprietor builds a mill on his own lands, it will be carried by his entail, or by a retour, without mentioning it, although the lands are not erected into a barony. If the lands disponed be astricted, or thirled to another mill, the purchaser is not allowed to build a new corn-mill on his property, even though he should offer security that it shall not hurt the thirle; which is introduced for preventing daily temptations to fraud.

2. Proprietors are prohibited to build dove-cotes, unless their yearly rent, lying within two miles thereof, extend to ten chalders of victual. A purchaser of lands, with a dove-cote, is not obliged to pull it down, though he should not be qualified to build one; but, if it becomes ruinous, he cannot rebuild it. The right of brewing, though not expressed in the grant, is implied in the nature of property; as are also the rights of fishing, fowling, and hunting, in so far as they are not restrained by statute.

3. There are certain rights naturally consequent on property, which are deemed to be reserved by the crown as *regalia*: unless they be specially conveyed. Gold and silver mines are of this sort: The first universally; and the other, where three half-pennies of silver can be extracted from the pound of lead, by act 1424, (three half-pennies at that time was equal to about two shillings five pennies of our present Scots money.) These were by our ancient law annexed to the Crown; but they are now dissolved from it; and every proprietor is intitled to a grant of the mines within his own lands, with the burden of delivering to the crown a tenth of what shall be brought up.

4. Salmon-

4. Salmon-fishing is likewise a right understood to be reserved by the Crown, if it be not expresly granted; but forty years possession thereof, where the lands are either erected into a barony, or granted with the general clause of fishings, establish as the full right of the salmon fishing in the vassal. A charter of lands, within which any of the king's forests lie, does not carry the property of such forest to the vassal.

5. All the subjects, which were by the Roman law accounted *res publicæ*, as rivers, high ways, ports, *&c.* are, since the introduction of feus, held to be *inter regalia*, or *in patrimonio principis*; and hence incroachment upon a highway is said to infer purpresture. No person has the right of a free port without a special grant, which implies a power in the grantee to levy anchorage and shore dues, and an obligation upon him to uphold the port in good condition. In this class of things, our forefathers reckoned fortalices, or small places of strength, originally built for the defence of the country, either against foreign invasions, or civil commotions; but these now pass with the lands in every charter,

6. The vassal acquires right by his grant, not only to the lands specially contained in the charter, but to those that have been possessed forty years as pertinent thereof. But, 1. If the lands in the grant are marked out by special limits, the vassal is circumscribed by the tenor of his own right, which excludes every subject without these limits from being pertinent of the lands. 2. A right possessed under an expres infeftment is preferable, *cæteris paribus*, to one possessed only as pertinent, 3. Where neither party is infeft *per expressum*, the mutual promiscuous possession by both, of a subject as pertinent, resolves into a commonty of the subject possessed: But if one of the parties has exercised all the acts of property of which the subject was capable, while the possession of the other was confined to pasturage only, or to casting feal and divot, the first is to be deemed sole proprietor, and the other to have merely a right of servitude.

7. As barony is a *nomen universitatis*, and unites the several parts contained in it into one individual right, the general conveyance of a barony carries with it all the different tenements of which it consists, though they should not be specially enumerated, (and this holds, even without erection into a barony, in lands that have been united under a special name.) Hence likewise, the possession by the vassal of the smallest part of the barony lands preserves to him the right of the whole.

8. The vassal is intitled, in consequence of his property, to levy the rents of his own lands, and to recover them from his tenants by an action for rent before his own court; and from all other possessors and intromitters, by an action of mails and duties before the Sheriff. He can also remove from his lands, tenants who have no leases, and he can grant tacks or leases to others. A tack is a contract of location, whereby the use of land or any other immoveable subject, is set to the lessee or tacksman for a certain yearly rent, either in money, the fruits of the ground, or services. It ought to be reduced into writing, as it is a right concerning lands; tacks therefore, that are given verbally, to endure for term of years, are good against neither party, for more than one year. An obligation to grant a tack is as effectual against the granter, as a formal tack. A liferenter, having a temporary property in the fruits, may grant tacks to endure for the term of his own liferent.

9. The tacksman's right is limited to the fruits which spring up annually from the subject set, either naturally, or by the industry of the tacksman; he is not therefore intitled to any of the growing timber above ground, and far less to the minerals, coal, clay, *&c.* under ground, the use of which consumes the substance. Tacks are, like other contracts, personal rights in their own nature, and consequently ineffectual against singular successors in the lands; but, for the encouragement of agriculture, they were, by act 1449, declared effectual to the tacksman for the full time of their endurance, into whose hands soever the lands might come.

10. To give a written tack the benefit of this statute, it must mention the special tack duty payable to the proprietor, which though small, if it be not elusory, secures the tacksman; and it must be followed by possession, which supplies the want of a seisin. If a tack does not expres the term of entry, the entry will commence at the next term after its date, agreeable to the rule, *Quod puré debetur, præsenti die debetur*. If it does not mention the ish, *i. e.* the term at which it is to determine, it is good for one year only; but, if the intention of parties to continue it for more than one year, should appear from any clause in the tack, it is sustained for two years as the *minimum*. Tacks granted to perpetuity, or with an indefinite ish, have not the benefit of the statute. Tacks of houses within borough do not fall within this act.

11. Tacks necessarily imply a *delectus personæ*, a choice by the setter of a proper person for his tenant. Hence the conveyance of a tack, which is not granted to assignees, is ineffectual without the landlord's consent. A right of tack, though it be heritable, falls under the *jus mariti*, because it cannot be separated from the labouring cattle and implements of tillage, which are moveable subjects. A tack therefore granted to a single woman without the liberty of assigning, falls by her marriage, because the marriage, which is a legal conveyance thereof to the husband, cannot be annulled. This implied exclusion of assignees, is however limited to voluntary, and does not extend to necessary assignments, as an adjudication of a tack by the tacksman's creditor; but a tack, expresly excluding assignees, cannot be carried even by adjudication. But tacksmen may subset, unless subtenants are expresly excluded; and liferent tacks, because they import a higher degree of right in the tacksman, than tacks for a definite term, may be assigned, unless assignees be specially excluded.

12. If neither the setter nor tacksman shall properly discover their intention to have the tack dissolved at the term fixed for its expiration, they are understood, or presumed, to have entered into a new tack upon the same terms with the former, which is called *tacit relocation*, and continues till the landlord warns the tenant to remove, or the tenant renounces his tack to the landlord: This obtains also in the case of moveable tenants, who possess from year to year without written tacks.

13. In tacks of land, the setter is commonly bound to put

put all the houses and office houses, necessary for the farm, in good condition at the tenant's entry; and the tenant must keep them and leave them so at his removal. But in tacks of houses, the setter must not only deliver to the tenant the subject set, in tenantable repair at his entry, but uphold it in that repair during the whole years of the tack.

14. If the inclemency of the weather, inundation, or calamity of war, should have brought upon the crop an extraordinary damage *(plus quam tolerabile)*, the landlord had, by the Roman law, no claim for any part of the tack-duty: If the damage was more moderate, he might exact the full rent. It is no where defined, what degree of sterility or devastation makes a loss not to be borne; but the general rule of the Roman law seems to be made ours. Tenants are obliged to pay no public burdens, to which they are not expresly bound by their tacks, except mill-services.

15. Tacks may be evacuated during their currency, 1. In the same manner as feu-rights, by the tacksman's running in arrear of his tack-duty for two years together. This irritancy may be prevented by the tenant's making payment at the bar before sentence. 2. Where the tenant either runs in arrear of one year's rent, or leaves his farm uncultivated at the usual season; in which case he may be ordained to give security for the arrears, and for the rent of the five following crops, if the tack shall subsist so long; otherwise, to remove, as if the tack were at an end. 3. Tacks may be evacuated at any time, by the mutual consent of parties.

16. The landlord, when he intends to remove a tenant whose tack is expiring, or who possesses without a tack, must, upon a precept signed by himself, warn the tenant forty days preceding the term of Whitsunday, at or immediately preceding the ish, personally, or at his dwelling house, to remove at that term, with his family and effects. This precept must be also executed on the ground of the lands, and thereafter read in the parish-church where the lands lie, after the morning service, and affixed to the most patent door thereof. Whitsunday, though it be a moveable feast, is, in questions of removing, fixed to the 15th of May. In warnings from tenements within borough, it is sufficient that the tenant be warned forty days before the ish of the tack, whether it be Whitsunday or Martinmas; and in these the ceremony of chalking the door is sustained as warning, when proceeding upon a verbal order from the proprietor.

17. This process of warning was precisely necessary for founding an action of removing against tenants, till act of sederunt of the court of Session, *Dec.* 14. 1756, which leaves it in the option of the proprietor, either to use the former method, or to bring his action of removing before the Judge ordinary; which, if it be called forty days before the said term of Whitsunday, shall be held as equal to a warning. Where the tenant is bound, by an express clause of his tack, to remove at the ish without warning, such obligation is, by the said act, declared to be a sufficient warrant for letters of horning, upon which, if the landlord charge his tenant forty days before the said Whitsunday, the judge is authorised to eject him within six days after the term of removing expressed in the tack.

18. Actions of removing might, even before this act of sederunt, have been pursued without any previous warning, 1. Against vicious possessors, *i. e.* persons who had seized the possession by force, or who, without any legal title, had intruded into it, after the last possessor had given it up. 2. Against possessors who had a naked tolerance. 3. Against tenants who had run in arrear of rent, during the currency of their tacks. 4. Again such as had sold their lands, and yet continued to possess after the term of the purchaser's entry. Upon the same ground, warning was not required, in removings against possessors of liferented lands, after the death of the liferenter who died in the natural possession: But if he possessed by tenants, these tenants could not be disturbed in their possessions till the next Whitsunday, that they might have time to look out for other farms; but they might be compelled to remove at that term, by an action of removing, without warning.

19. A landlord's title in a removing, let it be ever so lame, cannot be brought under question by a tenant whose tack flows immediately from him; but, if he is to insist against tenants not his own, his right must be perfected by infeftment, unless it be such as requires no infeftment, as terce, *&c.*

20. The defender, in a removing, must, before offering any defence which is not instantly verified, give security to pay to the setter the violent profits, if they should be awarded against him. These are so called, because the law considers the tenant's possession after the warning as violent. They are estimated, in tenements within borough, to double the rent; and in lands, to the highest profits the pursuer could have made of them, by possessing them either by a tenant, or by himself.

21. If the action of removing shall be passed from, or if the landlord shall, after using warning, accept of rent from the tenant, for any term subsequent to that of the removal, he is presumed to have changed his mind, and tacit relocation takes place. All actions of removing against the principal or original tacksman, and decrees thereupon, if the order be used, which is set forth *supra*, § 17. are, by the act of sederunt 1755, declared to be effectual again the assignees to the tack, or subtenants.

22. The landlord has, in security of his tack-duty, over and above the tenant's personal obligation, a tacit pledge or hypothec, not only in the fruits, but in the cattle pasturing on the ground. The corn, and other fruits, are hypothecated for the rent of that year whereof they are the crop; for which they remain affected, though the landlord should not use his right for years together.

23. The whole cattle on the ground, considered as a quantity, are hypothecated for a year's rent, one after another successively. The landlord may apply this hypothec payment of the past year's rent, at any time within three months from the last conventional term of payment, after which it ceases for that year. As the tenant may increase the subject of this hypothec. by purchasing oxen, sheep, *&c.* so he can impair it, by selling part of his stock; but if the landlord suspects the tenant's management, he may, by sequestration or poinding, make his right, which was before general upon the whole stock, special upon every individual. A superior has also a hypothec

pothec for his feu-duty, of the fame kind with that juft explained.

24. In tacks of houfes, breweries, fhops, and other tenements, which have no natural fruits, the furniture and other goods brought into the fubject fet are hypothecated to the landlord for one year's rent. But the tenant may by fale impair this hypothec, as he might that of cattle in rural tenements; and indeed, in the particular cafe of a fhop, the tenant rents it for no other purpofe, than as a place of fale.

Tit. 14. *Of the Tranfmiffion of Rights, by Confirmation and Refignation.*

A VASSAL may tranfmit his feu either to univerfal fucceffors, as heirs; or to fingular fucceffors, *i. e.* thofe who acquire by gift, purchafe, or other fingular title. This laft fort of tranfmiffion is either voluntary, by difpofition; or neceffary, by adjudication.

2. By the firft feudal rules, no fuperior could be compelled to receive any vaffal in the lands, other than the heir expreffed in the inveftiture; for the fuperior alone had the power of afcertaining to what order of heirs the fee granted by himfelf was to defcend. But this right of refufal in the fuperior did not take place, 1. In the cafe of creditors apprifers or adjudgers, whom fuperiors were obliged to receive upon payment of a year's rent. 2. In the cafe of purchafers of bankrupt eftates, who were put on the fame footing with adjudgers. The Crown refufes no voluntary difponee, on his paying a compofition to the exchequer of a fixth part of the valued rent. Now fuperiors are directed to enter all fingular fucceffors (except incorporations) who fhall have got from the vaffal a difpofition, containing procuratory of refignation; they always receiving the fees or cafualties that law entitles them to on a vaffal's entry, *i. e.* a year's rent.

3. Bafe rights, *i. e.* difpofitions to be holden of the difponer, are tranfmiffions only of the property, the fuperiority remaining as formerly. As this kind of right might, before eftablifhing the regifters, have been kept quite concealed from all but the granter and receiver, a public right was preferable to it, unlefs cloathed with poffeffion: But as this diftinction was no longer neceffary after the eftablifhment of the records, all infeftments are declared preferable, according to the dates of their feveral regiftrations; without refpect to the former diftinction of bafe and public, or of being cloathed and not cloathed with poffeffion.

4. Public rights, *i. e.* difpofitions to be holden of the granter's fuperior, may be perfected either by confirmation or refignation; and therefore, they generally contain both precept of feifin and procuratory of refignation. When the receiver is to complete his right in the firft way, he takes feifin upon the precept; but fuch feifin is ineffectual without the fuperior's confirmation; for the difponee cannot be deemed a vaffal, till the fuperior receive him as fuch, or confirm the holding. By the ufual ftyle in the tranfmiffion of lands, the difpofition contains an obligation and precept of infeftment, both *a me* and *de me*, in the option of the difponee; upon which, if feifin is taken indefinitely, it is conftrued in favour of the difponee to be a bafe infeftment, becaufe a public right is null without confirmation: But, if the receiver fhall afterwards obtain the fuperior's confirmation, it is confidered as if it had been from the beginning a public right.

5. Where two feveral public rights of the fame fubject are confirmed by the fuperior, their preference is governed by the dates of the confirmations, not of the infeftments confirmed; becaufe it is the confirmation which compleats a public right.

6. Though a public right becomes, by the fuperior's confirmation, valid from its date; yet if any mid impediment intervene betwixt that period and the confirmation, to hinder the two from being conjoined, *e. g.* if the granter of a public right fhould afterwards grant a bafe right to another, upon which feifin is taken before the fuperior's confirmation of the firft, the confirmation will have effect only from its own date; and confequently the bafe right firft compleated, will carry the *property* of the lands preferable to the public one.

7. Refignation is that form of law, by which a vaffal furrenders his feu to his fuperior; and it is either *ad perpetuam remanentiam*, or *in favorem*. In refignations *ad remanentiam*, where the feu is refigned, to the effect that it may remain with the fuperior, the fuperior, who before had the fuperiority, acquires, by the refignation, the property alfo of the lands refigned: and as his infeftment in the lands ftill fubfifted, notwithftanding the right by which he had given his vaffal the property; therefore, upon the vaffals refignation, the fuperior's right of property revives, and is confolidated with the fuperiority, without the neceffity of a new infeftment; but the inftrument of refignation muft be recorded.

8. Refignations *in favorem* are made, not with an intention that the property refigned fhould remain with the fuperior, but that it fhould be again given by him, in favour either of the refigner himfelf, or of a third party; confequently the fee remains in the refigner, till the perfon in whofe favour refignation is made gets his right from the fuperior perfected by feifin And becaufe refignations *in favorem*, are but incompleat perfonal deeds, our law has made no provifion for recording them. Hence, the firft feifin on a fecond refignation is preferable to the laft feifin upon the firft refignation; but the fuperior, accepting a fecond refignation, whereupon a prior feifin may be taken in prejudice of the firft refignatory, is liable in damages.

9. By our former decifions, one who was vefted with a perfonal right of lands, *i. e.* a right not compleated by feifin, effectually divefted himfelf by difponing it to another; after which, no right remained in the difponer, which could be carried by a fecond difpofition, becaufe a perfonal right is no more than a *jus obligationis*, which may be transferred by any deed fufficiently expreffing the will of the granter. But this doctrine, at the fame time that it rendered the fecurity of the records extremely uncertain, was not truly applicable to fuch rights as required feifin to complete them; and therefore it now obtains, that the granter even of a perfonal right of lands, is not fo divefted by conveying the right to one perfon, but that he may effectually make it over afterwards to another;

nother; and the preference between the two does not depend on the dates of the dispositions, but on the priority of the seisins following upon them.

Tit. 15. *Of redeemable Rights.*

An heritable right is said to be redeemable, when it contains a right of reversion, or return, in favour of the person from whom the right flows. Reversions are either legal, which arise from the law itself, as in adjudications, which law declares to be redeemable within a certain term after their date; or conventional, which are constituted by the agreement of parties, as in wadsets, rights of annualrent, and rights in security. A wadset (from wad or pledge) is a right, by which lands, or other heritable subjects, are impignorated by the proprietor to his creditor, in security of his debt; and, like other heritable rights, is perfected by seisin. The debtor, who grants the wadset, and has the right of reversion, is called the reverser; and the creditor, receiver of the wadset, is called the wadsetter.

Wadsets, by the present practice, are commonly made out in the form of mutual contracts, in which one party sells the land, and the other grants the right of reversion. When the right of reversion is thus incorporated in the body of the wadset, it is effectual without registration; because the singular successor in the wadset is, in that case, sufficiently certified of the reversion, though it be not registred, by looking into his own right, which bears it *in gremio*. But where the right of reversion is granted in a separate writing, it is ineffectual against the singular successor of the wadsetter, unless it be registred in the register of seisins within 60 days after the date of the seisin upon the wadset.

3. Rights of reversion are generally esteemed *stricti juris;* yet they go to heirs, though heirs should not be mentioned, unless there be some clause in the right, discovering the intention of parties, that the reversion should be personal to the reverser himself. In like manner, though the right should not express a power to redeem from the wadsetter's heir, as well as from himself, redemption will be competent against the heir. All our lawyers have affirmed, that reversions cannot be assigned, unless they are taken to assignees; but from the favour of legal diligence, they may be adjudged.

4. Reversions commonly leave the reverser at liberty to redeem the lands *quandocunqe,* without restriction in point of time; but a clause is adjected to some reversions, that if the debt be not paid against a determinate day, the right of reversion shall be irritated, and the lands shall become the irredeemable property of the wadsetter. Neverthelefs, the irritancy being penal, as in wadsets, the sum lent falls always short of the value of the lands, and the right of redemption is by indulgence continued to the reverser, even after the term has expired, while the irritancy is not declared. But the reverser, if he does not take the benefit of this indulgence, within forty years after the lapse of the term, is cut out of it by prescription.

5. If the reverser would redeem his lands, he must use an order of redemption against the wadsetter: the first step of which is premonition (or notice given under form of instrument) to the wadsetter, to appear at the time and place appointed by the reversion, then and there to receive payment of his debt, and thereupon to renounce his right of wadset. In the voluntary redemption of a right of wadset holden base, a renunciation duly registred re-establishes the reverser in the full right of the lands. Where the wadset was granted to be holden of the granter's superior, the superior must receive the reverser, on payment of a year's rent, if he produce a disposition from the wadsetter, containing procuratory of resignation. If, at executing the wadset, the superior has granted letters of regress, *i. e.* an obligation again to enter the reverser upon redemption of the lands, he will be obliged to receive him, without payment of the year's rent. But letters of regress will not have this effect against singular successors in the superiority, if they are not registred in the register of reversions. All wadsets that remain personal rights, are extinguished by simple discharges, though they should not be recorded.

6. If the wadsetter either does not appear at the time and place appointed, or refuses the redemption-money, the reverser must consign it under form of instrument, in the hands of the person thereto appointed in the right of reversion; or, if no person be named, in the hands of the clerk to the bills, a clerk of session, or any responsal person. An instrument of consignation, with the consignatory's receipt of the money consigned, compleats the order of redemption, stops the farther currency of interest against the reverser, and founds him in an action for declaring the order to be formal, and the lands to be redeemed in consequence of it.

7. After decree of declarator is obtained, by which the lands are declared to return to the debtor, the consigned money, which comes in place of the lands, becomes the wadsetter's, who therefore can charge the consignatory upon letters of horning to deliver it up to him; but, because the reverser may, at any time before decree, pass from his order, as one may do from any other step of diligence, the consigned sums continue to belong to the reverser, and the wadsetter's interest in the wadset continues heritable till that period.

8. If the wadsetter chuses to have his money rather than the lands, he must require from the reverser, under form of instrument, the sums due by the wadset, in terms of the right. The wadset sums continue heritable, notwithstanding requisition, which may be passed from by the wadsetter even after the reverser has consigned the redemption money in consequence thereof.

9. Wadsets are either proper or improper. A proper wadset is that whereby it is agreed, that the use of the land shall go for the use of the money; so that the wadsetter takes his hazard of the rents, and enjoys them without accounting, in satisfaction, or *in solutum* of his interest.

10. In an improper wadset, the reverser, if the rent should fall short of the interest, is taken bound to make up the deficiency; if it amounts to more, the wadsetter is obliged to impute the excrescence towards extinction of the capital: And, as soon as the whole sums, principal and interest, are extinguished by the wadsetter's possession,

session, he may be compelled to renounce, or divest himself in favour of the reverser.

11. If the wadsetter be intitled by his right to enjoy the rents without accounting, and if at the same time the reverser be subjected to the hazard of their deficiency, such contract is justly declared usurious; and also in all proper wadsets wherein any unreasonable advantage has been taken of the debtor, the wadsetter must, during the not requisition of the sum lent, either quit his possession to the debtor, upon his giving security to pay the interest, or subject himself to account for the suplus-rents, as in improper wadsets.

12. Infeftments of annualrent, the nature of which has been explained, are also redeemable rights. A right of annualrent does not carry the property of the lands, but it creates a real *nexus* or burden upon the property, for payment of the interest or annualrent contained in the right; and consequently, the bygone interests due upon it are *debita fundi.* The annualrenter may therefore either insist in a real action for obtaining letters of poinding the ground, or sue the tenant in a personal action towards the payment of his past interest: And in a competition for those rents, the annualrenter's preference will not depend on his having used a poinding of the ground, for his right was compleated by the seisin; and the power of poinding the ground, arising from that antecedent right, is *meræ facultatis*, and need not be exercised, if payment can be otherwise got. As it is only the interest of the sum lent which is a burden upon the lands, the annualrenter, if he wants his principal sum, cannot recover it either by poinding or by a personal action against the debtor's tenants, but must demand it from the debtor himself, on his personal obligation in the bond, either by requisition, or by a charge upon letters of horning, according as the right is drawn.

13. Rights of annualrent, being servitudes upon the property, and consequently consistent with the right of property in the debtor, may be extinguished without resignation.

14. Infeftments in security are another kind of redeemable rights (now frequently used in place of rights of annualrent), by which the receivers are infeft in the lands themselves, and not simply in an annualrent forth of them, for security of the principal sums, interest, and penalty, contained in the rights. If an infeftment in security be granted to a creditor, he may thereupon enter into the immediate possession of the lands or annualrent for his payment. They are extinguished as rights of annualrent.

15. All rights of annualrent, rights in security, and generally whatever constitutes a real burden on the fee, may be the ground of an adjudication, which is preferable to all adjudications, or other diligences, intervening between the date of the right and of the adjudication deduced on it; not only for the principal sum contained in the right, but also for the whole past interest contained in the adjudication. This preference arises from the nature of real debts, or *debita fundi*; but in order to obtain it for the interest of the interest accumulated in the adjudication, such adjudication must proceed on a process of poinding the ground.

Tit. 16. *Of Servitudes.*

Servitude is a burden affecting lands, or other heritable subjects, whereby the proprietor is either restrained from the full use of what is his own, or is obliged to suffer another to do something upon it. Servitudes are either natural, legal, or conventional. Nature itself may be said to constitute a servitude upon inferior tenements, whereby they must receive the water that falls from those that stand on higher ground. Legal servitudes are established by statute or custom, from considerations of public policy; among which may be numbered the restraints laid upon the proprietors of tenements within the city of Edinburgh. There is as great a variety of conventional servitudes, as there are ways by which the exercise of property may be restrained by paction in favour of another.

2. Conventional servitudes are constituted, either by grant, where the will of the party burdened is expressed in writing, or by prescription, where his consent is presumed from his acquiescence in the burden for 40 years. A servitude constituted by writing, or grant, is not effectual against the granter's singular successors, unless the grantee has been in the use or exercise of his right: But they are valid against the granter and his heirs, even without use. In servitudes that may be acquired by prescription, forty years exercise of the right is sufficient, without any title in writing, other than a charter and seisin of the lands, to which the servitude is claimed to be due.

3. Servitudes constituted by grant are not effectual, in a question with the superior of the tenement burdened with the servitude, unless his consent be adhibited; for a superior cannot be hurt by his vassal's deed: But, where the servitude is acquired by prescription, the consent of the superior, whose right afforded him a good title to interrupt, is implied. A servitude by grant, though followed only by a partial possession, must be governed, as to its extent, by the tenor of the grant; but a servitude by prescription is limited by the measure or degree of the use had by him who prescribes; agreeably to the maxim, *tantum præscriptum quantum possessum.*

4. Servitudes are either predial or personal. Predial servitudes are burdens imposed upon one tenement, in favour of another tenement. That to which the servitude is due is called the dominant, and that which owes it is called the servient tenement. No person can have right to a predial servitude, if he is not proprietor of some dominant tenement that may have benefit by it; for that right is annexed to a tenement, and so cannot pass from one person to another, unless some tenement goes along with it.

5. Predial servitudes are divided into rural servitudes, or of lands; and urban servitudes, or of houses. The rural servitudes of the Romans were *iter*, *actus*, *via*, *aquæductus*, *aquæhaustus*, and *jus pascendi pecoris.* Similar servitudes may be constituted with us, of a foot-road, horse-road, cart-road, dams, and aqueducts, watering of cattle, and pasturage. The right of a highway is not a servitude constituted in favour of a particular tenement, but is a right common to all travellers. The care of

of high-ways, bridges, and ferries, is committed to the sheriffs, justices of peace, and commissioners of supply in each shire.

6. Common pasturage, or the right of feeding one's cattle upon the property of another, is sometimes constituted by a general clause of pasturage in a charter or disposition, without mentioning the lands burdened; in which case, the right comprehends whatever had been formerly appropriated to the lands disponed out of the granter's own property, and likewise all pasturage due to them out of other lands. When a right of pasturage is given to several neighbouring proprietors, on a moor or common belonging to the granter, indefinite as to the number of cattle to be pastured, the extent of their several rights is to be proportioned according to the number that each of them can fodder in winter upon his own dominant tenement.

7. The chief servitudes of houses among the Romans were those of support, *viz. tigni immittendi*, and *oneris ferendi*. The first was the right of fixing in our neighbour's wall a joist or beam from our house: The second was that of resting the weight of one's house upon his neighbour's wall.

8. With us, where different floors or stories of the same house belong to different persons, as is frequent in the city of Edinburgh, the property of the house cannot be said to be entirely divided; the roof remains a common roof to the whole, and the area on which the house stands supports the whole; so that there is a communication of property, in consequence of which the proprietor of the ground floor must, without the constitution of any servitude, uphold it for the support of the upper, and the owner of the highest story must uphold that as a cover to the lower. Where the highest floor is divided into garrets among the several proprietors, each proprietor is obliged, according to this rule, to uphold that part of the roof which covers his own garret.

9. No proprietor can build, so as to throw the rain-water falling from his own house, immediately upon his neighbour's ground, without a special servitude, which is called of *stillicide*; but, if it falls within his own property, though at the smallest distance from the march, the owner of the inferior tenement must receive it.

10. The servitudes *altius non tollendi, et non officiendi luminibus vel prospectui*, restrain proprietors from raising their houses beyond a certain height, or from making any building whatsoever that may hurt the light or prospect of the dominant tenement. These servitudes cannot be constituted by prescription alone; for, though a proprietor should have built his house ever so low, or should not have built at all upon his grounds for forty years together, he is presumed to have done so for his own conveniency or profit; and therefore cannot be barred from afterwards building a house on his property, or raising it to what height he pleases, unless he be tied down by his own consent.

11. We have two predial servitudes to which the Romans were strangers, *viz.* that of fewel or feal and divot, and of thirlage. The first is a right, by which the owner of the dominant tenement may turn up peats, turfs, feals, or divots, from the ground of the servient, and carry them off either for fewel, or thatch, or the other uses of his own tenement.

12. THIRLAGE is that servitude, by which lands are astricted, or thirled, to a particular mill, and the possessors bound to grind their grain there, for payment of certain multures and sequels, as the agreed price of grinding. In this servitude, the mill is the dominant tenement, and the lands astricted (which are called also the thirle or sucken) the servient. Multure is the quantity of grain or meal payable to the proprietor of the mill, or to the multurer his tacksman. The sequels are the small quantities given to the servants, under the name of knaveship, bannock, and lock or gowpen. The quantities paid to the mill by the lands not astricted, are generally proportioned to the value of the labour, and are called out-town or out-sucken multures; but those paid by the thirle are ordinarily higher, and are called in-town or in-sucken multures.

13. Thirlage may be constituted by a land-holder, when, in the disposition of certain lands, he astricts them to his own mill; or when, in the disposition of a mill, he astricts his own lands to the mill disponed, or when, in letting his lands, he makes it a condition in the tacks. The grant of a mill with the general clause of multures, without specifying the lands astricted, conveys the thirlage of all the lands formerly astricted to that mill, whether they were the property of the granter, or of a third party.

14. A less formal constitution serves to astrict barony-lands to the mill of the barony, than is necessary in any other thirlage; which perhaps proceeds from the effects of the union between the two. Hence, if a baron makes over the mill of a barony, *cum multuris*, or *cum astrictis multuris*, it infers an astriction of the barony lands to the mill conveyed, even of such as had been before sold to another for a certain duty *pro omni alio onere*. But if, prior to the baron's conveyance of his mill *cum multuris*, he had sold any part of the barony-lands to another *cum multuris*, the first purchaser's lands are not astricted by the posterior grant; for a right of lands with the multures, implies a freedom of these lands from thirlage.

15. Thirlage is either, 1. Of grindable corns; or, 2. Of all growing corns; or, 3. Of the *invecta et illata*, *i. e.* of all the grain brought within the thirle, though of another growth. Where the thirlage is of grindable grain, it is in practice restricted to the corns which the tenants have occasion to grind, either for the support of their families, or for other uses; the surplus may be carried out of the thirle unmanufactured, without being liable in multure. Where it is of the *grana crescentia*, the whole grain growing upon the thirle is astricted, with the exceptions, 1. Of seed and horse-corn, which are destined to uses inconsistent with grinding; and, 2. Of the farm-duties due to the landlord, if they are deliverable in grain not grinded. But, if the rent be payable in meal, flour, or malt, the grain of which these are made must be manufactured in the dominant mill.

16. The thirlage of *invecta et illata* is seldom constituted but against the inhabitants of a borough or village, that they shall grind all the unmanufactured grain they import thither at the dominant mill. Multure, therefore, cannot be exacted in a thirlage of *invecta et illata*, for

flour or oat-meal brought into the fervient tenement, unlefs the importer had brought it in grain, and grinded it at another mill. The fame grain that owes multure, as *granum crefcens*, to the mill in whofe thirle it grew, if it fhall be afterwards brought within a borough where the *invecta et illata* are thirled, muft pay a fecond multure to the proprietor of that dominant tenement; but, where the right of thefe two thirlages is in the fame proprietor, he cannot exact both. Where lands are thirled of general terms, without expreffing the particular nature in the fervitude, the lighteft thirlage is prefumed, from the favour of liberty; but in the aftriction of a borough or village, where there is no growing grain which can be the fubject of thirlage, the aftriction of *invecta et illata* muft be neceffarily underftood.

17. Thirlage, in the general cafe, cannot be eftablifhed by prefcription alone, for *iis quæ funt meræ facultatis non præfcribitur;* but where one has paid for forty years together the heavy infucken multures, the flighteft title in writing will fubject his lands. Thirlage may be, contrary to the common rule, conftituted by prefcription alone, 1. Where one pays to a mill a certain fum, or quantity of grain yearly, in name of multure, whether he grinds at it or not (called dry multure.) 2. In mills of the King's property; which is conftituted *jure coronæ*, without titles in writing; and, where he derives right from another, his titles are more liable to be loft. This is extended in practice to mills belonging to church-lands, where thirty years poffeffion is deemed equivalent to a title in writing, from a prefumption that their rights were deftroyed at the reformation. Though thirlage itfelf cannot be conftituted by mere poffeffion, the proportion of multure payable to the dominant tenement may be fo fixed.

18. The poffeffors of the lands aftricted, are bound to uphold the mill, repair the dam-dykes and aqueducts, and bring home the millftones. Thefe fervices, though not expreffed in the conftitution, are implied.

19. Servitudes, being reftraints upon property, are *ftricti juris:* They are not therefore prefumed, if the acts upon which they are claimed can be explained confiftently with freedom; and, when fervitudes are conftituted, they ought to be ufed in the way leaft burdenfome to the fervient tenement. Hence, one who has a fervitude of peats upon his neighbour's mofs, is not at liberty to extend it for the ufe of any manufacture which may require an extraordinary expence of fewel; but muft confine it to the natural ufes of the dominant tenement.

20. Servitudes are extinguifhed, 1. *Confufione*, when the fame perfon comes to be proprietor of the dominant and fervient tenements; for *res fua nemini fervit*, and the ufe the proprietor thereafter makes of the fervient tenement is not *jure fervitutis*, but is an act of property. 2. By the perifhing, either of the dominant or fervient tenement. 3. Servitudes are loft *non utendo*, by the dominant tenement neglecting to ufe the right for forty years; which is confidered as a dereliction of it, though he, who has the fervient tenement, fhould have made no interruption, by doing acts contrary to the fervitude.

21. Perfonal fervitudes are thofe by which the property of a fubject is burdened, in favour, not of a tenement, but of a perfon. The only perfonal fervitude known in our law, is ufufruct or liferent; which is a right to ufe and enjoy a thing during life, the fubftance of it being preferved. A liferent cannot therefore be conftituted upon things which perifh in the ufe; and though it may upon fubjects which gradually wear out by time, as houfehold-furniture, *&c.* yet, with us, it is generally applied to heritable fubjects. He, whofe property is burdened, is ufually called the fiar.

22. Liferents are divided into conventional and legal. Conventional liferents are either fimple, or by refervation. A fimple liferent, or by a feparate conftitution, is that which is granted by the proprietor in favour of another: And this fort, contrary to the nature of predial fervitudes, requires feifin in order to affect fingular fucceffors; for a liferent of lands is, in ftrict fpeech, not a fervitude, but a right refembling property, which conftitutes the liferenter vaffal for life; and fingular fucceffors have no way of difcovering a liferent-right, which perhaps is not yet commenced, but by the records; whereas, in predial fervitudes, the conftant ufe of the dominant tenement makes them public. The proper right of liferent is intranfmiffible, *offibus ufufructuarii inhæret:* When the profits of the liferented fubject are tranfmitted to another, the right becomes merely perfonal, for it intitles the affignee to the rent, not during his own life, but his cedent's, and is therefore carried by fimple affignation, without feifin.

23. A liferent by refervation, is that which a proprietor referves to himfelf in the fame writing by which he conveys the fee to another. It requires no feifin; for the granter's former feifin, which virtually included the liferent, ftill fubfifts as to the liferent which is exprefsly referved. In conjunct infeftments taken to hufband and wife, the wife's right of conjunct fee refolves, in the general cafe, into a liferent.

24. Liferents by law, are the terce and the courtefy. The terce (*tertia*) is a liferent competent by law to widows, who have not accepted of fpecial provifions, in the third of the heritable fubjects, in which their hufbands died infeft; and takes place only where the marriage has fubfifted for year and day, or where a child has been born alive of it.

25. The terce is not limited to lands, but extends to teinds, and to fervitudes and other burdens affecting lands; thus, the widow is intitled, in the right of her terce, to a liferent of the third of the fums fecured, either by rights of annualrent, or by rights in fecurity. In improper wadfets, the terce is a third of the fum lent: In thofe that are proper, it is a third of the wadfet-lands; or in cafe of redemption, a third of the redemption money. Neither rights of reverfion, fuperiority, nor patronage, fall under the terce; for none of thefe have fixed profits, and fo are not proper fubjects for the widow's fubfiftence; nor tacks, becaufe they are not feudal rights. Burgage-tenements are alfo excluded from it, the reafon of which is not fo obvious Since the hufband's feifin is both the meafure and fecurity of the terce, fuch debts or diligences alone, as exclude the hufband's feifin, can prevail over it.

26. Where a terce is due out of lands burdened with

a prior terce ſtill ſubſiſting, the ſecond tercer has only right to a third of the two thirds that remain unaffected by the firſt terce. But upon the death of the firſt widow, whereby the lands are diſburdened of her terce, the leſſer terce becomes enlarged, as if the firſt had never exiſted. A widow, who has accepted of a ſpecial proviſion from her huſband, is thereby excluded from the terce, unleſs ſuch proviſion ſhall contain a clauſe that ſhe ſhall have right to both.

27. The widow has no title of poſſeſſion, and ſo cannot receive the rents in virtue of her terce, till ſhe be ſerved to it; and in order to this, ſhe muſt obtain a brief out of the chancery, directed to the Sheriff, who calls an inqueſt, to take proof that ſhe was wife to the deceaſed; and that the deceaſed died infeft in the ſubjects contained in the brief. The ſervice or ſentence of the jury, finding theſe points proved, does, without the neceſſity of a retour to the chancery, intitle the wife to enter into the poſſeſſion; but ſhe can only poſſeſs with the heir *pro indiviſo*, and ſo cannot remove tenants, till the ſheriff kens her to her terce, or divides the lands between her and the heir. In this diviſion, after determining by lot or kavil, whether to begin by the ſun or the ſhade, *i. e.* by the eaſt or the weſt, the ſheriff ſets off the two firſt acres for the heir, and the third for the widow. Sometimes the diviſion is executed, by giving one entire farm to the widow, and two of equal value to the heir. The widow's right is not properly conſtituted by this ſervice; it was conſtituted before, by the huſband's ſeiſin, and fixed by his death; the ſervice only declares it, and ſo intitles her to the third part of the rents *retro* to her huſband's death, preferable to any rights that may have affected the lands in the intermediate period between that and her own ſervice. The relict, if ſhe was reputed to be lawful wife to the deceaſed, muſt be ſerved, notwithſtanding any objections by the heir againſt the marriage, which may be afterwards tried by the commiſſary.

28. Courteſy is a liferent given by law, to the ſurviving huſband, of all his wife's heritage in which ſhe died infeft, if there was a child of the marriage born alive. A marriage, though of the longeſt continuance, gives no right to the courteſy, if there was no iſſue of it. The child born of the marriage muſt be the mother's heir: If ſhe had a child of a former marriage, who is to ſucceed to her eſtate, the huſband has no right to the courteſy while ſuch child is alive; ſo that the courteſy is due to the huſband, rather as father to an heir, than as huſband to an heireſs. Heritage is here oppoſed to conqueſt, and ſo is to be underſtood only of the heritable rights to which the wife ſucceeded as heir to her anceſtors, excluding what ſhe herſelf had acquired by ſingular titles.

29. Becauſe the huſband enjoys the liferent of his wife's whole heritage, on a lucrative title, he is conſidered as her temporary repreſentative, and ſo is liable in payment of all the yearly burdens chargeable on the ſubject, and of the current intereſt of all her debts, real and perſonal, to the value of the yearly rent he enjoys by the courteſy. The courteſy needs no ſolemnity to its conſtitution: That right, which the huſband had to the rents of his wife's eſtate, during the marriage, *jure mariti*, is continued with him after her death, under the name of courteſy, by an act of the law itſelf. As in the terce, the huſband's ſeiſin is the ground and meaſure of the wife's right; ſo in the courteſy, the wife's ſeiſin is the foundation of the huſband's; and the two rights are, in all other reſpects, of the ſame nature; if it is not that the courteſy extends to burgage holdings, and to ſuperiorities.

30. All liferenters muſt uſe their right *ſalva rei ſubſtantia*: Whatever therefore is part of the fee itſelf, cannot be encroached on by the liferenter, *e g.* woods or growing timber, even for the neceſſary uſes of the liferented tenement. But, where a coppice or *ſilva cædua* has been divided into hags, one of which was in uſe to be cut annually by the proprietor, the liferenter may continue the former yearly cuttings; becauſe theſe are conſidered as the annual fruits the ſubject was intended to yield, and ſo the proper ſubject of a liferent.

31. Liferenters are bound to keep the ſubject liferented in proper repair. They are alſo burdened with the alimony of the heir, where he has not enough for maintaining himſelf. The bare right of apparency founds the action againſt the liferenter. It is a burden perſonal to the liferenter himſelf, and cannot be thrown upon his adjudging creditors, as coming in his place by their diligences. Liferenters are alſo ſubjected to the payment of the yearly ceſſes, ſtipends, *&c.* falling due during their right, and to all other burdens that attend the ſubject liferented.

32. Liferent is extinguiſhed by the liferenter's death. That part of the rents which the liferenter had a proper right to, before his death, falls to his executors; the reſt, as never having been *in bonis* of the deceaſed, goes to the fiar. Martinmas and Whitſunday are, by our cuſtom, the legal terms of the payment of rent: Conſequently, if a liferenter of lands ſurvives the term of Whitſunday, his executors are intitled to the half of that year's rent, becauſe it was due the term before his death; and if he ſurvives the Martinmas, they have right to the whole. If the liferenter, being in the natural poſſeſſion, and having firſt ſowed the ground, ſhould die, even before the Whitſunday, his executors are intitled to the whole crop, in reſpect that both ſeed and induſtry were his. In a liferent of money conſtituted by a moveable bond, the executors have a right to the intereſt, down to the very day of the liferenter's death, where no terms are mentioned for the payment thereof; but in the caſe of an heritable bond, or of a money liferent ſecured on land, the intereſts of liferenter and fiar (or of heir and executor, for the ſame rules ſerve to fix the intereſts of both) are both governed by the legal terms of land-rent, without regard to the conventional.

Tit. 17. *Of Teinds.*

1. Teinds, or tithes, are that liquid proportion of our rents or goods, which is due to churchmen, for performing divine ſervice, or exerciſing the other ſpiritual functions proper to their ſeveral offices. Moſt of the canoniſts affirm, that the preciſe proportion of a tenth, not only of the fruits of the ground, but of what is acquired by perſonal induſtry, is due to the Chriſtian clergy, of divine right, which they therefore call the proper patrimony

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trimony of the church; though it is certain that tithes, in their infancy, were given, not to the clergy alone, but to lay-monks who were called *pauperes*, and to other indigent persons. Charles the Great was the first secular Prince who acknowledged this right in the church. It appears to have been received with us, as far back as David I.

2. The person employed by a cathedral church or monastery to serve the cure in any church annexed, was called a vicar, because he held the church, not in his own right, but in the right or *vice* of his employers; and so was removeable at pleasure, and had no share of the benefice, other than what they thought fit to allow him: But, in the course of time, the appellation of vicar was limited to those who were made perpetual, and who got a stated share of the benefice for their incumbency; from whence arose the distinction of benefices into parsonages and vicarages.

3. Parsonage-teinds are the teinds of corn; and they are so called because they are due to the parson or other titular of the benefice. Vicarage-teinds are the small teinds of calves, lint, hemp, eggs, *&c.* which were commonly given by the titular to the vicar who served the cure in his place. The first sort was universally due, unless in the case of their infeudation to laics, or of a pontifical exemption; but, by the customs of almost all Christendom, the lesser teinds were not demanded where they had not been in use to be paid. By the practice of Scotland, the teinds of animals, or of things produced from animals, as lambs, wool, calves, are due though not accustomed to be paid; but roots, herbs, *&c.* are not tithable, unless use of payment be proved: neither are personal teinds, *i. e.* the tenth of what one acquires by his own industry, acknowledged by our law; yet they have been found due, when supported by 40 years possession.

4. The parson who was entitled to the teind of corns, made his right effectual either by accepting of a certain number of teind-bolls yearly from the proprietor, in satisfaction of it; or more frequently, by drawing or separating upon the field his own tenth part of the corns, after they were reaped, from the stock or the remaining nine tenths of the crop, and carrying it off to his own granaries; which is called drawn teind.

5. After the reformation, James VI. considered himself as proprietor of all the church-lands; partly because the purposes for which they had been granted were declared superstitious; and partly, in consequence of the resignations which he, and Q. Mary his mother, had procured from the beneficiaries: and even as to the teinds, tho' our reformed clergy also claimed them as the patrimony of the church, our sovereign did not submit to that doctrine farther than extended to a competent provision for ministers. He therefore erected or secularised several abbacies and priories into temporal lordships; the grantees of which were called sometimes lords of erection, and sometimes titulars, as having by their grants the same title to the erected benefices, that the monasteries had formerly.

6. As the Crown's revenue suffered greatly by these erections, the temporality of all church benefices (*i. e.* church lands) was, by 1587, *c.* 29. annexed to the crown. That statute excepts from the annexation such benefices as were established before the reformation in laymen, whose rights the legislature had no intention to weaken. Notwithstanding this statute, his Majesty continued to make farther erections, which were declared null by 1592, *c.* 119. with an exception of such as had been made in favour of lords of parliament, since the general act of annexation in 1587.

7. K. Charles I. soon after his succession, raised a reduction of all these erections, whether ganted before or after the act of annexation, upon the grounds mentioned at length by Mr Forbes in his treatise of tithes, p. 159. At last the whole matter was referred to the King himself by four several submissions or compromises, in which the parties on one side were the titulars and their tacksmen, the bishops with the inferior clergy, and the royal boroughs, for the interest they had in the teinds that were gifted for the provision of ministers, schools, or hospitals within their boroughs; and, on the other part, the proprietors who wanted to have the leading of their own teinds. The submission by the titulars contained a surrender into his Majesty's hands of the superiorities of their several erections.

8. Upon each of these submissions his Majesty pronounced separate decrees-arbitral, dated Sept. 2. 1629, which are subjoined to the acts of parliament of his reign. He made it lawful to proprietors to sue the titulars for a valuation, and if they thought fit for a sale also, of their teinds, before the commissioners named or to be named for that purpose. The rate of teind, when it was possessed by the proprietor jointly with the stock, for payment of a certain duty to the titular, and so did not admit a separate valuation, was fixed at a fifth part of the constant yearly rent, which was accounted a reasonable *surrogatum*, in place of a tenth of the increase. Where it was drawn by the titular, and consequently might be valued separately from the stock, it was to be valued as its extent should be ascertained upon a proof before the commissioners; but in this last valuation, the King directed the fifth part to be deducted from the proved teind, in favour of the proprietor, which was therefore called the King's ease. The proprietor suing for a valuation gets the leading of his own teinds as soon as his suit commences; providing he does not allow protestation to be extracted against him for not insisting.

9. Where the proprietor insisted also for a sale of his teinds, the titular was obliged to sell them at nine years purchase of the valued teind-duty. If the pursuer had a tack of his own teinds, not yet expired; or if the defender was only tacksmen of the teinds, and so could not give the pursuer an heritable right; an abatement of the price was to be granted accordingly by the commissioners.

10. There is no provision in the decrees-arbitral, for selling the teinds granted for the sustentation of ministers, universities, schools or hospitals; because these were to continue, as a perpetual fund, for the maintenance of the persons or societies to whom they were appropriated; and they are expresly declared not subject to sale, by 1690. *c.* 30.—1693, *c.* 23. By the last of these acts, it is also provided

vided, that the teinds belonging to bifhops, which had then fallen to the crown, upon the abolifhing of epifcopacy, fhould not be fubject to fale as long as they remained with the Crown not difpofed of; nor thofe which the the proprietor, who had right both to ftock and teind, referved to himfelf, in a fale or feu of the lands. But, though none of thefe teinds can be fold, they may be valued.

11. The King, by the decrees arbitral, declared his own right to the fuperiorities of erection which had been refigned to him by the fubmiffion, referving to the titulars the feu-duties thereof, until payment by himfelf to them of one thoufand merks Scots for every chalder of feu-victual, and for each hundred merks of feu-duty, which right of redeeming the feu-duties was afterwards renounced by the Crown. If the church-vaffal fhould confent to hold his lands of the titular, he cannot thereafter recur to the Crown as his immediate fuperior.

12. In explaining what the conftant rent is, by which the teind muft be valued, the following rules are obferved. The rent drawn by the proprietor, from the fale of fubjects, that are more properly parts of the land than of the fruits, *e. g.* quarries, minerals, moffes, *&c.* is to be deducted from the rental of the lands; and alfo the rent of fupernumerary houfes, over and above what is neceffary for agriculture; and the additional rent that may be paid by the tenant, in confideration of the proprietor's undertaking any burden that law impofes on the tenant, *e. g.* upholding the tenant's houfes, becaufe none of thefe articles are paid properly on account of the fruits. Orchards muft alfo be deducted, and mill-rent, becaufe the profits of a mill arife from induftry; and the corns manufactured there fuffer a valuation, as rent payable by the tenant; and therefore ought not to be valued a fecond time againft the titular as mill-rent. The yearly expence of culture ought not to be deducted; for no rent can be proudced without it: But, if an improvement of rent is made at an uncommon expence, *e. g.* by draining a lake, the proprietor is allowed a reafonable abatement on that account.

13. Notwithftanding the feveral ways of mifapplying parochial teinds in the times of popery, fome few benefices remained entire in the hands of the parfons. The minifters planted in thefe, after the reformation, continued to have the full right to them, as proper beneficiaries; but a power was afterwards granted to the patron, to redeem the whole teind from fuch beneficiaries, upon their getting a competent ftipend modified to them; which teind fo redeemed, the patron is obliged to fell to the proprietor, at fix years purchafe.

14. Some teinds are more directly fubject to an allocation for the minifter's ftipend, than others. The teinds, in the hands of the lay titular, fall firft to be allocated, who, fince he is not capable to ferve the cure in his own perfon, ought to provide one who can; and if the titular, in place of drawing the teind, has fet it in tack, the tack-duty is allocated: This fort is called free teind. Where the tack-duty, which is the titular's intereft in the teinds, falls fhort, the tack itfelf is burdened, or, in other words, the furplus teind over and above the tack-duty: But, in this cafe, the commiffioners are empowered to recompenfe the tackfman, by prorogating his tack for fuch a number of years as they fhall judge equitable. Where this likewife proves deficient, the allocation falls on the teinds, heritably conveyed by the titular, unlefs he has warranted his grant againft future augmentations; in which cafe, the teinds of the lands belonging in property to the titular himfelf muft be allocated in the firft place.

15. Where there is fufficiency of free teinds in a parifh, the titular may allocate any of them he fhall think fit for the minifter's ftipend, fince they are all his own; unlefs there has been a previous decree of locality: And this holds, though the ftipend fhould have been paid immemorially out of the teinds of certain particular lands. This right was frequently abufed by titulars, who, as foon as a proprietor had brought an action of fale of his teinds, allocated the purfuer's full teind for the ftipend, whereby fuch action became ineffectual: It was therefore provided, that after citation in a fale of teinds it fhall not be in the titular's power to allocate the purfuer's teinds folely, but only in proportion with the other teinds in the parifh.

16. Minifters glebes are declared free from the payment of teind. Lands *cum decimis inclufis* are alfo exempted from teind. But in order to exempt lands from payment of teind, it is neceffary that the proprietor prove his right thereto, *cum decimis inclufis*, as far back as the above act of annexation 1587.

17. Teinds are *debita fructuum*, not *fundi*. The action therefore for bygone teinds is only perfonal, againft thofe who have intermeddled, unlefs where the titular is infeft in the lands, in fecurity of the valued teind-duty. Where a tenant is, by his tack, bound to pay a joint duty to his landlord for ftock and teind, without diftinguifhing the rent of each, his defence of a *bona fide* payment of the whole to the landlord has been fuftained in a fuit at the inftance of a laic titular, but repelled where a churchman was purfuer. In both cafes the proprietor who receives fuch rent is liable as intermeddler.

18. In tacks of teinds, as of lands, there is place for tacit relocation; to ftop the effect of which, the titular muft obtain and execute an inhibition of teinds againft the tackfman, which differs much from inhibition of lands (explained under the next title), and is intended merely to interpel or inhibit the tackfman from farther intermeddling. This diligence of inhibition may alfo be ufed at the fuit of the titular, againft any other poffeffor of the teinds; and if the tackfman or poffeffor fhall intermeddle after the inhibition is executed, he is liable in a fpuilzie.

19. Lands and teinds pafs by different titles: A difpofition of lands therefore, though granted by one who has alfo right to the teind, will not carry the teind, unlefs it fhall appear from fpecial circumftances that a fale of both was defigned by the parties. In lands *cum decimis inclufis*, where the teinds are confolidated with the ftock, the right of both muft neceffarily go together in all cafes.

Tit. 18. *Of Inhibitions.*

The conftitution and tranfmiffion of feudal rights being explained,

explained, and the burdens with which they are chargeable, it remains to be confidered, how thefe rights may be affected at the fuit of creditors, by legal diligence. Diligences are certain forms of law, whereby a creditor endeavours to make good his payment, either by affecting the perfon of his debtor, or by fecuring the fubjects belonging to him from alienation, or by carrying the property of thefe fubjects to himfelf. They are either real or perfonal. Real diligence is that which is proper to heritable or real rights; perfonal, is that by which the perfon of the debtor may be fecured, or his perfonal eftate affected. Of the firft fort we have two, *viz.* Inhibition and Adjudication.

2. Inhibition is a perfonal prohibition, which paffes by letters under the fignet, prohibiting the party inhibited to contract any debt, or do any deed, by which any part of his lands may be aliened or carried off, in prejudice of the creditor inhibiting. It muft be executed againft the debtor, perfonally, or at his dwelling houfe, as fummonfes, and thereafter publifhed and regiftred in the fame manner with interdictions, (fee Tit. vii. 30.)

3. Inhibition may proceed, either upon a liquid obligation, or even on an action commenced by a creditor for making good a claim not yet fuftained by the judge; which laft is called inhibition upon a depending action. The fummons, which conftitutes the dependence, muft be executed againft the debtor before the letters of inhibition pafs the fignet; for no fuit can be faid to depend againft one, till he be cited in it as a defender: But the effect of fuch inhibition is fufpended, till decree be obtained in the action againft the debtor; and in the fame manner, inhibitions on conditional debts have no effect, till the condition be purified. Inhibitions are not granted, without a trial of the caufe, when they proceed on conditional debts. And though, in other cafes, inhibitions now pafs of courfe, the Lords are in ufe to ftay, or recal them, either on the debtor's fhewing caufe why the diligence fhould not proceed, or even *ex officio* where the ground of the diligence is doubtful.

4. Though inhibitions, by their uniform ftyle, difable the debtor from felling his moveable as well as his heritable eftate, their effect has been long limited to heritage, from the interruption that fuch an embargo upon moveables muft have given to commerce; fo that debts contracted after inhibition may be the foundation of diligence, againft the debtor's perfon and moveable eftate. An inhibition fecures the inhibiter againft the alienation, not only of the lands that belonged to his debtor when he was inhibited, but of thofe that he fhall afterwards acquire; but no inhibition can extend to fuch after-purchafes as lie in a jurifdiction where the inhibition was not regiftred; for it could not have extended to thefe, tho' they had been made prior to the inhibition.

5. This diligence only ftrikes againft the voluntary debts or deeds of the inhibited perfon: It does not reftrain him from granting neceffary deeds, *i. e.* fuch as he was obliged to grant anterior to the inhibition, fince he might have been compelled to grant thefe before the inhibiter had acquired any right by his diligence. By this rule, a wadfetter or annualrenter might, after being inhibited, have effectually renounced his right to the reverfer on payment, becaufe law could have compelled him to it; but to fecure inhibiters againft the effect of fuch alienations, it is declared by act of federunt of the court of Seffion, Feb. 19. 1680, that, after intimation of the inhibition to the reverfer, no renunciation or grant of redemption fhall be fuftained, except upon declarator of redemption brought by him, to which the inhibiter muft be made a party.

6. An inhibition is a diligence fimply prohibitory, fo that the debt, on which it proceeds, continues perfonal after the diligence; and confequently, the inhibitor, in a queftion with anterior creditors whofe debts are not ftruck at by the inhibition, is only preferable from the period at which his debt is made real by adjudication: And where debts are contracted on heritable fecurity, though pofterior to the inhibition, the inhibiter's debt, being perfonal, cannot be ranked with them; he only draws back from the creditors ranked the fums contained in his diligence. The heir of the perfon inhibited is not reftrained from alienation, by the diligence ufed againft his anceftor; for the prohibition is perfonal, affecting only the debtor againft whom the diligence is ufed.

7. Inhibitions do not, of themfelves, make void the pofterior debts or deeds of the perfon inhibited; they only afford a title to the ufer of the diligence to fet them afide, if he finds them hurtful to him: And even where a debt is actually reduced *ex capite inhibitionis*, fuch reduction, being founded folely in the inhibiter's intereft, is profitable to him alone, and cannot alter the natural preference of the other creditors.

8. Inhibitions may be reduced, upon legal nullities, arifing either from the ground of debt, or the form of diligence. When payment is made by the debtor to the inhibiter, the inhibition is faid to be purged. Any creditor, whofe debt is ftruck at by the inhibition, may, upon making payment to the inhibiter, compel him to affign the debt and diligence in his favour, that he may make good his payment the more effectually againft the common debtor.

Tit. 19. *Of Comprifings, Adjudications, and Judicial Sales.*

Heritable rights may be carried from the debtor to the creditor, either by the diligence of apprifing (now adjudication), or by a judicial fale carried on before the court of Seffion. Apprifing, or comprifing, was the fentence of a fheriff, or of a meffenger who was fpecially conftituted fheriff for that purpofe, by which the heritable rights belonging to the debtor were fold for payment of the debt due to the apprifer; fo that apprifings were, by their original conftitution, proper fales of the debtor's lands, to any purchafer who offered. If no purchafer could be found, the fheriff was to apprife or tax the value of the lands by an inqueft, (whence came the name of apprifing), and to make over to the creditor lands to the value of the debt.

2. That creditors may have accefs to affect the eftate of their deceafed debtor, though the heir fhould ftand off from entering, it is made lawful (by 1540, *c.* 106.) for any creditor to charge the heir of his debtor to enter to his anceftor,

year

year and day being paſt after the anceſtor's death, within forty days after the charge; and, if the heir fails, the creditor may proceed to appriſe his debtor's lands, as if the heir had been entered. Cuſtom has ſo explained this ſtatute, that the creditor may charge the heir, immediately after the death of his anceſtor, provided letters of appriſing be not raiſed till after the expiry both of the year and of the forty days next enſuing the year, within which the heir is charged to enter. But this ſtatute relates only to ſuch charges on which appriſing is to be led againſt the anceſtor's lands; for, in thoſe which are to be barely the foundation of a common ſummons or proceſs againſt the heir, action will be ſuſtained if the year be elapſed from the anceſtor's death before the execution of the ſummons, though the forty days ſhould not be alſo expired. Though the ſtatute authoriſes ſuch charges againſt majors only, practice has alſo extended it againſt minors, and the rule is extended to the caſe where the heir is the debtor. One muſt, in this matter, diſtinguiſh between a general and a ſpecial charge. A general charge ſerves only to fix the repreſentation of the heir who is charged, ſo as to make the debt his, which was formerly his anceſtor's: But a ſpecial charge makes up for the want of a ſervice, explained Tit. xxvii. 25. and ſtates the heir, *fictione juris*, in the right of the ſubjects to which he is charged to enter. Where therefore the heir is the debtor, a general charge for fixing the repreſentation againſt him is unneceſſary, ſince the only concern of the creditor is, that his debtor make up titles to the anceſtor's eſtate, which is done by a ſpecial charge: But where the deceaſed was the debtor, the creditor muſt firſt charge his heir to enter in general, that it may be known whether he is to repreſent the debtor; if he does not enter within forty days, the debt may be fixed againſt him by a decree of conſtitution, on which he muſt be charged to enter heir in ſpecial, upon forty days more; and theſe muſt be elapſed before the creditor can proceed to appriſe.

3. Appriſings in courſe of time underwent ſeveral changes in their form and effect, till at length, by act 1672, *c.* 19. adjudications were ſubſtituted in their place, which directed to proceed againſt debtors by way of action before the court of Seſſion. By that ſtatute, ſuch part of the debtor's lands is to be adjudged as is equivalent to the principal ſum and intereſt of the debt, with the compoſition due to the ſuperior and expences of infeftment, and a fifth part more in reſpect the creditor is obliged to take land for his money. The debtor muſt deliver to the creditor a valid right of the lands to be adjudged, or tranſumpts thereof, renounce the poſſeſſion in his favour, and ratify the decree of adjudication: And law conſiders the rent of the lands as preciſely commenſurated to the intereſt of the debt; ſo that the adjudger lies under no obligation to account for the ſurplus rents. In this, which is called a ſpecial adjudication, the legal or time within which the debtor may redeem, is declared to be five years; and the creditor attaining poſſeſſion upon it can uſe no farther execution againſt the debtor, unleſs the lands be evicted from him.

4. Where the debtor does not produce a ſufficient right to the lands, or is not willing to renounce the poſſeſſion, and ratify the decree, (which is the caſe that has moſt frequently happened), the ſtatute makes it lawful for the creditor to adjudge all right belonging to the debtor in the ſame manner, and under the ſame reverſion of ten years, as he could, by the former laws, have appriſed it. In this laſt kind, which is called a general adjudication, the creditor muſt limit his claim to the principal ſum, intereſt, and penalty, without demanding a fifth part more. But no general adjudication can be inſiſted on, without libelling in the ſummons the other alternative of a ſpecial adjudication; for ſpecial adjudications are introduced by the ſtatute in the place of appriſings; and it is only where the debtor refuſes to comply with the terms thereof that the creditor can lead a general adjudication.

5. Abbreviates are ordained to be made of all adjudications, which muſt be recorded within ſixty days after the date of the decree. In every other reſpect, general adjudications have the ſame effects that appriſings had; adjudgers in poſſeſſion are accountable for the ſurplus rents; a citation in adjudications renders the ſubject litigious; ſuperiors are obliged to enter adjudgers; the legal of adjudications does not expire during the debtor's minority, *&c.* Only it may be obſerved, that though appriſings could not proceed before the term of payment, yet where the debtor is *vergens ad inopiam*, the court *ex nobili officio* admit adjudication for the debt before it be payable. But this ſort being founded ſolely in equity, ſubſiſts merely as a ſecurity, and cannot carry the property to the creditor by any length of time.

6. There are two kinds of adjudication, which took place at the ſame time with appriſings, and ſtill obtain; *viz.* adjudications on a decree *cognitionis cauſa*, otherwiſe called *contra hereditatem jacentem*, and adjudications in implement. Where the debtor's apparent heir, who is charged to enter, formally renounces the ſucceſſion, the creditor may obtain a decree *cognitionis cauſa;* in which, though the heir renouncing is cited for the ſake of form, no ſentence condemnatory can be pronounced againſt him, in reſpect of his renunciation; the only effect of it is to ſubject the *hereditas jacens* to the creditor's diligence.

7. Adjudications *contra hereditatem jacentem*, carry not only the lands themſelves that belonged to the deceaſed, but the rents thereof fallen due ſince his death; for theſe, as an acceſſory to the eſtate belonging to the deceaſed, would have deſcended to the heir if he had entered, which rule is applied to all adjudications led on a ſpecial charge. This ſort of adjudication is declared redeemable within ſeven years, by any co-adjudging creditor, either of the deceaſed debtor, or of the heir renouncing. The heir himſelf, who renounces, cannot be reſtored againſt his renunciation, nor conſequently redeem, if he be not a minor. But even a major may redeem indirectly, by granting a ſimulate bond to a confident perſon; the adjudication upon which, when conveyed to himſelf, is a good title to redeem all other adjudications againſt the lands belonging to his anceſtor.

8. Adjudications in implement are deduced againſt thoſe who have granted deeds without procuratory of reſignation or precept of ſeiſin, and refuſe to diveſt themſelves; to

to the end that the ſubject conveyed may be effectually veſted in the grantee. Theſe adjudications may be alſo directed againſt the heir of the granter, upon a charge to enter. Here there is no place for a legal reverſion; for, as the adjudication is led for completing the right of a ſpecial ſubject, it muſt carry that ſubject as irredeemably as if the right had been voluntarily completed.

9. All adjudications led within year and day of that one which has been made firſt effectual by ſeiſin (where ſeiſin is neceſſary) or exact diligence for obtaining ſeiſin, are preferable *pari paſſu*. The year and day runs from the date of the adjudication, and not of the ſeiſin or diligence for obtaining it. After the days of that period, they are preferable according the their dates. All the co adjudgers within the year are preferable *pari paſſu* as if one adjudication had been led for all their debts. This makes the ſeiſin or diligence on the firſt adjudication a common right to the reſt, who muſt therefore be refund to the owner of that diligence his whole expence laid out in carrying on and completing it. And though that firſt adjudication ſhould be redeemed, the diligence upon it ſtill ſubſiſts as to the reſt. This *pari paſſu* preference, however, does not deſtroy the legal preference of adjudications led on *debita fundi*. See Tit. xv. 15. Nor does it take place in adjudications in implement.

10. Before treating of judicial ſales of bankrupts eſtates, the nature of ſequeſtration may be ſhortly explained, which is a diligence that generally uſhers in actions of ſale. Sequeſtration of lands is a judicial act of the court of Seſſion, whereby the management of an eſtate is put into the hands of a factor or ſteward named by the court, who gives ſecurity, and is to be accountable for the rents to all having intereſt. This diligence is competent, either where the right of the lands is doubtful, if it be applied for before either of the competitors has attained poſſeſſion; or where the eſtate is heavily charged with the debts: But, as it is an unfavourable diligence, it is not admitted, unleſs that meaſure ſhall appear neceſſary for the ſecurity of creditors. Subjects, not brought before the court by the diligence of creditors, cannot fall under ſequeſtration; for it is the competition of creditors which alone founds the juriſdiction of the court to take the diſputed ſubject into their poſſeſſion.

11. The court of Seſſion who decrees the ſequeſtration has the nomination of the factor, in which they are directed by the recommendation of the creditors. A factor appointed by the Seſſion, though the proprietor had not been infeft in the lands, has a power to remove tenants. Judicial factors muſt, within ſix months after extracting their factory, make up a rental of the eſtate, and a liſt of the arrears due by tenants, to be put into the hands of the clerk of the proceſs, as a charge againſt themſelves, and a note of ſuch alterations in the rental as may afterwards happen; and muſt alſo deliver to the clerk annually a ſcheme of their accounts, charge and diſcharge, under heavy penalties. They are, by the nature of their office, bound to the ſame degree of diligence that a prudent man adhibits in his own affairs; they are accountable for the intereſt of the rents, which they either have, or by diligence might have recovered, from a year after their falling due. As it is much in the power of thoſe factors to take advantage of the neceſſities of creditors, by purchaſing their debts at an undervalue, all ſuch purchaſes made either by the factor himſelf, or to his behoof, are declared equivalent to an acquitance or extinction of the debt. No factor can warrantably pay to any creditor, without an order of the court of Seſſion; for he is, by the tenor of his commiſſion, directed to pay the rents to thoſe who ſhall be found to have beſt right to them. Judicial factors are intitled to a ſalary, which is generally ſtated at five *per cent.* of their intromiſſions; but it is ſeldom aſcertained till their office expires, or till their accounting; that the court may modify a greater or ſmaller ſalary, or none, in proportion to the factor's integrity and diligence. Many caſes occur, where the court of Seſſion, without ſequeſtration, name a factor to preſerve the rents from periſhing; *e. g.* where an heir is deliberating whether to enter, where a minor is without tutors, where a ſucceſſion opens to a perſon reſiding abroad; in all which caſes, the factor is ſubjected to the rules laid down in act of ſederunt, Feb. 13. 1730.

12. The word *bankrupt* is ſometimes applied to perſons whoſe funds are not ſufficient for their debts; and ſometimes, not to the debtor, but to his eſtate. The court of Seſſion are empowered, at the ſuit of any real creditor, to try the value of a bankrupt's eſtate, and ſell it for the payment of his debts.

13. No proceſs of ſale, at the ſuit of a creditor, can proceed without a proof of the debtor's bankruptcy, or at leaſt that his lands are ſo charged with debts, that no prudent perſons will buy from him; and therefore the ſummons of ſale muſt comprehend the debtor's whole eſtate. The debtor, or his apparent heir, and all the real creditors in poſſeſſion, muſt be made parties to the ſuit; but it is ſufficient if the other creditors be called by an edictal citation. The ſummons of ſale contains a concluſion of ranking or preference of the bankrupt's creditors. In this ranking, firſt and ſecond terms are aſſigned to the whole creditors for exhibiting in court (or producing) their rights and diligences; and the decree of certification proceeding thereupon, againſt the writings not produced, has the ſame effect in favour of the creditors who have produced their rights, as if that decree had proceeded upon an action of reduction-improbation. See Tit xxx. 5. The ranking of theſe creditors muſt be concluded by an extracted decree, before the actual ſale. The irredeemable property of the lands is adjudged by the court to the higheſt offerer at the ſale. The creditors receiving payment muſt grant to the purchaſer abſolute warrandice, to the extent of the ſum received by them; and the lands purchaſed are declared diſburdened of all debts or deeds of the bankrupt, or his anceſtors, either on payment of the price by the purchaſer to the creditors according to their preference, or on conſignation of it, in caſe of their refuſal, in the hands of the magiſtrates of Edinburgh: The only remedy provided to ſuch creditors as judge themſelves hurt by the ſale of diviſion of the price, even though they ſhould be minors, is an action for recovering their ſhare of the price againſt the creditors who have received it.

14. The expence of theſe proceſſes is diſburſed by the factor out of the rents in his hands; by which the whole

whole burden of such expence falls upon the posterior creditors.

15. Apparent heirs are intitled to bring actions of sale of the estates belonging to their ancestors, whether bankrupt or not; the expence of which ought to fall upon the pursuer, if there is any excrescence of the price, after payment of the creditors.

16. As processes of ranking and sale are designed for the common interest of all the creditors, no diligence carried on or completed during their pendency ought to give any preference in the competition; *pendente lite, nihil innovandum*.

17. It is a rule in all real diligences, that where a creditor is preferable on several different subjects, he cannot use his preference arbitrarily, by favouring one creditor more than another; but must allocate his universal or catholic debt proportionally against all the subjects or parties whom it affects. If it is material to such creditor to draw his whole payment out of any one fund, he may apply his debt so as may best secure himself; but that inequality will be rectified, as to the posterior creditors, who had likewise, by their rights and diligences, affected the subjects out of which he drew his payment, by obliging him to assign in their favour his right upon the separate subjects which he did not use in the ranking; by which they may recur against these separate subjects for the shares which the debt preferred might have drawn out of them. As the obligation to assign is founded merely in equity, the catholic creditor cannot be compelled to it, if his assigning shall weaken the preference of any separate debt vested in himself, affecting the special subject sought to be assigned. But if a creditor upon a special subject shall acquire from another a catholic right, or a catholic creditor shall purchase a debt affecting a special subject, with a view of creating to the special debt a higher degree of preference than was naturally due to it, by an arbitrary application of the catholic debt, equity cannot protect him from assigning in favour of the creditor excluded by such application, especially if, prior to the purchase, the subject had become litigious by the process of ranking; for transmissions ought not to hurt creditors who are no parties to them, nor to give the purchaser any new right, which was not formerly in himself or his cedent.

Tit. 20. *Of Obligations and Contracts in general.*

The law of heritable rights being explained, moveable rights fall next to be considered, the doctrine of which depends chiefly on the nature of Obligations. An obligation is a legal tie, by which one is bound to pay or perform something to another. Every obligation on the person obliged, implies an opposite right in the creditor, so that what is a burden in regard to the one is right with respect to the other; and all rights founded on obligation are called personal. There is this essential difference between a real and a personal right, that a *jus in re*, whether of property, or of an inferior kind as servitude, entitles the person vested with it to possess the subject as his own; or if he is not in possession, to demand it from the possessors; whereas the creditor in a personal right has only *jus ad rem*, or a right to compel the debtor to fulfil his obligation; without any right in the subject itself, which the debtor is bound to transfer to him. One cannot oblige himself, but by a present act of the will. A bare resolution therefore, or purpose to be obliged, is alterable at pleasure.

2. Obligations are either, first, merely natural, where one person is bound to another by the law of nature, but cannot be compelled by any civil action to the performance. Thus, though deeds granted by a minor having curators, without their consent, are null, yet the minor is naturally obliged to perform such deeds; and parents are naturally obliged to provide their children in reasonable patrimonies. Natural obligations intitle the creditor to retain what he has got in virtue thereof, without being subjected to restore it. 2. Obligations are merely civil, which may be sued upon by an action, but are elided by an exception in equity; this is the case of obligations granted through force or fear, *&c*. 3. Proper or full obligations, are those which are supported both by equity and the civil sanction.

3. Obligations may be also divided into, 1. Pure, to which neither day nor condition is adjected. These may be exacted immediately. 2. Obligations (*ex die*), which have a day adjected to their performance. In these, *dies statem cedit, sed non venit;* a proper debt arises from the date of the obligation, because it is certain that the day will exist; but the execution is suspended, till the lapse of that day. 3. Conditional obligations; in which there is no proper debt (*dies non cedit*) till the condition be purified, because it is possible the condition may exist; and which therefore are said to create only the hope of a debt; but the granter, even of these, has no right to resile. An obligation, to which a day is adjected that possibly may never exist, implies a condition; *dies incertus pro conditione habetur*. Thus, in the case of a provision to a child, payable when he attains to the age of fourteen, if the child dies before that age, the provision falls.

4. Obligations, when considered with regard to their cause, were divided by the Romans, into those arising from contract, quasi contract, delict, and quasi delict: But there are certain obligations, even full and proper ones, which cannot be derived from any of these sources, and to which Lord Stair gives the name of obediential. Such as the obligation on parents to aliment or maintain their children; which arises singly from the relation of parent and child, and may be enforced by the civil magistrate. Under parents are comprended the mother, grandfather, and grandmother, in their proper order. This obligation on parents extends to the providing of their issue in all the necessaries of life, and giving them suitable education. It ceases, when the children can earn a livelyhood by their own industry; but the obligation on parents to maintain their indigent children, and reciprocally on children to maintain their indigent parents, is perpetual. This obligation is, on the father's death, transferred to the eldest son, the heir of the family; who, as representing the father, must aliment his younger brothers and sisters: The brothers are only intitled to alimony, till their age of twenty-one, after which they are presumed able to do for themselves; but the obligation to

to maintain the fifters continues till their marriage. In perfous of lower rank, the obligation to aliment the fifters ceafes after they are capable of fubfifting by any fervice or employment.

5. All obligations, arifing from the natural duty of reftitution, fall under this clafs: Thus, things given upon the view of a certain event, muft be reftored, if that event does not afterwards exift: Thus alfo, things given *ob turpem caufam*, where the turpitude is in the receiver and not in the giver, muft be reftored. And on the fame principle, one upon whofe ground a houfe is built or repaired by another, is obliged, without any covenant, to reftore the expence laid out upon it, in fo far as it has been profitable to him.

6. A contract is the voluntary agreement of two or more perfons, whereby fomething is to be given or performed upon one part, for a valuable confideration, either prefent or future, on the other part. Confent, which is implied in agreement, is excluded, 1. By error in the effentials of the contract, for in fuch cafe, the party does not properly contract, but errs or is deceived; And this may be alfo applied to contracts which take their rife from fraud or impofition. 2. Confent is excluded by fuch a degree of reftraint upon any of the contracting parties, as extorts the agreement; for where violence or threatening are ufed againft a perfon, his will has really no part in the contract.

7. Loan or *mutuum* is that contract which obliges a perfon, who has borrowed any fungible fubject from another, to reftore to him as much of the fame kind, and of equal goodnefs. Whatever receives its eftimation in number, weight, or meafure, is a fungible, as corn, wine, current coin, *&c*. The only proper fubjects of this contract are things which cannot be ufed, without either their extinction or alienation; hence, the property of the thing lent is neceffarily transferred by delivery to the borrower, who confequently muft run all the hazards, either of its deterioration or its perifhing, according to the rule, *res perit fuo domino*. Where the borrower neglects to reftore, at the time and place agreed on, the eftimation of the thing lent muft be made according to its price at that time and in that place; becaufe it would have been worth fo much to the lender, if the obligation had been duly performed. If there is no place nor time ftipulated for, the value is to be ftated according to the price that the commodity gave when and where it was demanded. In the loan of money, the value put on it by public authority, and not its intrinfic worth, is to be confidered. This contract is obligatory only on one part; for the lender is fubjected to no obligation: The only action therefore that it produces, is pointed againft the borrower, that he may reftore as much in quantity and quality as he borrowed, together with the damage the lender may have fuffered through default of due performance.

8. Commodate is a fpecies of loan, gratuitous on the part of the lender, where the thing lent may be ufed, without either its perifhing or its alienation. Hence, in this fort of loan, the property continues with the lender: the only right the borrower acquires in the fubject is its ufe, after which he muft reftore the individual thing that he borrowed: Confequently, if the fubject perifhes, it perifhes to the lender, unlefs it has perifhed by the borrower's fault. What degree of fault or negligence makes either of the contracting parties liable to the other in damages, is comprehended under the following rules. Where the contract gives a mutual benefit to both parties, each contracter is bound to adhibit a middle fort of diligence, fuch as a man of ordinary prudence ufes in his affairs. Where only one of the parties has benefit by the contract, that party muft ufe exact diligence; and the other who has no advantage by it is accountable only for dole, or for grofs omiffions which the law conftrues to be dole. Where one employs lefs care on the fubject of any contract which implies an exuberant truft, than he is known to employ in his own affairs, it is confidered as dole.

9. By thefe rules, the borrower in the contract of commodate muft be exactly careful of the thing lent, and reftore it at the time fixed by the contract, or after that ufe is made of it for which it was lent: If he puts it to any other ufe, or neglects to reftore it at the time covenanted, and if the thing perifhes thereafter, even by mere accident, he is bound to pay the value. On the other part, the lender is obliged to reftore to the borrower fuch of the expences difburfed by him on that fubject, as arofe from any uncommon accident, but not thofe that naturally attend the ufe of it. Where a thing is lent gratuoufly, without fpecifying any time of redelivery, it conftitutes the contract of *precarium*, which is revokable at the lender's pleafure, and, being entered into from a perfonal regard to the borrower, ceafes by his death.

10. Depofitation is a contract, by which one who has the cuftody of a thing committed to him (the depofitary), is obliged to reftore it to the depofitar. If a reward is bargained for by the depofitary for his care, it refolves into the contract of location. As this contract is gratuitous, the depofitary is only anfwerable for the confequences of grofs neglect; but after the depofit is redemanded, he is accountable even for cafual misfortunes. He is intitled to a full indemnification for the loffes he has fuftained by the contract, and to the recovery of all fums expended by him on the fubject.

11. An obligation arifes without formal paction, barely by a traveller's entering into an inn, fhip, or ftable, and there depofiting his goods, or putting up his horfes; whereby the innkeeper, fhipmafter, or ftabler, is accountable, not only for his own facts and thofe of his fervants, (which is an obligation implied in the very exercife of thefe employments), but of the other guefts or paffengers; and, indeed, in every cafe, unlefs where the goods have been loft *damno fatali*, or carried off by pirates or houfebreakers. Not only the mafters of fhips but their employers, are liable each of them for the fhare that he has in the fhip; but by the prefent cuftom of trading nations, the goods brought into a fhip muft have been delivered to the mafter or mate, or entered into the fhip-books. Carriers fall within the intendment of this law; and practice has extended it to vintners within borough. The extent of the damage fuftained by the party may be proved by his own oath *in litem*.

12. Sequeftration, whether voluntarily confented to by the parties, or authorifed by the judge, is a kind of depofit;

depoſit; but as the office of ſequeſtree, to whoſe care the ſubject in diſpute is committed, is not conſidered as gratuitous, he cannot throw it up at pleaſure, as a common depoſitary may do; and he is liable in the middle degree of diligence. Conſignation of money is alſo a depoſit. It may be made, either where the debt is called in queſtion by the debtor, as in ſuſpenſions; or where the creditor refuſes to receive his money, as in wadſets, *&c.* The riſk of the conſigned money lies on the conſigner, where he ought to have made payment, and not conſignation, or has conſigned only a part; or has choſen for conſignatory, a perſon neither named by the parties nor of good credit. The charger, or other creditor, runs the riſk, if he has charged for ſums not due, or has without good reaſon refuſed payment, by which refuſal the conſignation became neceſſary. It is the office of a conſignatory, to keep the money in ſafe cuſtody, till it be called for: If therefore he puts it out at intereſt, he muſt run the hazard of the debtor's inſolvency; but, for the ſame reaſon, though he ſhould draw intereſt for it, he is liable in none to the conſigner.

13. Pledge, when oppoſed to wadſet, is a contract, by which a debtor puts into the hands of his creditor a ſpecial moveable ſubject in ſecurity of the debt, to be redelivered on payment. Where a ſecurity is eſtabliſhed by law to the creditor, upon a ſubject which continues in the debtor's poſſeſſion, it has the ſpecial name of an hypothec. Tradeſmen and ſhip-carpenters have an hypothec on the houſe or ſhip repaired, for the materials and other charges of reparation; but not for the expence of building a new ſhip. Owners of ſhips have an hypothec on the cargo for the freight, heritors on the fruits of the ground, and landlords on the *invecta et illata*, for their rents. Writers alſo, and agents, have a right of hypothec, or more properly of retention, in their conſtituent's writings, for their claim of pains and diſburſements. A creditor cannot, for his own payment, ſell the ſubject impignorated, without applying to the judge-ordinary for a warrant to put it up to public ſale or roup; and to this application the debtor ought to be made a party.

Tit. 21. *Of Obligations by Word or Writ.*

THE appellation of *verbal* may be applied to all obligations to the conſtitution of which writing is not eſſential, which includes both real and conſenſual contracts; but as theſe are explained under ſeparate titles, obligations *by word*, in the ſenſe of this rubric, muſt be reſtricted, either to promiſes, or to ſuch verbal agreements as have no ſpecial name to diſtinguiſh them. Agreement implies the intervention of two different parties, who come under mutual obligations to one another. Where nothing is to be given or performed but on one part, it is properly called a promiſe, which, as it is gratuitous, does not require the acceptance of him to whom the promiſe is made. An offer, which muſt be diſtinguiſhed from a promiſe, implies ſomething to be done by the other party; and conſequently is not binding on the offerer, till it be accepted, with its limitations or conditions, by him to whom the offer is made; after which, it becomes a proper agreement.

2. Writing muſt neceſſarily intervene in all obligations and bargains concerning heritable ſubjects, though they ſhould be only temporary; as tacks, which, when they are verbal, laſt but for one year. In theſe no verbal agreement is binding, though it ſhould be referred to the oath of the party; for, till writing is adhibited, law gives both parties a right to reſile, as from an unfiniſhed bargain; which is called *locus pœnitentiæ*. If, upon a verbal bargain of lands, part of the price ſhall be paid by him who was to purchaſe, the *interventus rei*, the actual payment of money, creates a valid obligation, and gives a beginning to the contract of ſale: And in general, where-ever matters are no longer entire, the right to reſile ſeems to be excluded. An agreement, whereby a real right is paſſed from, or reſtricted, called *pactum liberatorium*, may be perfected verbally; for freedom is favourable, and the purpoſe of ſuch agreement is rather to diſſolve than to create an obligation. Writing is alſo eſſential to bargains made under condition that they ſhall be reduced into writing; for in ſuch caſes, it is *pars contractus*, that, till writing be adhibited, both parties ſhall have liberty to withdraw. In the ſame manner, verbal or nuncupative teſtaments are rejected by our law; but verbal legacies are ſuſtained, where they do not exceed *L.* 100 *Scots*.

3. Anciently, when writing was little uſed, deeds were executed by the party appending his ſeal to them; in preſence of witneſſes. For preventing frauds that might happen by appending ſeals to falſe deeds, the ſubſcription alſo of the granter was afterwards required, and, if he could not write, that of a notary. As it might be of dangerous conſequence, to give full force to the ſubſcription of the parties by initials, which is more eaſily counterfeited; our practice, in order to ſuſtain ſuch ſubſcription, ſeems to require a proof, not only that the granter uſed to ſubſcribe in that way, but that *de facto* he had ſubſcribed the deed in queſtion; at leaſt, ſuch proof is required, if the inſtrumentary witneſſes be ſtill alive.

4. As a further check, it was afterwards provided that all writings carrying any heritable right, and other deeds of importance, be ſubſcribed by the principal parties, if they can ſubſcribe; otherwiſe, by two notaries, before four witneſſes ſpecially deſigned. The ſubſequent practice extended this requiſite of the deſignation of the witneſſes to the caſe where the parties themſelves ſubſcribed. Cuſtom has conſtrued obligations for ſums exceeding *L.* 100 *Scots*, to be obligations of importance. In a diviſible obligation, *ex. gr.* for a ſum of money, though exceeding *L.* 100, the ſubſcription of one notary is ſufficient, if the creditor reſtricts his claim to *L.* 100: But, in an obligation indiviſible, *e. g.* for the performance of a fact, if it be not ſubſcribed in terms of the ſtatute, it is void. When notaries thus atteſt a deed, the atteſtation or docquet muſt ſpecially expreſs that the granter gave them a mandate to ſign; nor is it ſufficient that this be mentioned in the body of the writing.

5. In every deed, the name of him who writes it, with his dwelling place or other mark of diſtinction, muſt be inſerted. The witneſſes muſt both ſubſcribe as witneſſes, and their names and deſignations be inſerted in the body of the deed: And all ſubſcribing witneſſes muſt know the granter, and either ſee him ſubſcribe, or hear him

him acknowledge his fubfcription; otherwife they are declared punifhable as acceffory to forgery. Deeds, decrees, and other fecurities, confifting of more than one fheet, may be written by way of book, in place of the former cuftom of pafting together the feveral fheets, and figning the joinings on the margin; provided each page be figned by the granter, and marked by its number; and the tefting claufe exprefs the number of pages.

6. Inftruments of feifin are valid, if fubfcribed by one notary, before a reafonable number of witneffes; which is extended by practice to inftruments of refignation. Two witneffes are deemed a reafonable number to every deed that can be executed by one notary. It is not neceffary, that the witneffes to a notorial inftrument, or execution, fee the notary or meffenger fign; for they are called as witneffes to the tranfaction which is attefted, and not to the fubfcription of the perfon attefting.

7. A new requifite has been added to certain deeds fince the union, for the benefit of the revenue: They muft be executed on ftamped paper, or parchment, paying a certain duty to the crown. Charters, inftruments of refignation, feifins, and retours of lands holden of a fubject, are charged with 2 *s.* 3 *d.* of duty: Bonds, tacks, contracts, and other perfonal obligations, paid at firft 6 *d.* to which a farther duty of 1 *s.* has been fince added. Bail-bonds, bills, teftaments, difcharges, or acquittances of rent or of intereft and judicial deeds, as notorial inftruments, bonds of cautionry in fufpenfions, *&c.* are excepted.

8. The granter's name and defignation are effential, not properly as folemnities, but becaufe no writing can have effect without them. Bonds were, by our ancient practice, frequently executed without filling up the creditor's name; and they paffed from hand to hand, like notes payable to the bearer: But as there was no method for the creditor of a perfon poffeffed of thefe to fecure them for his payment, all writings taken blank in the creditor's name are declared null, as covers to fraud; with the exception of indorfations of bills of exchange.

9. Certain privileged writings do not require the ordinary folemnities. 1. Holograph deeds (written by the granter himfelf) are effectual without witneffes. The date of no holograph writing, except a bill of exchange, (fee next paragr.) can be proved by the granter's own affertion, in prejudice either of his heir or his creditors, but muft be fupported by other adminicles. 2. Teftaments, if executed where men of fkill in bufinefs cannot be had, are valid though they fhould not be quite formal: and let the fubject of a teftament be ever fo valuable, one notary figning for the teftator, before two witneffes, is in practice fufficient. Clergymen were frequently notaries before the reformation; and, though they were afterwards prohibited to act as notaries, the cafe of teftaments is excepted; fo that thefe are fupported by the atteftation of one minifter, with two witneffes. 3. Difcharges to tenants are fuftained without witneffes, from their prefumed rufticity, or ignorance in bufinefs. 4. Miffive letters *in re mercatoria*, commiffions, and fitted accounts in the courfe of trade, and bills of exchange, though they are not holograph, are, from the favour of commerce, fuftained without the ordinary folemnities.

10. A bill of exchange is an obligation in the form of a mandate, whereby the drawer or mandant defires him to whom it is directed, to pay a certain fum, at the day and place therein mentioned, to a third party. Bills of exchange are drawn by a perfon in one country to his correfpondent in another; and they have that name, becaufe it is the exchange, or the value of money in one place compared with its value in another, that generally determines the precife extent of the fum contained in the draught. The creditor in the bill is fometimes called the the poffeffor, or *porteur*. As parties to bills are of different countries, queftions concerning them ought to be determined by the received cuftom of trading nations, unlefs where fpecial ftatute interpofes. For this reafon, bills of exchange, though their form admits not of witneffes, yet prove their own dates, in queftions either with the heir, or creditors of the debtor; but this doctrine is not extended to inland bills payable to the drawer himfelf.

11. A bill is valid, without the defignation, either of the drawer, or of the perfon to whom it is made payable: It is enough, that the drawer's fubfcription appears to be truly his; and one's being poffeffor of a bill marks him out to be the creditor, if he bears the name given in the bill to the creditor: Nay, though the perfon drawn on fhould not be defigned, his acceptance prefumes that it was he whom the drawer had in his eye. Bills drawn blank, in the creditor's name, fall under the ftatutory nullity; for though indorfations of bills are excepted from it, bills themfelves are not. Not only the perfon drawn upon muft fign his acceptance, but the drawer muft fign his draught, before any obligation can be formed againft the accepter: Yet it is fufficient in practice, that the drawer figns, before the bill be produced in judgment; though it fhould be after the death both of the creditor and accepter. A creditor in a bill may tranfmit it to another by indorfation, though the bill fhould not bear *to his order;* by the fame rule that other rights are tranfmiffible by affignation, though they do not bear *to affigneys.*

12. The drawer, by figning his draught, becomes liable for the value to the creditor in the bill, in cafe the perfon drawn upon either does not accept, or after acceptance does not pay; for he is prefumed to have received value from the creditor at giving him the draught, though it fhould not bear *for value received*: But, if the drawer was debtor to the creditor in the bill before the draught, the bill is prefumed to be given towards payment of the debt, unlefs it exprefsly bears *for value.* The perfon drawn upon, if he refufe to accept, while he has the drawer's money in his hands, is liable to him in damages. As a bill prefumes value from the creditor, indorfation prefumes value from the indorfee; who therefore, if he cannot obtain payment from the accepter, has recourfe againft the indorfer, unlefs the bill be indorfed in thefe words, *without recourfe.*

13. Payment of a bill, by the accepter, acquits both the drawer and him at the hands of the creditor; but it intitles the accepter, if he was not the drawer's debtor, to an action of recourfe againft him; and, if he was, to a

a ground of compenſation. Where the bill does not bear value in the hands of the perſon drawn upon, it is preſumed that he is not the drawer's debtor, and conſequently he has recourſe againſt the drawer, *ex mandato.*

14. Bills, when indorſed, are conſidered as ſo many bags of money delivered to the onerous indorſee; which therefore carry right to the contents, free of all burdens that do not appear on the bills themſelves. Hence, a receipt or diſcharge, by the original creditor, if granted on a ſeparate paper, does not exempt the accepter from ſecond payment to the indorſee; hence alſo, no ground of compenſation competent to the accepter againſt the original creditor can be pleaded againſt the indorſee: But, if the debtor ſhall prove, by the oath of the indorſee, that he paid not the full value for the indorſation, the indorſee is juſtly conſidered as but a name; and therefore all exceptions, receivable againſt the original creditor, will be ſuſtained againſt him.

15. Bills muſt be negotiated by the poſſeſſor, againſt the perſon drawn upon, within a preciſe time, in order to preſerve recourſe againſt the drawer. In bills payable ſo many days after ſight, the creditor has a diſcretionary power of fixing the payment ſomewhat ſooner or later, as his occaſions ſhall require. Bills payable on a day certain, need not be preſented for acceptance till the day of payment, becauſe that day can neither be prolonged nor ſhortened by the time of acceptance. For the ſame reaſon, the acceptance of bills, payable on a preciſe day, need not be dated: But, where a bill is drawn payable ſo many days after ſight, it muſt; becauſe there the term of payment depends on the date of the acceptance.

16 Though bills are, in ſtrict law, due the very day on which they are made payable, and may therefore be proteſted on the day thereafter; yet there are three days immediately following the day of payment, called days of grace, within any of which the creditor may proteſt the bill: But if he delay proteſting till the day after the laſt day of grace, he loſes his recourſe. Where a bill is proteſted, either for not acceptance, or not payment, the diſhonour muſt be notified to the drawer or indorſer, within three poſts at fartheſt. This ſtrictneſs of negotiation is confined to ſuch bills as may be proteſted by the poſſeſſor upon the third day of grace: Where therefore bills are indorſed after the days of grace are expired, the indorſee is left more at liberty, and does not loſe his recourſe, though he ſhould not take a formal proteſt for not payment, if, within a reaſonable time, he ſhall give the indorſer notice of the accepter's refuſing to pay. Not only does the poſſeſſor, who neglects ſtrict negotiation, loſe his recourſe againſt the drawer, where the perſon drawn upon becomes afterwards bankrupt, but though he ſhould continue ſolvent; for he may, in that caſe, recover payment from the debtor, and ſo is not to be indulged in an unneceſſary proceſs againſt the drawer, which he has tacitly renounced by his negligence. Recourſe is preſerved againſt the drawer, though the bill ſhould not be duly negotiated, if the perſon drawn upon was not his debtor; for there the drawer can qualify no prejudice by the neglect of diligence, and he ought not to have drawn on one who owed him nothing.

17. The privileges ſuperadded to bills by ſtatute are, that tho', by their form, they can have no clauſe of regiſtration, yet, if duly proteſted, they are regiſtrable within ſix months after their date in caſe of not acceptance, or in ſix months after the term of payment in the caſe of not payment; which regiſtration is made the foundation of ſummary diligence, either againſt the drawer or indorſer in the caſe of not acceptance, or againſt the accepter in caſe of not payment. This is extended to inland bills, *i. e.* bills both drawn and made payable in Scotland. After acceptance, ſummary diligence lies againſt no other than the accepter; the drawer and indorſer muſt be purſued by an ordinary action. It is only the principal ſum in the bill, and intereſt, that can be charged for ſummarily: The exchange, when it is not included in the draught, the re exchange incurred by ſuffering the bill to be proteſted and returned, and the expence of diligence, muſt all be recovered by an ordinary action; becauſe theſe are not liquid debts, and ſo muſt be previouſly conſtituted.

18. Bills, when drawn payable at any conſiderable diſtance of time after date, are denied the privileges of bills; for bills are intended for currency, and not to lie as a ſecurity in the creditor's hands. Bills are not valid which appear *ex facie* to be donations. No extrinſic ſtipulation ought to be contained in a bill which deviates from the proper nature of bills; hence, a bill to which a penalty is adjected, or with a clauſe of intereſt from the date, is null. Inland precepts drawn, not for money the medium of trade, but for fungibles, are null, as wanting writer's name and witneſſes. It is not an agreed point whether promiſſory notes, without writer and witneſſes, unleſs holograph, are probative. This however is certain, that they at no rate intitle to the privileges of bills.

19. As for the ſolemnities eſſential to deeds ſigned in a foreign country, when they come to receive execution in Scotland, it is a general rule, that no laws can be of authority beyond the dominions of the lawgiver. Hence, in ſtrictneſs, no deed, though perfected according to the law of the place where it is ſigned, can have effect in another country where different ſolemnities are required to a deed of that ſort. But this rigour is ſo ſoftened *ex comitate*, by the common conſent of nations, that all perſonal obligations granted according to the law of that country where they are ſigned, are effectual every where, which obtains even in obligations to convey heritage. Conveyances themſelves, of heritable ſubjects, muſt be perfected according to the law of the country where the heritage lies, and from which it cannot be removed.

20. A writing, while the granter keeps it under his own power or his doer's, has no force; it becomes obligatory, only after it is delivered to the grantee himſelf, or found in the hands of a third perſon. As to which laſt, the following rules are obſerved. A deed found in the hands of one, who is doer both for the granter and grantee, is preſumed to have been put in his hands as doer for the grantee. The preſumption is alſo for delivery, if the deed appears in the hands of one who is a ſtranger to both. Where a deed is depoſited in the hands of a third perſon, the terms of depoſitation may be proved by the oath of the depoſitary, unleſs where they are reduced

reduced into writing. A deed appearing in the cuftody of the grantee himfelf, is confidered as his abfolute right; in fo much that the granter is not allowed to prove that it was granted in truft, otherwife than by a written declaration figned by the truftee, or by his oath.

21. The following deeds are effectual without delivery, 1. Writings containing a claufe difpenfing with the delivery: Thefe are of the nature of revokable deeds, where the death of the granter is equivalent to delivery, becaufe after death there can be no revocation. 2. Deeds in favour of children, even natural ones; for parents are the proper cuftodiars or keepers of their childrens writings. From a fimilar reafon, poftnuptial fettlements by the hufband to the wife need no delivery. 3. Rights which are not to take effect till the granter's death, or even where he referves an intereft to himfelf during his life; for it is prefumed he holds the cuftody of thefe, merely to fecure to himfelf fuch referved intereft. 4. Deeds that the granter lay under an antecedent natural obligation to execute, *e.g.* rights granted to a cautioner for his relief. 5. Mutual obligations, *e. g.* contracts; for every fuch deed, the moment it is executed, is a common evident to all the parties contracters. Laftly, the publication of a writing by regiftration, is equivalent to delivery.

Tit. 22. *Of Obligations and Contracts arifing from Confent, and of acceffory Obligations.*

Contracts confenfual, *i. e.* which might, by the Roman law, be perfected by fole confent, without the intervention either of things or of writing, are fale, permutation, location, fociety, and mandate. Where the fubject of any of thefe contracts is heritable, writing is neceffary.

2. Sale is a contract, by which one becomes obliged to give fomething to another, in confideration of a certain price in current money to be paid for it. Things confifting merely in hope, may be the fubject of this contract, as the draught of a net. Commodities, where their importation or ufe is abfolutely prohibited, cannot be the fubject of fale; and even in run goods, no action lies againft the vender for not delivery, if the buyer knew the goods were run.

3. Though this contract may be perfected before delivery of the fubject, the property remains till then with the vender. See Tit. viii. 9. Yet till delivery, the hazard of its deterioration falls on the purchafer, becaufe he has all the profits arifing from it, after the fale. On the other hand, the fubject itfelf perifhes to the vender; 1. If it fhould perifh through his fault, or after his undue delay to deliver it. 2. If a fubject is fold as a fungible, and not as an individual, or *corpus*, *e g.* a quantity of farm-wheat, fold without diftinguifhing the parcel to be delivered from the reft of the farm. 3. The *periculum* lies on the vender till delivery, if he be obliged by a fpecial article in the contract to deliver the fubject at a certain place.

4. Location is that contract, where an hire is ftipulated for the ufe of things, or for the fervice of perfons. He who lets his work or the ufe of his property to hire, is the locator or leffor; and the other, the conductor or leffee. In the location of things, the leffor is obliged to deliver the fubject, fitted to the ufe it was let for; and the leffee muft preferve it carefully, put it to no other ufe, and, after that is over, reftore it. Where a workman or artificer lets his labour, and if the work is either not performed according to contract, or if it be infufficient, even from mere unfkilfulnefs, he is liable to his employer in damages, for he ought not, as an artificer, to have undertaken a work to which he was not equal. A fervant hired for a certain term, is intitled to his full wages, though from ficknefs or other accident he fhould be difabled for a part of his time; but, if he die before the term, his wages are only due for the time he actually ferved. If a mafter dies, or without good reafon turns off, before the term, a fervant who eats in his houfe, the fervant is intitled to his full wages, and to his maintenance till that term: And, on the other part, a fervant who without ground deferts his fervice, forfeits his wages and maintenance, and is liable to his mafter in damages.

5. Society or copartnerfhip is a contract, whereby the feveral partners agree concerning the communication of lofs and gain arifing from the fubject of the contract. It is formed by the reciprocal choice that the partners make of one another; and fo is not conftituted in the cafe of co-heirs, or of feveral legatees in the fame fubject. A copartnerfhip may be fo conftituted, that one of the partners fhall, either from his fole right of property in the fubject, or from his fuperior fkill, be intitled to a certain fhare of the profits, without being fubjected to any part of the lofs; but a fociety, where one partner is to bear a certain proportion of lofs, without being intitled to any fhare of the profits, is juftly reprobated. All the partners are intitled to fhares of profit and lofs proportioned to their feveral ftocks, where it is not otherwife covenanted.

6. As partners are united, from a *delectus perfonæ*, in a kind of brotherhood, no partner can, without a fpecial power contained in the contract, transfer any part of his fhare to another. All the partners are bound *in folidum* by the obligation of any one of them, if he fubfcribe by the *firm* or focial name of the company; unlefs it be a deed that falls not under the common courfe of adminiftration. The company-effects are the company property of the fociety fubjected to its debts; fo that no partner can claim a divifion thereof, even after the fociety is diffolved, till thefe are paid: And, confequently, no creditor of a partner can, by diligence, carry to himfelf the property of any part of the common ftock, in prejudice of a company-creditor: but he may, by arreftment, fecure his debtor's fhare in the company's hands, to be made forthcoming to him at the clofe of the copartnerfhip, in fo far as it is not exhaufted by the company debts.

7. Society being founded in the mutual confidence among the *focii*, is diffolved, not only by the renunciation, but by the death of any one of them, if it be not otherwife fpecially covenanted. A partner, who renounces upon unfair views, or at a critical time, when his withdrawing may be fatal to the fociety, loofes his partners from all their engagements to him, while he is bound to them for all the profits he fhall make by his withdraw-

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ing, and for the loſs ariſing thereby to the company. Not only natural, but civil death, *e. g.* ariſing from a ſentence inflicting capital puniſhment, makes one incapable to perform the duties of a partner, and conſequently diſſolves the ſociety. In both caſes, of death and renunciation, the remaining partners may continue the copartnerſhip, either expreſsly, by entering into a new contract; or tacitly, by carrying on their trade as formerly. Public trading companies are now every day conſtituted, with rules very different from thoſe which either obtained in the Roman law, or at this day obtain in private ſocieties. The proprietors or partners in theſe, though they may transfer their ſhares, cannot renounce; nor does their death diſſolve the company, but the ſhare of the deceaſed deſcends to his repreſentative.

8 A joint trade is not a copartnerſhip, but a momentary contract, where two or more perſons agree to contribute a ſum, to be employed in a particular courſe of trade, the produce whereof is to be divided among the adventurers, according to their ſeveral ſhares, after the voyage is finiſhed. If, in a joint trade, that partner who is intruſted with the money for purchaſing the goods, ſhould, in place of paying them in caſh, buy them upon credit, the furniſher who followed his faith alone in the ſale, has no recourſe againſt the other adventurers; he can only recover from them what of the buyer's ſhare is yet in their hands. Where any one of the adventurers, in a joint trade, becomes bankrupt, the others are preferable to his creditors, upon the common ſtock, as long as it continues undivided, for their relief of all the engagements entered into by them on account of the adventure.

9. Mandate is a contract, by which one employs another to manage any buſineſs for him; and by the Roman law, it muſt have been gratuitous. It may be conſtituted tacitly, by one's ſuffering another to act in a certain branch of his affairs, for a tract of time together, without challenge. The mandatory is at liberty not to accept of the mandate; and, as his powers are ſolely founded in the mandant's commiſſion, he muſt, if he undertakes it, ſtrictly adhere to the directions given him: Nor is it a good defence, that the method he followed was more rational; for in that his employer was the proper judge. Where no ſpecial rules are preſcribed, the mandatory, if he acts prudently, is ſecure, whatever the ſucceſs may be; and he can ſue for the recovery of all the expences reaſonably diſburſed by him in the execution of his office.

10. Mandates may be general, containing a power of adminiſtring the mandant's whole affairs; but no mandate implies a power of diſpoſing gratuitouſly of the conſtituent's property; nor even of ſelling his heritage for an adequate price: But a general mandatory may ſell ſuch of the moveables as muſt otherwiſe periſh. No mandatory can, without ſpecial powers, tranſact doubtful claims belonging to his conſtituent, or refer them to arbiters.

11. Mandates expire, 1. By the revocation of the employer, though only tacit, as if he ſhould name another mandatory for the ſame buſineſs. 2. By the renunciation of the mandatory; even after he has executed part of his commiſſion, if his office be gratuitous. 3. By the death, either of the mandant or mandatory: But if matters are not entire, the mandate continues in force, notwithſtanding ſuch revocation, renunciation, or death. Procuratories of reſignation, and precepts of ſeiſin, are made out in the form of mandates; but, becauſe they are granted for the ſole benefit of the mandatory, all of them, excepting precepts of *clare conſtat*, are declared to continue after the death either of the granter or grantee. Deeds which contain a clauſe or mandate for regiſtration, are for the ſame reaſon made regiſtrable after the death of either.

12. The favour of commerce has introduced a tacit mandate, by which maſters of ſhips are empowered to contract in name of their exercitors or employers, for repairs, ſhip-proviſions, and whatever elſe may be neceſſary for the ſhip or crew; ſo as to oblige, not themſelves only, but their employers. Whoever has the actual charge of the ſhip is deemed the maſter, though he ſhould have no commiſſion from the exercitors, or ſhould be ſubſtituted by the maſter in the direction of the ſhip without their knowledge. Exercitors are liable, whether the maſter has paid his own money to a merchant for neceſſaries, or has borrowed money to purchaſe them. The furniſher or lender muſt prove that the ſhip needed repairs, proviſions, *&c* to ſuch an extent; but he is under no neceſſity to prove the application of the money or materials to the ſhip's uſe. If there are ſeveral exercitors, they are liable *ſinguli in ſolidum*. In the ſame manner the undertaker of any branch of trade, manufacture, or other land negotiation, is bound by the contracts of the inſtitors whom he ſets over it, in ſo far as relates to the ſubject of the *præpoſitura*.

13. Contracts and obligations, in themſelves imperfect, receive ſtrength, by the contracter or his heirs doing any act thereafter which imports an approbation of them, and conſequently ſupplies the want of an original legal conſent: This is called homologation; and it takes place even in deeds intrinſically null, whether the nullity ariſes from the want of ſtatutory ſolemnities, or from the incapacity of the granter. It cannot be inferred, 1. By the act of a perſon who was not in the knowledge of the original deed; for one cannot approve what he is ignorant of. 2 Homologation has no place where the act or deed which is pleaded as ſuch can be aſcribed to any other cauſe; for an intention to come under an obligation is not preſumed.

14. Quaſi-contracts are formed without explicit conſent, by one of the parties doing ſomething that by its nature either obliges him to the other party or the other party to him. Under this claſs may be reckoned tutory, *&c.* the entry of an heir, *negotiorum geſtio*, *indebiti ſolutio*, communion of goods between two or more common proprietors, and *mercium jactus levandæ navis cauſa*. *Negotiorum geſtio* forms thoſe obligations which ariſe from the management of a perſon's affairs in his abſence, by another, without a mandate. As ſuch manager acts without authority from the proprietor, he ought to be liable in exact diligence, unleſs he has from friendſhip interpoſed in affairs which admitted no delay; and he is accountable for his intromiſſions with intereſt. On the

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other part, he is intitled to the recovery of his neceſſary diſburſements on the ſubject, and to be relieved of the obligations in which he may have bound himſelf in conſequence of the management.

15. *Indebiti ſolutio*, or the payment to one of what is not due to him, if made through any miſtake, either of fact, or even of law, founds him who made the payment in an action againſt the receiver for repayment (*condictio indebiti.*) This action does not lie, 1. If the ſum paid was due *ex æquitate*, or by a natural obligation; for the obligation to reſtore is founded ſolely in equity. 2. If he who made the payment knew that nothing was due; for *qui conſulto dat quod non debebat, præſumitur donare.*

16. Where two or more perſons become common proprietors of the ſame ſubject, either by legacy, gift or purchaſe, without the view of co partnerſhip, an obligation is thereby created among the proprietors to communicate the profit and loſs ariſing from the ſubject, while it remains common: And the ſubject may be divided at the ſuit of any having intereſt. This diviſion, where the queſtion is among the common proprietors, is *according to the valuation of their reſpective properties:* But, where the queſtion is between the proprietors and thoſe having ſervitudes upon the property, the ſuperfice is only divided, without prejudice to the property. Commonties belonging to the King, or to royal boroughs, are not diviſible. Lands lying runrig, and belonging to different proprietors, may be divided, with the exception of borough and incorporated acres; the execution of which is committed to the judge-ordinary, or juſtices of the peace.

17. The throwing of goods overboard, for lightening a ſhip in a ſtorm, creates an obligation, whereby the owners of the ſhip and goods ſaved are obliged to contribute for the relief of thoſe whoſe goods were thrown overboard, that ſo all may bear a proportional loſs of the goods ejected for the common ſafety. In this contribution, the ſhip's proviſions ſuffer no eſtimation. A maſter who has cut his maſt, or parted with his anchor, to ſave the ſhip, is intitled to this relief; but if he has loſt them by the ſtorm, the loſs falls only on the ſhip and freight. If the ejection does not ſave the ſhip, the goods preſerved from ſhipwreck are not liable in contribution. Ejection may be lawfully made, if the maſter and a third part of the mariners judge that meaſure neceſſary, though the owner of the goods ſhould oppoſe it: And the goods ejected are to be valued at the price that the goods of the ſame ſort which are ſaved ſhall be afterwards ſold for.

18. There are certain obligations, which cannot ſubſiſt by themſelves, but are acceſſions to, or make a part of other obligations. Of this ſort are fidejuſſion, and the obligation to pay intereſt. Cautionry, or fidejuſſion, is that obligation by which one becomes engaged as ſecurity for another, that he ſhall either pay a ſum, or perform a deed.

19. A cautioner for a ſum of money may be bound, either ſimply as cautioner for the principal debtor, or conjunctly and ſeverally for and with the principal debtor. The firſt has, by our cuſtoms, the *beneficium ordinis*, or of diſcuſſion; by which the creditor is obliged to diſcuſs the proper debtor, before he can inſiſt for payment againſt the cautioner. Where one is bound as full debtor with and for the principal, or conjunctly and ſeverally with him, the two obligants are bound equally in the ſame obligation, each *in ſolidum*; and conſequently, the cautioner, though he is but an acceſſory, may be ſued for the whole, without either diſcuſſing, or even citing the principal debtor. Cautioners for performance of facts by another, or for the faithful diſcharge of an office, *e. g.* for factors, tutors, *&c.* cannot by the nature of their engagement be bound conjunctly and ſeverally with the principal obligant, becauſe the fact to which the principal is bound cannot poſſibly be performed by any other. In ſuch engagements, therefore, the failure muſt be previouſly conſtituted againſt the proper debtor, before action can be brought againſt the cautioner, for making up the loſs of the party ſuffering.

20. The cautioner, who binds himſelf at the deſire of the principal debtor, has an *actio mandati*, or of relief againſt him, for recovering the principal and intereſt paid by himſelf to the creditor, and for neceſſary damages; which action lies *de jure*, though the creditor ſhould not aſſign to him on payment. As relief againſt the debtor is implied in fidejuſſory obligations, the cautioner, where ſuch relief is cut off, is no longer bound: Hence, the defence of preſcription frees the cautioner, as well as the principal debtor.

21. But, 1. Where the cautionry is interpoſed to an obligation merely natural, the relief is reſtricted to the ſums that have really turned to the debtor's profit. 2. A cautioner who pays without citing the debtor, loſes his relief, in ſo far as the debtor had a relevant defence againſt the debt, in whole or in part. Relief is not competent to the cautioner, till he either pays the debt, or is diſtreſſed for it; except, 1. Where the debtor is expreſsly bound to deliver to the cautioner his obligation cancelled, againſt a day certain, and has failed; or, 2. Where the debtor is *vergens ad inopiam*; in which caſe the cautioner may, by proper diligence, ſecure the debtor's funds for his own relief, even before payment or diſtreſs.

22. A right of relief is competent *de jure* to the cautioner who pays againſt his co-cautioners, unleſs where the cautioner appears to have renounced it. In conſequence of this implied relief, a creditor, if he ſhall grant a diſcharge to any one of the cautioners, muſt, in demanding the debt from the others, deduct that part, as to which he has cut off their relief by that diſcharge. Where a cautioner in a bond ſigns a bond of corroboration, as a principal obligant with the proper debtor, and with them a new cautioner, the cautioner in the new bond is intitled to a total relief againſt the firſt cautioner, at whoſe deſire he is preſumed to be bound.

23. Cautionry is alſo judicial, as in a ſuſpenſion. It is ſufficient to looſe the cautioner, that when he became bound, the ſuſpender had good reaſon to ſuſpend, *e. g.* if the charger had at that period no title, or had not then performed his part, though theſe grounds of ſuſpenſion ſhould be afterwards taken off. In all maritime cauſes, where the parties are frequently foreigners, the defender muſt give caution *judicio ſiſti et judicatum ſolvi:* Such cautioner gets free by the death of the defender before ſentence;

fentence; but he continues bound, though the caufe fhould be carried from the admiral to the court of feffion. This fort of caution is only to be exacted in caufes ftrictly maritime.

24. It happens frequently, that a creditor takes two or more obligants bound to him, all as principal debtors, without fidejuffion. Where they are fo bound, for the performance of facts that are in themfelves indivifible, they are liable each for the whole, or *finguli in folidum*. But, if the obligation be for a fum of money, they are only liable *pro rata*; unlefs, 1. Where they are in exprefs words bound conjunctly and feverally; or, 2. In the cafe of bills or promiffory notes One of feveral obligants of this fort, who pays the whole debt, or fulfils the obligation, is intitled to a proportional relief againft the reft; in fuch manner, that the lofs muft, in every cafe, fall equally upon all the folvant obligants.

25. Obligations for fums of money are frequently accompanied with an obligation for the annualrent or intereft thereof. Intereft (*ufuræ*) is the profit due, by the debtor of a fum of money, to the creditor, for the ufe of it. The canon law confidered the taking of intereft as unlawful: The law of Mofes allowed it to be exacted from ftrangers; and all the reformed nations of Europe have found it neceffary, after the example of the Romans, to authorife it at certain rates fixed by ftatute. Soon after the reformation, our legal intereft was fixed at the rate of ten *per cent. per annum*; from which time, it has been gradually reduced, till at laft, by 12. *Ann. ftat.* 2. *c.* 16. it was brought to five *per cent.* and has continued at that rate ever fince.

26 Intereft is due, either by law, or by paction. It is due by law, either from the force of ftatute, under which may be included acts of federunt, or from the nature of the tranfaction. Bills of exchange, and inland bills, though they fhould not be protefted, carry intereft from their date in cafe of not acceptance; or from the day of their falling due, in cafe of acceptance and not payment. Where a bill is accepted, which bears no term of payment, or which is payable on demand, no intereft is due till demand be made of the fum, the legal voucher of which is a notorial proteft. Intereft is due by a debtor after denunciation, for all the fums contained in the diligence, even for that part which is made up of intereft. Sums paid by cautioners on diftrefs, carry intereft, not only as to the principal fum in the obligation, but as to to the intereft paid by the cautioner. Factors named by the court of Seffion are liable for intereft by a fpecial act of federunt; fee Tit. xix. 10.

27. It arifes *ex lege*, or from the nature of the tranfaction, that a purchafer in a fale is liable in intereft for the price of the lands bought from the term of his entry, though the price fhould be arrefted in his hands, or tho' the feller fhould not be able to deliver to him a fufficient progrefs or title to the lands; for no purchafer can in equity enjoy the fruits of the lands, while at the fame time he retains the intereft of the price: But lawful confignation of the price made by a purchafer, upon the refufal of the perfons having right to receive it, ftops the currency of intereft. Where one intermeddles with money belonging to another which carries intereft, he ought to reftore it *cum omni obventione et caufa*, and is therefore liable in the intereft of it, as being truly an acceffory of the fubject itfelf. It is alfo from the nature of the tranfaction, that intereft is in certain cafes allowed to merchants or others in name of damages.

28. Intereft is due by exprefs paction, where there is a claufe in a bond or obligation, by which money is made to carry intereft. An obligation is not lawful, where it is agreed on, that the yearly intereft of the fum lent, if it fhould not be paid punctually as it falls due, fhall be accumulated into a principal fum bearing intereft; but an obligation may be lawfully granted, not only for the fum truly lent, but for the intereft to the day at which the obligation is made payable, whereby the intermediate intereft is accumulated into a principal fum, from the term of payment. Intereft may be alfo due by implied paction: Thus, where intereft upon a debt is by a letter promifed for time paft, fuch promife implies a paction for intereft as long as the debt remains unpaid; thus alfo, the ufe of payment of intereft prefumes a paction, and when intereft is expreffed for one term, it is prefumed to be bargained for till payment.

29. The fubject matter of all obligations confifts either of things, or of facts. Things exempted from commerce cannot be the fubject of obligation. See Tit. viii. 2. et feq. One cannot be obliged to the performance of a fact naturally impoffible; nor of a fact in itfelf immoral, for that is alfo in the judgment of law impoffible. Since impoffible obligations are null, no penalty or damage can be incurred for non-performance; but it is otherwife, if the fact be in itfelf poffible, though not in the debtor's power; in which cafe the rule obtains, *locum facti impræftabilis fubit damnum et intereffe*.

30. An obligation, to which a condition is adjected, either naturally or morally impoffible, is in the general cafe null; for the parties are prefumed not to have been ferious. But fuch obligation is valid, and the condition thereof held *pro non fcripta*, 1. In teftaments; 2. In obligations, to the performance of which the granter lies under a natural tie, as in bonds of provifion to a child. Where an obligation is granted under a condition, lawful but unfavourable, *e. g.* that the creditor fhall not marry without the confent of certain friends, no more weight is given to the condition than the judge thinks reafonable, A condition, which is in fome degree in the power of the creditor himfelf, is held as fulfilled, if he has done all he could to fulfil it. Implement or performance cannot be demanded in a mutual contract, by that party who himfelf declines, or cannot fulfil the counterpart.

31. Donation, fo long as the fubject is not delivered to the donee, may be juftly ranked among obligations; and it is that obligation which arifes from the mere good will and liberality of the granter. Donations imply no warrandice, but from the future facts of the donor. They are hardly revokable by our law for ingratitude, though it fhould be of the groffeft kind: Thofe betwixt man and wife are revokable by the donor, even after the death of the donee; but remuneratory grants, not being truly donations, cannot be fo revoked That fpecial fort of donation, which is conftituted verbally, is called a promife. The Roman law intitled all donors to the *beneficium*

neficium competentiæ, in virtue of which they might retain ſuch part of the donation as was neceſſary for their own ſubſiſtence. Our law allows this benefit to fathers, with reſpect to the proviſions granted to their children, and to grandfathers, which is a natural conſequence of childrens obligation to aliment their indigent parents; but to no collateral relation, not even to brothers.

32. Donations, made in contemplation of death, or *mortis cauſa*, are of the nature of legacies, and like them revokable: Conſequently, not being effectual in the granter's life, they cannot compete with any of his creditors; not even with thoſe whoſe debts were contracted after the donation. They are underſtood to be given from a perſonal regard to the donee, and therefore fall by his predeceaſe. No deed, after delivery, is to be preſumed a *donatio mortis cauſa*; for revocation is excluded by delivery.

33. Deeds are not preſumed, *in dubio*, to be donations. Hence, a deed by a debtor to his creditor, if donation be not expreſſed, is preſumed to be granted in ſecurity or ſatisfaction of the debt; but bonds of proviſion to children are, from the preſumption of paternal affection, conſtrued to be intended as an additional patrimony: Yet a tocher, given to a daughter in her marriage-contract, is preſumed to be in ſatisfaction of all former bonds and debts; becauſe marriage-contracts uſually contain the whole proviſions in favour of the bride. One who aliments a perſon that is come of age, without an expreſs paction for board, is preſumed to have entertained him as a friend, unleſs in the caſe of thoſe who earn their living by the entertainment or board of ſtrangers. But alimony given to minors, who cannot bargain for themſelves, is not accounted a donation; except either where it is preſumed, from the near relation of the perſon alimenting, that it was given *ex pietate*; or where the minor had a father or curators, with whom a bargain might have been made.

Tit. 23. *Of the Diſſolution or Extinction of Obligations.*

Obligations may be diſſolved by performance or implement, conſent, cômpenſation, novation, and confuſion. 1. By ſpecifical performance: Thus, an obligation for a ſum of money is extinguiſhed by payment. The creditor is not obliged to accept of payment by parts, unleſs where the ſum is payable by different diviſions. If a debtor in two or more ſeparate bonds to the ſame creditor, made an indefinite payment, without aſcribing it, at the time, to any one of the obligations, the payment is applied, 1. To intereſt, or to ſums not bearing intereſt. 2. To the ſums that are leaſt ſecured, if the debtor thereby incurs no rigorous penalty. But, 3. If this application be penal on the debtor, *e. g.* by ſuffering the legal of an adjudication to expire, the payment will be ſo applied to as to ſave the debtor from that forfeiture. Where one of the debts is ſecured by a cautioner, the other not, the application is to be ſo made, *cæteris paribus*, that both creditor and cautioner may have equal juſtice done to them.

2. Payment made by the debtor upon a miſtake in fact, to one whom he believed, upon probable grounds, to have the right of receiving payment, extinguiſhes the obligation. But payment made to one, to whom the law denies the power of receiving it, has not this effect; as if a debtor, ſeized by letters of caption, ſhould make payment to the meſſenger; for *ignorantia juris neminem excuſat*. In all debts, the debtor, if he be not interpelled, may ſafely pay before the term, except in tack-duties or feu-duties; the payment whereof, before the terms at which they are made payable, is conſtrued to be colluſive, in a queſtion with a creditor of the landlord or ſuperior. Payment is *in dubio* preſumed, by the voucher of the debt being in the hands of the debtor; *chirographum, apud debitorem repertum, præſumitur ſolutum.*

3. Obligations are extinguiſhable by the conſent of the creditor, who, without full implement, or even any implement, may renounce the right conſtituted in his own favour. Though a diſcharge or acquittance, granted by one whom the debtor *bona fide* took for the creditor, but who was not, extinguiſhes the obligation, if the ſatisfaction made by the debtor was real; yet where it is imaginary, the diſcharge will not ſcreen him from paying to the true creditor the debt that he had made no prior ſatisfaction for. In all debts which are conſtituted by writing, the extinction, whether it be by ſpecifical performance, or bare conſent, muſt be proved, either by the oath of the creditor, or by a diſcharge in writing; and the ſame ſolemnities which law requires in the obligation, are neceſſary in the diſcharge: But, where payment is made, not by the debtor himſelf, but by the creditor's intromiſſion with the rents of the debtor's eſtate, or by delivery to him of goods in name of the debtor, ſuch delivery or intromiſſion, being *facti*, may be proved by witneſſes, though the debt ſhould have been not only conſtituted by writing, but made real on the debtor's lands by adjudication.

4. A diſcharge, though it ſhould be general, of all that the granter can demand, extends not to debts of an uncommon kind, which are not preſumed to have been under the granter's eye. This doctrine applies alſo to general aſſignations. In annual payments, as of rents, feu-duties, intereſt, *&c.* three conſecutive diſcharges by the creditor, of the yearly or termly duties, preſume the payment of all preceedings. Two diſcharges by the anceſtor, and the third by the heir, do not infer this preſumption, if the heir was ignorant of the anceſtor's diſcharges. And diſcharges by an adminiſtrator, as a factor, tutor, *&c.* preſume only the payment of all preceeding duties incurred during his adminiſtration. This preſumption ariſes from repeating the diſcharges thrice ſucceſſively; and ſo does not hold in the caſe of two diſcharges, though they ſhould include the duties of three or more terms.

5. Where the ſame perſon is both creditor and debtor to another, the mutual obligations, if they are for equal ſums, are extinguiſhed by compenſation; if for unequal, ſtill the leſſer obligation is extinguiſhed, and the greater diminiſhed, as far as the concourſe of debt and credit goes. To found compenſation, 1. Each of the parties muſt be debtor and creditor at the ſame time. 2. Each

of

of them muſt be debtor and creditor in his own right. 3. The mutual debts muſt be of the ſame quality: Hence, a ſum of money cannot be compenſated with a quantity of corns; becauſe, till the prices are fixed, at which the corns are to be converted into money, the two debts are incommenſurable. Laſtly, compenſation cannot be admitted, where the mutual debts are not clearly aſcertained, either by a written obligation, the ſentence of a judge, or the oath of the party. Where this requires but a ſhort diſcuſſion, ſentence for the purſuer is delayed for ſome time, *ex æquitate*, that the defender may make good his ground of compenſation. Where a debt for fungibles is aſcertained in money, by the ſentence of a judge, the compenſation can have no effect farther back than the liquidation, becauſe, before ſentence, the debts were incommenſurable: But, where a debt for a ſum of money is, in the courſe of a ſuit, conſtituted by the oath of the debtor, the compenſation, after it is admitted by the judge, operates, *retro*, in ſo far as concerns the currency of intereſt, to the time that, by the parties acknowledgment, the debt became due; for, in this caſe, the debtor's oath is not what creates the debt, or makes it liquid; it only declares that ſuch a liquid ſum was truly due before. Compenſation cannot be offered after decree, either by way of ſuſpenſion or reduction; unleſs it has been formerly pleaded, and unjuſtly repelled. Decrees in abſence are excepted.

6. The right of retention, which bears a near reſemblance to compenſation, is chiefly competent, where the mutual debts, not being liquid, cannot be the ground of compenſation; and it is ſometimes admitted *ex æquitate*, in liquid debts, where compenſation is excluded by ſtatute: Thus, though compenſation cannot be pleaded after decree, either againſt a creditor or his aſſigney; yet, if the original creditor ſhould become bankrupt, the debtor, even after decree, may retain againſt the aſſigney, till he gives ſecurity for ſatisfying the debtor's claim againſt the cedent. This right is frequently founded in the expence diſburſed or work employed on the ſubject retained, and ſo ariſes from the mutual obligations incumbent on the parties. But retention may be ſuſtained, though the debt due to him who claims it does not ariſe from the nature of the obligation by which he is debtor: Thus, a factor on a land eſtate may retain the ſums levied by him in conſequence of his factory, not only till he be paid of the diſburſements made on occaſion of ſuch eſtate, but alſo till he be diſcharged from the ſeparate engagements he may have entered into on his conſtituent's account.

7. Obligations are diſſolved by novation, whereby one obligation is changed into another, without changing either the debtor or creditor. The firſt obligation being thereby extinguiſhed, the cautioners in it are looſed, and all its conſequences diſcharged; ſo that the debtor remains bound only by the laſt. As a creditor to whom a right is once conſtituted, ought not to loſe it by implication, novation is not eaſily preſumed, and the new obligation is conſtrued to be merely corroborative of the old; but, where the ſecond obligation expreſsly bears to be *in ſatisfaction* of the firſt, theſe words muſt neceſſarily be explained into novation. Where the creditor accepts of a new debtor, in place of the former who is diſcharged, this method of extinction is called delegation.

8. Obligations are extinguiſhed *confuſione*, where the debt and credit meet in the ſame perſon, either by ſucceſſion or ſingular title, *e. g.* when the debtor ſucceeds to the creditor, or the creditor to the debtor, or a ſtranger to both, for one cannot be debtor to himſelf. If the ſucceſſion, from which the *confuſio* ariſes, happens afterwards to be divided, ſo as the debtor and creditor come again to be different perſons; the *confuſio* does not produce an extinction, but only a temporary ſuſpenſion of the debt.

Tit. 24. *Of Aſſignations.*

Heritable rights, when they are cloathed with infeftment, are tranſmitted by diſpoſition, which is a writing containing procuratory of reſignation and precept of ſeiſin; but thoſe which either require no ſeiſin, or on which ſeiſin has actually followed, are tranſmiſſible by ſimple aſſignation. He who grants the aſſignation, is called the cedent; and he who receives it, the aſſigney or ceſſionary: If the aſſigney conveys his right to a third perſon, it is called a tranſlation; and if he aſſigns it back to the cedent, a retroceſſion. Certain rights are, from the uſes to which they are deſtined, incapable of tranſmiſſion, as alimentary rights: Others cannot be aſſigned by the perſon inveſted in them, without ſpecial powers given to him, as tacks, reverſions: The tranſmiſſion of a third ſort, is not preſumed to be intended, without an expreſs conveyance; as of paraphernal goods, which are ſo proper to the wife, that a general aſſignation by her to her huſband, of all that did or ſhould belong to her at her deceaſe, does not comprehend them. A liferent-right is, by its nature, incapable of a proper tranſmiſſion; but its profits may be aſſigned, while it ſubſiſts.

2. Aſſignations muſt not only be delivered to the aſſigney, but intimated by him to the debtor. Intimations are conſidered as ſo neceſſary for compleating the conveyance, that in a competition between two aſſignations, the laſt, if firſt intimated, is preferred.

3. Though, regularly, intimation to the debtor is made by an inſtrument, taken in the hands of a notary, by the aſſigney or his procurator; yet the law admits equipollencies, where the notice of the aſſignment given to the debtor is equally ſtrong. Thus, a charge upon letters of horning at the aſſigney's inſtance, or a ſuit brought by him againſt the debtor, ſupplies the want of intimation; theſe being judicial acts, which expoſe the conveyance to the eyes both of the judge and of the debtor; or the debtor's promiſe of payment by writing to the aſſigney, becauſe that is in effect a corroborating of the original debt. The aſſigney's poſſeſſion of the right, by entering into payment of the rents or intereſt, is alſo equal to an intimation; for it imports, not only notice to the debtor, but his actual compliance: But the debtor's private knowledge of the aſſignment is not ſuſtained as intimation.

4. Certain conveyances need no intimation. 1. Indorſations of bills of exchange; for theſe are not to be fettered with forms, introduced by the laws of particular ſtates. 2. Bank-notes are fully conveyed by the bare delivery

delivery of them; for as they are payable to the bearer, their property muſt paſs with their poſſeſſion. 3. Adjudication, which is a judicial conveyance, and marriage, which is a legal one, carry the full right of the ſubjects thereby conveyed, without intimation: neverthelefs, as there is nothing in theſe conveyances which can of themſelves put the debtor *in mala fide*, he is therefore *in tuto* to pay to the wife, or to the original creditor in the debt adjudged, till the marriage or adjudication be notified to him. Aſſignments of moveable ſubjects, though they be intimated, if they are made *retenta poſſeſſione*, (the cedent retaining the poſſeſſion), cannot hurt the cedent's creditors; for ſuch rights are preſumed, in all queſtions with creditors, to be colluſive, and granted in truſt for the cedent himſelf.

5. An aſſignation carries to the aſſigney the whole right of the ſubject conveyed, as it was in the cedent; and conſequently, he may uſe diligence, either in his cedent's name while he is alive, or in his own.

6. After an aſſignation is intimated, the debtor cannot prove payment, or compenſation, by the oath of the cedent, who has no longer any intereſt in the debt; unleſs the matter has been made litigious by an action commenced prior to the intimation: But the debtor may refer to the oath of the aſſigney, who is in the right of the debt, that the aſſignment was gratuitous, or in truſt for the cedent; either of which being proved, the oath of the cedent will affect the aſſigney. If the aſſignation be in part onerous, and in part gratuitous, the cedent's oath is good againſt the aſſigney, only in ſo far as his right is gratuitous. All defences competent againſt the original creditor in a moveable debt, which can be proved otherwiſe than by his oath, continue relevant againſt even an onerous aſſigney; whoſe right can be no better than that of his author, and muſt therefore remain affected with all the burdens which attended it in the author's perſon.

Tit. 25. *Of Arreſtments and Poindings.*

The diligences, whereby a creditor may affect his debtor's moveable ſubjects, are arreſtment and poinding. By arreſtment is ſometimes meant the ſecuring of a criminal's perſon till trial; but as it is underſtood in the rubric of this title, it is the order of a judge, by which he who is debtor in a moveable obligation to the arreſter's debtor, is prohibited to make payment or delivery till the debt due to the arreſter be paid or ſecured. The arreſter's debtor is uſually called the common debtor; becauſe, where there are two or more competing creditors, he is debtor to all of them. The perſon in whoſe hands the diligence is uſed, is ſtyled the arreſtee.

2. Arreſtment may be laid on by the authority either of the ſupreme court, or of an inferior judge. In the firſt caſe, it proceeds either upon ſpecial letters of arreſtment, or on a warrant contained in letters of horning; and it muſt be executed by a meſſenger. The warrants granted by inferior judges are called precepts of arreſtment, and they are executed by the officer proper to the court. Where the debtor to the common debtor is a pupil, arreſtment is properly uſed in the hands of the tutor, as the pupil's adminiſtrator: This doctrine may perhaps extend to other general adminiſtrators, as commiſſioner, *&c.* But arreſtment, uſed in the hands of a factor or ſteward, cannot found an action of forthcoming without calling the conſtituent. Where the debtor to the common debtor is a corporation, arreſtment muſt be uſed in the hands of the directors or treaſurer, who repreſent the whole body. Arreſtment, when it is uſed in the hands of the debtor himſelf, is inept; for that diligence is intended only as a reſtraint upon third parties.

3. All debts, in which one is perſonally bound, though they ſhould be heritably ſecured, are grounds upon which the creditor may arreſt the moveable eſtate belonging to his debtor. Arreſtment may proceed on a debt the term of payment whereof is not yet come, in caſe the debtor be *vergens ad inopiam.* If a debt be not yet conſtituted by decree or regiſtration, the creditor may raiſe and execute a ſummons againſt his debtor for payment, on which pending action arreſtment may be uſed, in the ſame manner as inhibition, which is called arreſtment upon a dependence. If one's ground of credit be for the performance of a fact, or if his depending proceſs be merely declaratory, without a concluſion of payment or delivery, ſuch claims are not admitted to be ſufficient grounds for arreſtment.

4. Moveable debts are the proper ſubject of arreſtment; under which are comprehended conditional debts, and even depending claims. For leſſening the expence of diligence to creditors, all bonds which have not been made properly heritable by ſeiſin are declared arreſtable. But this does not extend to adjudications, wadſets, or other perſonal rights of lands, which are not properly debts. Certain moveable debts are not arreſtable. 1. Debts due by bill, which paſs from hand to hand as bags of money. 2. Future debts; for though inhibition extends to *adquirenda* as well as *adquiſita*, yet arreſtment is limited, by its warrant, to the debt due at the time of ſerving it againſt the arreſtee. Hence, an arreſtment of rents or intereſt carries only thoſe that have already either fallen due, or at leaſt become current. Claims, depending on the iſſue of a ſuit, are not conſidered as future debts; for the ſentence, when pronounced, has a retroſpect to the period at which the claim was firſt founded. The like doctrine holds in conditional debts. 3. Alimentary debts are not arreſtable; for theſe are granted on perſonal conſiderations, and ſo are not communicable to creditors; but the paſt intereſt due upon ſuch debt may be arreſted by the perſon who has furniſhed the alimony. One cannot ſecure his own effects to himſelf for his maintenance, ſo as they ſhall not be affectable by his creditors. Salaries annexed to offices granted by the king, and particularly thoſe granted to the judges of the Seſſion, and the fees of ſervants, are conſidered as alimentary funds; but the ſurplus fee, over and above what is neceſſary for the ſervant's perſonal uſes, may be arreſted.

5. If, in contempt of the arreſtment, the arreſtee ſhall make payment of the ſum, or deliver the goods arreſted, to the common debtor, he is not only liable criminally for breach of arreſtment, but he muſt pay the debt again to the arreſter. Arreſtment is not merely prohibitoty, as inhibitions are; but is a ſtep of diligence which founds the uſer in a ſubſequent action, whereby the property of the

the fubject arrefted may be adjudged to him: It therefore does not, by our later practice, fall by the death of the arreftee, but continues to fubfift, as a foundation for an action of forthcoming againft his heir, while the fubject arrefted remains *in medio*. Far lefs is arreftment loft, either by the death of the arrefter, or of the common debtor.

6. Where arreftment proceeds on a depending action, it may be loofed by the common debtor's giving fecurity to the arrefter for his debt, in the event it fhall be found due. Arreftment founded on decrees, or on regiftred obligations, which in the judgment of law are decrees, cannot be loofed, but upon payment or confignation; except, 1. Where the term of payment of the debt is not yet come, or the condition has not yet exifted. 2. Where the arreftment has proceeded on a regiftred contract, in which the debts or mutual obligations are not liquid. 3. Where the decree is fufpended, or turned into a libel; for, till the fufpenfion be difcuffed, or the pending action concluded, it cannot be known whether any debt be truly due. A loofing takes off the *nexus*, which had been laid on the fubject arrefted; fo that the arreftee may thereafter pay fafely to his creditor, and the cautioner is fubftituted in place of the arreftment, for the arrefter's fecurity: Yet the arrefter may, while the fubject continues with the arreftee, purfue him in a forthcoming, notwithftanding the loofing.

7. Arreftment is only an inchoated or begun diligence; to perfect it, there muft be an action brought by the arrefter againft the arreftee, to make the debt or fubject arrefted forthcoming. In this action, the common debtor muft be called for his intereft, that he may have an opportunity of excepting to the lawfulnefs or extent of the debt, on which the diligence proceeded. Before a forthcoming can be purfued, the debt due by the common debtor to the arrefter, muft be liquidated; for the arrefter can be no further intitled to the fubject arrefted than to the extent of the debt due to him by the common debtor. Where the fubject arrefted is a fum of money, it is, by the decree of forthcoming, directed to be paid to the purfuer towards fatisfying his debt; where goods are arrefted, the judge ordains them to be expofed fale, and the price to be delivered to the purfuer. So that in either cafe, decrees of forthcoming are judicial affignations to the arrefter of the fubject arrefted

8. In all competitions, regard is had to the dates, not of the grounds of debt, but of the diligences proceeding upon them. In the competition of arreftments, the preference is governed by their dates, according to the priority even of hours, where it appears with any certainty which is the firft. But, as arreftment is but a begun diligence, therefore if a prior arrefter fhall neglect to infift in an action of forthcoming for fuch a time as may be reafonably conftrued into a defertion of his begun diligence, he lofes his preference. But, as dereliction of diligence is not eafily prefumed, the diftance of above two years, between the firft arreftment and the decree of forthcoming, was found not to make fuch a *mora* as to intitle the pofterior arrefter to a preference. This rule of preference, according to the dates of the feveral arreftments, holds, by our prefent practice, whether they have proceeded on a decree, or on a dependence; on debts not yet payable, or on debts already payable; provided the pendency fhall have been clofed, or the debt have become payable, before the iffue of the competition.

9. In the competition of arreftments with affignations, an affignation by the common debtor, intimated before arreftment, is preferable to the arreftment. If the affignation is granted before arreftment, but not intimated till after it, the arrefter is preferred

10. Poinding is that diligence affecting moveable fubjects, by which their property is carried directly to the creditor. No poinding can proceed, till a charge be given to the debtor to pay or perform, and the days thereof be expired, except poindings againft vaffals for their feu duties, and poindings againft tenants for rent, proceeding upon the landlord's own decree; in which the ancient cuftom of poinding without a previous charge continues. A debtor's goods may be poinded by one creditor, though they have been arrefted before by another; for arreftment being but an imperfect diligence, leaves the right of the fubject ftill in the debtor, and fo cannot hinder any creditor from ufing a more perfect diligence, which has the effect of carrying the property directly to himfelf.

11. No cattle pertaining to the plough, nor inftruments of tillage, can be poinded in the time of labouring or tilling the ground, unlefs where the debtor has no other goods. By labouring time is underftood, that time, in which that tenant, whofe goods are to be poinded, is ploughing, though he fhould have been earlier or later than his neighbours; but fummer-fallowing does not fall under this rule.

12. In the execution of poinding, the debtor's goods muft be apprifed, firft on the ground of the lands where they are laid hold on, and a fecond time at the market-crofs of the jurifdiction, by the ftated apprifers thereof; or, if there are none, by perfons named by the meffenger or other officer employed in the diligence. Next, the meffenger muft, after public intimation by three oyeffes, declare the value of the goods according to the fecond apprifement, and require the debtor to make payment of the debt, including intereft and expences. If payment fhall be offered to the creditor, or in his abfence to his lawful attorney; or if, in cafe of refufal by them, confignation of the debt fhall be made in the hands of the judge-ordinary or his clerk, the goods muft be left with the debtor; if not, the meffenger ought to adjudge and deliver them over, at the apprifed value, to the ufer of the diligence towards his payment: And the debtor is intitled to a copy of the warrant and executions, as a voucher that the debt is difcharged in whole or in part by the goods poinded.

13. Minifters may poind for their ftipends, upon one apprifement on the ground of the lands; and landlords were always in ufe to poind fo, for their rents. Apprifement of the goods at the market-crofs of the next royal borough, or even of the next head-borough of ftewartry or regality, though thefe jurifdictions be abolifhed, is declared as fufficient as if they were carried to the head-borough of the fhire. Poinding, whether it be confidered as a fentence, or as the execution of a fentence, muft be proceeded

proceeded in between ſun-riſing and ſun-ſetting; or at leaſt it muſt be finiſhed before the going off of day-light. The powers of the officer employed in the execution of poindings, are not clearly defined by cuſtom, in the caſe of a third party claiming the property of the goods to be poinded. This is certain, that he may take the oath of the claimant, upon the verity of his claim; and if from thence it ſhall appear that the claimant's title is colluſive, he ought to proceed in the diligence; but, if there remains the leaſt doubt, his ſafeſt courſe is to deliver the goods to the claimant, and to expreſs in his execution the reaſons why poinding did not proceed.

14. Any perſon who ſtops a poinding *via facti*, on groundleſs pretences, is liable, both criminally, in the pains of deforcement, (ſee Tit. xxxiii. 15.) and civilly, in the value of the goods which might have been poinded by the creditor.

Tit. 26. *Of Preſcriptions.*

Prescription, which is a method, both of eſtabliſhing and of extinguiſhing property, is either poſitive or negative. Poſitive preſcription is generally defined, as the Roman *uſucapio*, the acquiſition of property (it ſhould rather be, when applied to our law, the ſecuring it againſt all further challenge) by the poſſeſſor's continuing his poſſeſſion for the time which law has declared ſufficient for that purpoſe: Negative, is the loſs or amiſſion of a right, by neglecting to follow it forth, or uſe it, during the whole time limited by law. The doctrine of preſcription, which is, by ſome writers, condemned as contrary to juſtice, has been introduced, that the claims of negligent creditors might not ſubſiſt for ever, that property might be at laſt fixed, and forgeries diſcouraged, which the difficulty of detecting muſt have made exceeding frequent, if no length of time had limited the legal effect of writings.

2. Poſitive preſcription was firſt introduced into our law by 1617, *c.* 12. which enacts, that whoever ſhall have poſſeſſed his lands, annualrents, or other heritages, peaceably in virtue of infeftments, for forty years continually after their dates, ſhall not thereafter be diſquieted in his right by any perſon pretending a better title. Under *heritages* are comprehended every right that is *fundo annexum*, and capable of continual poſſeſſion. Continued poſſeſſion, if proved as far back as the memory of man, preſumes poſſeſſion upwards to the date of the infeftment. The whole courſe of poſſeſſion muſt by the act be founded on ſeiſins, and conſequently no part thereof on the bare right of apparency; but forty years poſſeſſion, without ſeiſin, is ſufficient in the preſcription of ſuch heritable rights as do not require ſeiſin. The poſſeſſion muſt alſo be without any *lawful* interruption, *i. e.* it muſt neither be interrupted *via facti*, nor *via juris*. The preſcription of ſubjects not expreſſed in the infeftment as part and pertinent of another ſubject ſpecially expreſſed, has been explained, Tit. xiii. 6.

3. The act requires, that the poſſeſſor produce, as his title of preſcription, a charter of the lands, preceeding the forty years poſſeſſion, with the ſeiſin following on it: and where there is no charter extant, ſeiſins, one or more ſtanding together for forty years, and proceeding either on retours, or precepts of *clare conſtat*. This has given riſe to a reaſonable diſtinction obſerved in practice, between the preſcription of a ſingular ſucceſſor, and of an heir. Singular ſucceſſors muſt produce for their title of preſcription, not only a ſeiſin, but its warrant, as a charter, diſpoſition, *&c.* either in their own perſon, or in that of their author: But the production by an heir of ſeiſins, one or more, ſtanding together for forty years, and proceeding on retours or precepts of *clare conſtat*, is ſufficient. The heir is not obliged to produce the retours or precepts on which his ſeiſins proceed, nor is the ſingular ſucceſſor obliged to produce the ground of his charter; ſo that if the title of preſcription produced be a fair deed, and a ſufficient title of property, the poſſeſſor is ſecure by the act, which admits no ground of challenge, but falſehood. A ſpecial ſtatute, for eſtabliſhing the poſitive preſcription in moveable rights, was not neceſſary; for, ſince a title in writing is not requiſite for the acquiring of theſe, the negative preſcription, by which all right of action for recovering their property is cut off, effectually ſecures the poſſeſſor.

4. The negative preſcription of obligations, by the lapſe of forty years, was introduced into our law long before the poſitive, by 1469, *c.* 29.—1474, *c.* 55. This preſcription is now amplified by the foreſaid act 1617, which has extended it to all actions competent upon heritable bonds, reverſions, and others whatſoever; unleſs where the reverſions are either incorporated in the body of the wadſet right, or regiſtred in the regiſter of reverſions: And reverſions ſo incorporated, or regiſtred, are not only exempted from the negative preſcription, but they are an effectual bar againſt any perſon from pleading the poſitive.

5. A ſhorter negative preſcription is introduced by ſtatute, in certain rights and debts. Actions of ſpuilzie, ejection, *and others of that nature*, muſt be purſued within three years after the commiſſion of the fact on which the action is founded. As in ſpuilzes and ejections, the purſuer was intitled, *in odium* of violence, to a proof by his own oath *in litem*, and to the violent profits againſt the defender, the ſtatute meant only to limit theſe ſpecial privileges by a three years preſcription, without cutting off the right of action, where the claim is reſtricted to ſimple reſtitution. Under the general words, *and others of that nature*, are comprehended all actions where the purſuer is admitted to prove his libel by his own oath *in litem*.

6. Servants fees, houſe-rents, mens ordinaries, (*i. e.* mony due for board,) and merchants accounts, fall under the triennial preſcription, by 1579, *c.* 83. There is alſo a general clauſe ſubjoined to this ſtatute, of *other the like debts*, which includes alimentary debts, wages due to workmen, and accounts due to writers, agents, or procurators. Theſe debts may by this act, be proved after the three years, either by the writing or oath of the debtor; ſo that they preſcribe only as to the mean of proof by witneſſes; but after the three years, it behoves the creditor to refer to the debtor's oath, not only the conſtitution, but the ſubſiſtence of the debt. In the preſcription of houſe rents, ſervants fees, and alimony, each term's

term's rent, fee, or alimony, runs a ſeparate courſe of preſcription; ſo that in an action for theſe, the claim will be reſtricted to the arrears incurred within the three years immediately before the citation: But, in accounts, preſcription does not begin till the laſt article; for a ſingle article cannot be called an account. Actions of removing muſt alſo be purſued within three years after the warning. Reductions of erroneous retours, preſcribe, if not purſued within twenty years.

7. Miniſters ſtipends and multures preſcribe in five years after they are due; and arrears of rent, five years after the tenant's removing from the lands. As the preſcription of mails and duties was introduced in favour of poor tenants, that they might not ſuffer by neglecting to preſerve their diſcharges, a proprietor of lands ſubject to a liferent, who had obtained a leaſe of all the liferented lands from the liferenter, is not intitled to plead it, nor a tackſman of one's whole eſtate, who had by the leaſe a power of removing tenants. Bargains concerning moveables, or ſums of money which are proveable by witneſſes, preſcribe in five years after the bargain. Under theſe are included ſales, locations, and all other conſenſual contracts, to the conſtitution of which writing is not neceſſary. But all the above mentioned debts, may, after the five years, be proved, either by the oath or the writing of the debtor; of which above, § 6. A quinquennial preſcription is eſtabliſhed in arreſtments, whether on decrees or depending actions: The firſt preſcribe in five years after uſing the arreſtment, and the laſt in five years after ſentence is pronounced on the depending action.

8. No perſon binding for or with another, either as cautioner or co-principal, in a bond or contract for a ſum of money, continues bound after ſeven years from the date of the bond, provided he has either a clauſe of relief in the bond, or a ſeparate bond of relief, intimated to the creditor, at his receiving the bond. But all diligence uſed within the ſeven years againſt the cautioner, ſhall ſtand good. As this is a public law, intended to prevent the bad conſequences of raſh engagements, its benefit cannot, before the lapſe of the ſeven years, be renounced by the cautioner. As it is correctory, it is ſtrictly interpreted: Thus, bonds bearing a mutual clauſe of relief *pro rata*, fall not under it; nor bonds of corroboration, nor obligations, where the condition is not purified, or the term of payment not come within the ſeven years; becauſe no diligence can be uſed on theſe. The ſtatute excludes all cautionries for the faithful diſcharge of offices; theſe not being obligations in a bond or contract for ſums of money. And practice has denied the benefit of it to all judicial cautioners, as cautioners in a ſuſpenſion. Actions of count and reckoning, competent either to minors againſt their tutors or curators, or *vice verſa*, preſcribe in ten years after the majority or death of the minor.

9. Holograph bonds, miſſive letters, and books of account, not atteſted by witneſſes, preſcribe in twenty years, unleſs the creditor ſhall thereafter prove the verity of the ſubſcription by the debtor's oath. It is therefore ſufficient to ſave from the effect of this preſcription, that the conſtitution of the debt be proved by the party's oath, after the twenty years; whereas in ſtipends, merchants accounts, *&c.* not only the conſtitution, but the ſubſiſtence of the debt, muſt be proved by writing or the debtor's oath, after the term of preſcription. Some lawyers extend this preſcription of holograph writings to all obligations for ſums not exceeding L. 100 *Scots*, which are not atteſted by witneſſes; becauſe though theſe are in practice ſuſtained, yet they ought not to have the ſame duration with deeds atteſted by witneſſes. Though in the ſhort preſcriptions of debts, the right of action is forever loſt, if not exerciſed within the time limited; yet where action was brought on any of thoſe debts, before the preſcription was run, it ſubſiſted, like any other right, for forty years. As this defeated the purpoſe of the acts eſtabliſhing theſe preſcriptions, all proceſſes upon warnings, ſpuilzies, ejections, or arreſtments, or for payment of the debts contained in act 1669, *c.* 9. are by the ſaid act, joined with 1685, *c.* 14. declared to preſcribe in five years, if not wakened within that time; ſee Tit. 30.

10. Certain obligations are loſt by the lapſe of leſs than forty years, without the aid of ſtatute, where the nature of the obligation, and the circumſtances of parties, juſtify it: Thus, bills which are not intended for laſting ſecurities, produce no action, where the creditor has been long ſilent, unleſs the ſubſiſtence of the debt be proved by the debtor's oath; but the preciſe time is not fixed by practice. Thus alſo, a receipt for bills granted by a writer to his employer, not inſiſted upon for twenty-three years, was found not productive of an action. The preſcriptions of the reſtitution of minors, of the benefit of inventory, *&c.* are explained in their proper places.

11. In the poſitive preſcription, as eſtabliſhed by the act 1617, the continued poſſeſſion for forty years, proceeding upon a title of property not chargeable with falſehood, ſecures the poſſeſſor againſt all other grounds of challenge, and ſo preſumes *bona fides, præſumptione juris et de jure*. In the long negative preſcription, *bona fides* in the debtor is not required: The creditor's neglecting to inſiſt for ſo long a time, is conſtrued as an abandoning of his debt, and ſo is equivalent to a diſcharge. Hence, though the ſubſiſtence of the debt ſhould be referred to the debtor's own oath, after the forty years, he is not liable.

12. Preſcription runs *de momento in momentum*: The whole time defined by law muſt be compleated, before a right can be either acquired or loſt by it; ſo that interruption, made on the laſt day of the fortieth year, breaks its courſe. The poſitive preſcription runs againſt the Sovereign himſelf, even as to his annexed property, but it is generally thought he cannot ſuffer by the negative: He is ſecured againſt the negligence of his officers, in the management of proceſſes by expreſs ſtatute, 1600, *c.* 14. The negative, as well as the poſitive preſcription, runs againſt the church, though churchmen have but a temporary intereſt in their benefices. But becauſe the rights of beneficiaries to their ſtipends are liable to accidents, through the frequent change of incumbents, thirteen years poſſeſſion does, by a rule of the Roman chancery which we have adopted, found a preſumptive title in the beneficiary: But this is not properly preſcription; for if by titles recovered, perhaps out of the incumbent's own hands,

hands, it ſhall appear that he has poſſeſſed tithes, or other ſubjects, to a greater extent than he ought, his poſſeſſion will be reſtricted accordingly. This right muſt not be confounded with that eſtabliſhed in favour of churchmen, which is confined to church lands and rents, and conſtitutes a proper preſcription, upon a poſſeſſion of thirty years.

13. The clauſe in the act 1617, ſaving minors from preſcription, is extended to the poſitive, as well as to the negative preſcription; but the exception of minority is not admitted in the caſe of hoſpitals for children, where there is a continual ſucceſſion of minors, that being a *caſus inſolitus*. Minors are expreſsly excepted in ſeveral of the ſhort preſcriptions, as 1579, *c*. 81.——1669, *c*. 9.; but where law leaves them in the common caſe, they muſt be ſubject to the common rules.

14. Preſcription does not run *contra non valentem agere*, againſt one who is barred, by ſome legal incapacity, from purſuing; for in ſuch caſe, neither negligence nor dereliction can be imputed to him. This rule is, by a favourable interpretation, extended to wives who *ex reverentia maritali* forbear to purſue actions competent to them againſt their huſbands. On the ſame ground, preſcription runs only from the time that the debt or right could be ſued upon. Thus, inhibition preſcribes only from the publiſhing of the deed granted to the inhibiter's prejudice; and in the preſcription of removings, the years are computed only from the term at which the defender is warned to remove. Neither can preſcription run againſt perſons who are already in poſſeſſion, and ſo can gain nothing by a purſuit. Thus, where a perſon, who has two adjudications affecting the ſame lands, is in poſſeſſion upon one of them, preſcription cannot run againſt the other during ſuch poſſeſſion.

15. Certain rights are incapable of preſcription: 1. Things that law has exempted from commerce. 2. *Res meræ facultatis*, *e. g.* a faculty to charge a ſubject with debts, to revoke, *&c.* cannot be loſt by preſcription, for faculties may, by their nature, be exerciſed at any time: Hence, a proprietor's right of uſing any act of property on his own grounds, cannot be loſt by the greateſt length of time. 3. Exceptions competent to a perſon for eliding an action, cannot preſcribe, unleſs the exception is founded on a right productive of an action, *e. g.* compenſation; ſuch right muſt be inſiſted on, within the years of preſcription. 4. Obligations of yearly penſions or payments, though no demand has been made on them for forty years, do not ſuffer a total preſcription, but ſtill ſubſiſt as to the arrears fallen due within that period; becauſe preſcription cannot run againſt an obligation, till it be payable, and each year's penſion or payment is conſidered as a ſeparate debt.

16. No right can be loſt *non utendo* by one, unleſs the effect of that preſcription be to eſtabliſh it in another. Hence the rule ariſes, *juri ſanguinis nunquam præſcribitur*. Hence alſo, a proprietor of land cannot loſe his property by the negative preſcription, unleſs he who objects it can himſelf plead the poſitive. On the ſame ground, a ſuperior's right of feu-duties cannot be loſt *non utendo*; becauſe being inherent in the ſuperiority, it is truly a right of lands that cannot ſuffer the negative preſcription, except in favour of one who can plead the poſitive; which the vaſſal cannot do, being deſtitute of a title. This rule applies alſo to parſonage tithes, which are an inherent burden upon all lands not ſpecially exempted; and from which therefore the perſon liable cannot preſcribe an immunity, by bare non-payment: But ſuch vicarage tithes as are only due where they are eſtabliſhed by uſage, may be loſt by preſcription. In all theſe caſes, though the radical right cannot ſuffer the negative preſcription, the bygone duties, not demanded within the forty years, are loſt to the proprietor, ſuperior, or titular.

17. Preſcription may be interrupted by any deed, whereby the proprietor or creditor uſes his right or ground of debt. In all interruptions, notice muſt be given to the poſſeſſor of the ſubject, or the debtor, that the proprietor or creditor intends to ſue upon his right. All writings whereby the debtor himſelf acknowledges the debt, and all proceſſes for payment brought or diligences uſed againſt him upon his obligation, by horning, inhibition, arreſtment, *&c.* muſt be effectual to interrupt preſcription.

18. Interruptions, by citation upon libelled ſummonſes, where they are not uſed by a minor, preſcribe, if not renewed every ſeven years: But where the appearance of parties, or any judicial act has followed thereupon, it is no longer a bare citation, but an action which ſubſiſts for forty years. Citations for interrupting the preſcription of real rights muſt be given by meſſengers; and the ſummonſes, on which ſuch citations proceed, muſt paſs the ſignet upon a bill, and be regiſtred within ſixty days after the execution, in a particular regiſter appointed for that purpoſe: And where interruption of real rights is made *via facti*, an inſtrument muſt be taken upon it, and recorded in the ſaid regiſter; otherwiſe it can have no effect againſt ſingular ſucceſſors.

19. Interruption has the effect to cut off the courſe of preſcription, ſo that the perſon preſcribing can avail himſelf of no part of the former time, but muſt begin a new courſe, commencing from the date of the interruption. Minority therefore is no proper interruption; for it neither breaks the courſe of preſcription, nor is it a document or evidence taken by the minor on his right: It is a perſonal privilege competent to him, by which the operation of the preſcription is indeed ſuſpended during the years of minority, which are therefore diſcounted from it; but it continues to run after majority, and the years before and after the minority may be conjoined to compleat it. The ſame doctrine applies to the privilege ariſing from one's incapacity to act.

20. Diligence uſed upon a debt, againſt any one of two or more co-obligants, preſerves the debt itſelf, and ſo interrupts preſcription againſt all of them; except in the ſpecial caſe of cautioners, who are not affected by any diligence uſed againſt the principal debtor. In the ſame manner, a right of annualrent, conſtituted upon two ſeparate tenements, is preſerved as to both from the negative preſcription, by diligence uſed againſt either of them. But whether ſuch diligence has alſo the effect to hinder the poſſeſſor of the other tenement by ſingular titles from the benefit of the poſitive preſcription, may be doubted.

Tit. 27. *Of Succession in heritable Rights.*

Singular successors are those who succeed to a person yet alive, in a special subject by singular titles; but succession, in its proper sense, is a method of transmitting rights from the dead to the living. Heritable rights descend by succession to the heir properly so called; moveable rights, to the executors, who are sometimes said to be heirs in moveables. Succession is either by special destination, which descends to those named by the proprietor himself; or legal, which devolves upon the persons whom the law marks out for successors, from a presumption, that the proprietor would have named them, had he made a destination. The first is in all cases preferred to the other, as presumption must yield to truth.

2 In the succession of heritage, the heirs at law are otherwise called heirs general, heirs whatsoever, or heirs of line; and they succeed by the right of blood, in the following order. First, descendents sons are prefered to daughters, and the eldest son to all the younger. Where there are daughters only, they succeed equally, and are called heirs-portioners. Failing immediate descendents, grand-children succeed; and in default of them, great-grand-children; and so on *in infinitum*; preferring, as in the former case, males to females, and the eldest male to the younger.

3. Next after descendents, collaterals succeed; among whom the brothers *german* of the deceased have the first place. But as, in no case, the legal succession of heritage is, by the law of Scotland, divided into parts, unless where it descends to females; the immediate younger brother of the deceased excludes the rest, according to the rule, *heritage descends*. Where the deceased is himself the youngest, the succession goes to the immediate elder brother, as being the least deviation from this rule. If there are are no brothers german, the sisters german succeed equally; then brothers *consanguinean*, in the same order as brothers german; and failing them, sisters *consanguinean* equally. Next, the father succeeds. After him, his brothers and sisters, according to the rules already explained; then the grand-father; failing him, his brothers and sistters; and so upwards, as far back as propinquity can be proved. Though children succeed to their mother, a mother cannot to her child; nor is there any succession by our law through the mother of the deceased; in so much that one brother *uterine*, *i. e.* by the mother only, cannot succeed to another, even in that estate which flowed originally from their common mother.

4. In heritage there is a right of representation, by which one succeeds, not from any title in himself, but in the place of, and as representing some of his deceased ascendents. Thus, where one leaves a younger son, and a grandchild by his eldest, the grandchild, though farther removed in degree from the decased than his uncle, excludes him, as coming in place of his father the eldest son. Hence arises the distinction between succession *in capita*, where the division is made into as many equal parts as there are *capita* or heirs, which is the case of heirs portioners; and succession *in stirpes*, where the remoters heirs draw no more among them than the share belonging to their ascendent or *stirps*, whom they represent; an example of which may be figured in the case of one who leaves behind him a daughter alive, and two grand-daughters by a daughter deceased. In which case the two grand-daughters would succeed equally to that half which would have belonged to their mother had she been alive.

5. In the succession of heirs-portioners, indivisible rights, *e. g.* titles of dignity, fall to the eldest sister. A single right of superiority goes also to the eldest; for it hardly admits a division, and the condition of the vassal ought not to be made worse by multiplying superiors upon him. Where there are more such rights, the eldest may perhaps have her election of the best; but the younger sisters are entitled to a recompence, in so far as the divisions are unequal; at least, where the superiorities yield a constant yearly rent. The principal seat of the family falls to the eldest, with the garden and orchard belonging to it, without recompence to the younger sisters; but all other houses are divided amongst them, together with the lands on which they are built, as parts and pertinents of these lands.

6. Those heritable rights, to which the deceased did himself succeed as heir to his father or other ancestor, get sometimes the name of heritage in a strict sense, in opposition to the *feuda nova*, or feus of conquest, which he had acquired by singular titles, and which descend, not to his heir of line, but of conquest. This distinction obtains only, where two or more brothers or uncles, or their issue, are next in succession; in which case the immediate younger brother, as heir of line, succeeds to the proper heritage, because that descends; whereas the conquest ascends to the immediate elder brother. It has no place in female succession, which the law divides equally among the heirs-portioners. Where the deceased was the younger brother, the immediate elder brother is heir both of line and of conquest. An estate, disponed by a father to his eldest son, is not conquest in the son's person, but heritage; because the son would have succeeded to it, though there had been no disposition. The heir of conquest succeeds to all rights affecting land, which require seisin to perfect them. But teinds go to the heir of line; because they are merely a burden on the fruits, not on the land. Tacks do not fall under conquest, because they are complete rights without seisin; nor personal bonds taken to heirs secluding executors.

7. The heir of line is entitled to the succession, not only of subjects properly heritable, but to that sort of moveables called *heirship*, which is the best of certain kinds. This doctrine has been probably introduced, that the heir might not have an house and estate to succeed to, quite dismantled by the executor. In that sort which goes by pairs or dozens, the best pair or dozen is the heirship. There is no heirship in fungibles, or things estimated by quantity, as grain, hay, current money, *&c.* To intitle an heir to this privilege, the deceased must have been either, 1. A Prelate: 2. A Baron, *i. e.* one who stood infeft at his death in lands, though not erected into a barony; or even in a right of annualrent: Or, 3. A burgess; not an honorary one, but a trading burgess of a royal borough, or at least one intitled to enter burgess,

gefs, in the right of his anceftor. Neither the heir of conqueft, nor of tailzie, has right to heirfhip-moveables.

8. As to fucceffion by deftination, no proprietor can fettle any heritable eftate, in the proper form of a teftament; not even bonds fecluding executors, though thefe are not heritable *ex fua natura*: But, where a teftament is in part drawn up in the ftyle of a deed *inter vivos*, fuch part of it may contain a fettlement of heritage, though executors fhould be named in the teftamentary part. The common method of fettling the fucceffion of heritage is by difpofition, contract of marriage, or fimple procuratory of refignation: And, though a difpofition fettling heritage fhould have neither precept nor procuratory, it founds an action againft the heir of line to complete his titles to the eftate; and thereafter diveft himfelf in favour of the difponee. The appellation of tailzie, or entail, is chiefly ufed in the cafe of a land eftate, which is fettled on a long feries of heirs, fubftituted one after another. The perfon firft called in the tailzie, is the inftitute; the reft, the heirs of tailzie, or the fubftitutes.

9. Tailzies, when confidered in relation to their feveral degrees of force, are either, 1. Simple deftinations: 2. Tailzies with prohibitory claufes. 3. Tailzies with prohibitory, refolutive, and irritant claufes That is a fimple deftination, where the perfons called to the fucceffion are fubftituted one after another, without any reftraint laid on the exercife of their property The heirs, therefore, fucceeding to fuch eftate, are abfolute fiars, and confequently may alter the deftination at pleafure.

10. In tailzies with claufes prohibitory, *e.g.* declaring that it fhall not be lawful to the heirs to contract debts or alien the lands in prejudice of the fucceffion, none of the heirs can alien gratuitoufly. But the members of entail may contract debts which will be effectual to the creditors, or may difpofe of the eftate for onerous caufes. In both thefe forts, the maker himfelf may alter the tailzie; except, 1. Where it has been granted for an onerous caufe, as in mutual tailzies; or, 2. Where the maker is exprefsly difabled, as well as the inftitute or the heirs.

11. Where a tailzie is guarded with irritant and refolutive claufes, the eftate entailed cannot be carried off by the debt, or deed, of any of the heirs fucceeding thereto, in prejudice of the fubftitutes. It was long doubted, whether fuch tailzies ought to be effectual, even where the fuperior's confent was adhibited; becaufe they funk the property of eftates, and created a perpetuity of liferents. They were firft explicitely authorifed by 1685, *c.* 22. By this ftatute, the entail muft be regiftred in a fpecial regifter eftablifhed for that purpofe; and the irritant and refolutive claufes muft be inferted, not only in the procuratories, precepts, and feifins, by which the tailzies are firft conftituted, but in all the after-conveyances thereof; otherwife they can have no force againft fingular fucceffors. But a talzie, even without thefe requifites, is effectual againft the heir of the granter, or againft the inftitute who accepts of it.

12. An heir of entail has full power over the entailed eftate, except in fo far as he is exprefsly fettered; and as entails are an unfavourable reftraint upon property, and a frequent fnare to trading people, they are *ftrictiffimi juris*; fo that no prohibition or irritancies are to be inferred by implication.

13. An heir, who counteracts the directions of the tailzie, by aliening any part of the eftate, charging it with debt, *&c.* is faid to contravene. It is not the fimple contracting of debt that infers contravention; the lands entailed muft be actually adjudged upon the debt contracted. An heir may, where he is not exprefsly barred, fettle rational provifions on his wife and children, without incurring contravention.

14. When the heirs of the laft perfon fpecially called in a tailzie come to fucceed, the irritancies have no longer any perfon in favour of whom they can operate; and confequently, the fee, which was before tailzied, becomes fimple and unlimited in the perfon of fuch heirs. The King may purchafe lands within Scotland, notwithftanding the ftricteft entail; and where the lands are in the hands of minors or fatuous perfons, his Majefty may purchafe them from the curators or guardians. And heirs of entail may fell to their vaffals the fuperiorities belonging to the entailed eftate; but in all thefe cafes, the price is to be fettled in the fame manner that the lands or fuperiorities fold were fettled before the fale.

15. Rights, not only of land-eftates, but of bonds, are fometimes granted to two or more perfons in conjunct fee. Where a right is fo granted to two ftrangers, without any fpecial claufe adjected to it, each of them has an equal intereft in the fee, and the part of the deceafed defcends to his own heir. If the right be taken to the two jointly, and *the longeft liver* and their heirs, the feveral fhares of the conjunct fiars are affectable by their creditors during their lives; but, on the death of any one of them, the furvivor has the fee of the whole, in fo far as the fhare of the predeceafed remains free, after payment of his debts. Where the right is taken to the two in conjunct fee, and to the heirs of one of them, he to whofe heirs the right is taken, is the only fiar; the right of the other refolves into a fimple liferent: Yet where a father takes a right to himfelf and his fon jointly, and to the fon's heirs, fuch right being gratuitous is not underftood to ftrip the father of the fee, unlefs a contrary intention fhall plainly appear from the tenor of the right.

16. Where a right is taken to a hufband and wife, in conjunct fee and liferent, the hufband, as the *perfona dignior*, is the only fiar: The wife's right refolves into a liferent, unlefs it be prefumeable, from fpecial circumftances, that the fee was intended to be in the wife. Where a right of moveables is taken to hufband and wife, the heirs of both fucceed equally, according to the natural meaning of the words.

17. Heirs of provifion are thofe who fucceed to any fubject, in virtue of a provifion in the inveftiture, or other deed of fettlement This appellation is given moft commonly to heirs of a marriage Thefe are more favourably regarded than heirs by fimple deftination, who have only the hope of fucceffion; for heirs of a marriage, becaufe their provifions are conftituted by an onerous contract, cannot be difappointed of them by any gratuitous deed of the father. Neverthelefs, as their right is only a right of fucceffion, which is not defigned to reftrain the father

father from granting onerous or rational deeds, he continues to have the full power of felling the fubject, or charging it with debts, unlefs a proper right of credit be given to the heir by the marriage-contract, *e. g.* if the father fhould oblige himfelf to infeft the heir in the lands, or make payment of the fum provided againft a day certain, or when the child attains a certain age, *&c.* for fuch rights, when perfected by infeftment, or fecured by diligence, are effectual againft all the pofterior deeds of the father, even onerous.

18. Though all provifions to children, by a marriage-contract conceived in the ordinary form, being merely rights of fucceffion, are poftponed to every onerous debt of the granter, even to thofe contracted pofterior to the provifions; yet where a father executes a bond of provifion to a child actually exifting, whether fuch child be the heir of a marriage or not, a proper debt is thereby created, which, though it be without doubt gratuitous, is not only effectual againft the father himfelf and his heirs, but is not reducible at the inftance even of his prior onerous creditors, if he was folvent at the time of granting it. A father may, notwithftanding a firft marriage-contract, fettle a jointure on a fecond wife, or provide the children of a fecond marriage; for fuch fettlements are deemed onerous; but where they are exorbitant, they will be reftricted to what is rational: And in all fuch fettlements, where the provifions of the firft marriage-contract are incroached upon, the heirs of that marriage have recourfe againft the father, in cafe he fhould afterwards acquire a feparate eftate, which may enable him to fulfil both obligations.

19. Where heritable rights are provided to the *heirs* of a marriage, they fall to the eldeft fon, for he is the heir at law in heritage. Where a fum of money is fo provided, the word *heir* is applied to the fubject of the provifion, and fo marks out the executor, who is the heir in moveables. When an heritable right is provided to the *bairns* (or iffue) of a marriage, it is divided equally among the children, if no divifion be made by the father; for fuch deftination cuts off the exclufive right of the legal heir. No provifion granted to bairns, gives a fpecial right of credit to any one child, as long as the father lives: The right is granted *familiæ*; fo that the whole muft indeed go to one or other of them; but the father has a power inherent in him, to divide it among them, in fuch proportions as he thinks beft; yet fo as none of them may be entirely excluded, except in extraordinary cafes.

20. A claufe of return is that, by which a fum in a bond or other right, is, in a certain event, limited to return to the granter himfelf, or his heirs. When a right is granted for onerous caufes, the creditor may defeat the claufe of return, even gratuitoufly. But, where the fum in the right flows from the granter, or where there is any other reafonable caufe for the provifion of return in his favour, the receiver cannot difappoint it gratuitoufly. Yet fince he is fiar, the fum may be either affigned by him for an onerous caufe, or affected by his creditors.

21. An heir is, in the judgment of law, *eadem perfona cum defuncto*, and fo reprefents the deceafed univerfally, not only in his rights, but in his debts: In the firft view, he is faid to be heir *active;* in the fecond *paffive*. From this general rule are excepted, heirs fubftituted in a fpecial bond, and even fubftituted in a difpofition *omnium bonorum*, to take effect at the granter's death; for fuch fubftitutes are confidered as fingular fucceffors, and their right as an univerfal legacy, which does not fubject the legatee *ultra valorem*.

22. Before an heir can have an active title to his anceftor's rights, he muft be entered by fervice and retour. He who is intitled to enter heir, is, before his actual entry, called apparent heir. The bare right of apparency carries certain privileges with it. An apparent heir may defend his anceftor's titles againft any third party who brings them under challenge. Tenants may fafely pay him their rents; and after they have once acknowledged him by payment, he may compel them to continue it; and the rents not uplifted by the apparent heir belong to his executors, upon his death.

23. As an heir is, by his entry, fubjected univerfally to his anceftor's debts, apparent heirs have therefore a year (*annus deliberandi*) allowed to them from the anceftor's deceafe, to deliberate whether they will enter or not; till the expiring of which, though they may be charged by creditors to enter, they cannot be fued in any procefs founded upon fuch charge. Though declaratory actions, and others which contain no perfonal conclufion, may be purfued againft the apparent heir, without a previous charge; action does not lie even upon thefe, within the year, if the heir cannot make the proper defences without incurring a paffive title. But judicial fales, commenced againft an anceftor, may be continued upon a citation of the heir, without waiting the year of deliberating. This *annus deliberandi* is computed, in the cafe of a pofthumous heir, from the birth of fuch heir. An apparent heir, who by immixing with the eftate of his anceftor, is as much fubjected to his debts as if he had entered, can have no longer a right to deliberate whether he will enter or not.

24. All fervices proceed on brieves from the chancery, which are called brieves of inqueft, and have been long known in Scotland. The judge, to whom the brief is directed, is required to try the matter by an inqueft of fifteen fworn men. The inqueft, if they find the claim verified, muft declare the claimant heir to the deceafed, by a verdict or fervice, which the judge muft atteft, and return the brief, with the fervice proceeding on it, to the chancery.

25. The fervice of heirs is either general or fpecial. A general fervice vefts the heir in the right of all heritable fubjects, which either do not require feifin, or which have not been perfected by feifin in the perfon of the anceftor. A fpecial fervice, followed by feifin, vefts the heir in the right of the fpecial fubjects in which the anceftor died infeft.

26. If an heir, doubtful whether the eftate of his anceftor be fufficient for clearing his debts, fhall at any time within the *annus deliberandi*, exhibit upon oath a full inventory of all his anceftor's heritable fubjects, to the clerk of the fhire where the lands lie; or, if there is no heritage requiring feifin, to the clerk of the fhire where he died; and if, after the fame is fubfcribed by the fheriff

riff or sheriff depute, the clerk, and himself, and registered in the sheriff's books, the extract thereof shall be registered within forty days after expiry of the *annus deliberandi* in the general register appointed for that purpose, his subsequent entry will subject him no farther than to the value of such inventory. If the inventory be given up and registred within the time prescribed, the heir may serve on it, even after the year.

27. Creditors are not obliged to acquiesce in the value of the estate given up by the heir; but, if they be real creditors, may bring the estate to a public sale, in order to discover its true value; since an estate is always worth what can be got for it. An heir by inventory, as he is, in effect, a trustee for the creditors, must account for that value to which the estate may have been improved since the death of the ancestor, and he must communicate to all the creditors the eases he has got in transacting with any one of them.

28. Practice has introduced an anomalous sort of entry, without the interposition of an inquest, by the sole consent of the superior, who, if he be satisfied that the person applying to him is the next heir, grants him a precept (called of *clare constat*, from the first words of its recital), commanding his bailie to infeft him in the subjects that belonged to his ancestor. These precepts are, no doubt, effectual against the superior who grants them, and his heirs; and they may, when followed by seisin, afford a title of prescription: But as no person can be declared an heir by private authority, they cannot bar the true heir from entering after twenty years, as a legal entry would have done. Of the same nature is the entry by hasp and staple, commonly used in burgage tenements of houses; by which the bailie, without calling an inquest, cognosces or declares a person heir, upon evidence brought before himself; and, at the same time, infefts him in the subject, by the symbol of the hasp and staple of the door. Charges given by creditors to apparent heirs to enter, stand in the place of an actual entry, so as to support the creditor's diligence.

29. A general service cannot include a special one; since it has no relation to any special subject, and carries only that class of rights on which seisin has not proceeded; but a special service implies a general one of the same kind or character, and consequently carries even such rights as have not been perfected by seisin. Service is not required to establish the heir's right in titles of honour, or offices of the highest dignity; for these descend *jure sanguinis*.

30. An heir, by immixing with his ancestor's estate without entry, subjects himself to his debts, as if he had entered; or, in our law-phrase, incurs a passive title. The only passive title by which an apparent heir becomes liable universally for all his ancestor's debts, is *gestio pro herede*, or his behaving as none but an heir has right to do. Behaviour as heir is inferred, from the apparent heir's intromission, after the death of the ancestor, with any part of the lands or other heritable subjects belonging to the deceased, to which he himself might have compleated an active title by entry.

31. This passive title is excluded, if the heir's intromission be by order of law; or if it be founded on singular titles, and not as heir to the deceased. But an apparent heir's purchasing any right to his ancestor's estate, otherwise than at public roup (auction), or his possessing it in virtue of rights settled in the person of any near relation of the ancestor, to whom he himself may succeed as heir, otherwise than upon purchase by public sale, is deemed behaviour as heir.

32. Behaviour as heir is also excluded, where the intromission is small, unless an intention to defraud the ancestor's creditors be presumable from the circumstances attending it. Neither is behaviour inferred against the apparent heir, from the payment of his ancestor's debt, which is a voluntary act, and profitable to the creditors: nor by his taking out of brieves to serve; for one may alter his purpose, while it is not compleated: nor by his assuming the titles of honour belonging to his ancestor, or exercising an honorary office hereditary in the family; for these are rights annexed to the blood, which may be used without proper representation. But the exercising an heritable office of profit, which may pass by voluntary conveyance, and consequently is adjudgeable, may reasonably be thought to infer a passive title. Lastly, as passive titles have been introduced, merely for the security of creditors; therefore, where questions concerning behaviour arise among the different orders of heirs, they are liable to one another no farther than *in valorem* of their several intromissions.

33. Another passive title in heritage, may be incurred by the apparent heir's accepting a gratuitous right from the ancestor, to any part of that estate to which he himself might have succeeded as heir; and it is called *præceptio hereditatis*, because it is a taking of the succession by the heir before it opens to him by the death of his ancestor. If the right be onerous, there is no passive title; If the consideration paid for it does not amount to its full value, the creditors of the deceased may reduce it, in so far as it is gratuitous, but still it infers no passive title.

34. The heir incurring this passive title is no farther liable, than if he had, at the time of his acceptance, entered heir to the granter, and so subjected himself to the debts that were then chargeable against him; but with the posterior debts he has nothing to do, not even with those contracted between the date of the right, and the infeftment taken upon it, and he is therefore called *successor titulo lucrativo post contractum debitum*.

35. Neither of these passive titles takes place, unless the subject intermeddled with or disponed, be such as the intromitter or receiver would succeed to as heir, In this also, these two passive titles agree, that the intromission in both must be after the death of the ancestor; for there can be no *termini habiles* of a passive title, while the ancestor is alive. But in the following respect they differ: *Gestio pro herede*, being a vicious passive title founded upon a quasi delict, cannot be objected against the delinqent's heir, if process has not been litiscontested while the delinquent himself was alive; whereas the *successor titulo lucrativo* is, by the acceptance of the disposition, understood to have entered into a tacit contract with the granter's creditors, by which he undertakes the burden of their debts; and all actions founded on contract are transmissible against heirs.

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36. An apparent heir, who is cited by the anceſtor's creditor in a proceſs for payment, if he offers any peremptory defence againſt the debt, incurs a paſſive title; for he can have no intereſt to object againſt it, but in the character of heir. In the ſame manner, the heir's not renouncing upon a charge to enter heir, infers it: But the effect of both theſe is limited to the ſpecial debt purſued for, or charged upon. This paſſive title, which is inferred from the heir's not renouncing, has no effect till decree paſs againſt him; and even a renunciation offered after decree, if the decree be in abſence, will intitle the heir to a ſuſpenſion of all diligence againſt his perſon and eſtate, competent upon his anceſtor's debts.

37. By the principles of the feudal law, an heir, when he is to compleat his titles by ſpecial ſervice, muſt neceſſarily paſs over his immediate anceſtor, *e. g.* his father, if he was not infeft; and ſerve heir to that anceſtor who was laſt veſt and ſeiſed in the right, and in whoſe *hereditas jacens* the right muſt remain, till a title be connected thereto from him. As this bore hard upon creditors, who might think themſelves ſecure in contracting with a perſon whom they ſaw for ſome time in the poſſeſſion of an eſtate, and from thence conclude that it was legally veſted in him; it is therefore provided, that every perſon, paſſing over his immediate anceſtor who had been three years in poſſeſſion, and ſerving heir to one more remote, ſhall be liable for the debts and deeds of the perſon interjected, to the value of the eſtate to which he is ſerved. This being correctory of the feudal maxims, has been ſtrictly interpreted, ſo as not to extend to the gratuitous deeds of the perſon interjected, nor to the caſe where the interjected perſon was a naked fiar, and poſſeſſed only civilly through the liferenter

38. Our law, from its jealouſy of the weakneſs of mankind while under ſickneſs, and of the importunity of friends on that occaſion, has declared that all deeds affecting heritage, if they be granted by a perſon on death-bed, (*i. e.* after contracting that ſickneſs which ends in death), to the damage of the heir, are ineffectual, except where the debts of the granter have laid him under a neceſſity to alien his lands. As this law of deathbed is founded ſolely in the privilege of the heir, deathbed-deeds, when conſented to by the heir, are not reducible. The term properly oppoſed to death-bed is *liege pouſtie*, by which is underſtood a ſtate of health; and it gets that name, becauſe perſons in health have the *legitima poteſtas*, or lawful power of diſpoſing of their property at pleaſure.

39. The two extremes being proved, of the granter's ſickneſs immediately before ſigning, and of his death following it, though at the greateſt diſtance of time, did, by our former law, found a preſumption that the deed was granted on death bed, which could not have been elided, but by a poſitive proof of the granter's convaleſcence; but now the allegation of death-bed is alſo excluded, by his having lived ſixty days after ſigning the deed. The legal evidence of convaleſcence is the granter's having been, after the date of the deed, at kirk *OR* market unſupported; for a proof of either will ſecure the deed from challenge. The going to kirk or market muſt be performed, when people are met together in the church or churchyard for any public meeting, civil or eccleſiaſtical, or in the market place at the time of public market. No other proof of convaleſcence is receiveable, becauſe at kirk and market there are always preſent unſuſpected witneſſes, which we can hardly be ſure of in any other caſe.

40. The privilege of ſetting aſide deeds *ex capite lecti*, is competent to all heirs, not to heirs of line only, but of conqueſt, tailzie, or proviſion; not only to the immediate, but to remoter heirs, as ſoon as the ſucceſſion opens to them. But, where it is conſented to or ratified by the immediate heir, it is ſecured againſt all challenge, even from the remoter. Yet the immediate heir cannot, by any antecedent writing, renounce his right of reduction, and thereby give ſtrength to deeds that may be afterwards granted *in lecto* to his hurt; for no private renunciation can authoriſe a perſon to act contrary to a public law; and ſuch renunciation is preſumed to be extorted through the fear of exheredation. If the heir ſhould not uſe this privilege of reduction, his creditor may, by adjudication, transfer it to himſelf, or he may without adjudication, reduce the deed, libelling upon his intereſt as creditor to the heir: But the granter's creditors have no right to this privilege, in regard that the law of death-bed was introduced, not in behalf of the granter himſelf, but of his heir.

41. The law of death-bed ſtrikes againſt diſpoſitions of every ſubject to which the heir would have ſucceeded, or from which he would have had any benefit, had it not been ſo diſponed. Deathbed-deeds granted in conſequence of a full or proper obligation in *liege pouſtie*, are not ſubject to reduction; but, where the antecedent obligation is merely natural, they are reducible. By ſtronger reaſon, the deceaſed cannot, by a deed merely voluntary, alter the nature of his eſtate on death bed to the prejudice of his heir, ſo as from heritable to make it moveable; but if he ſhould, in *liege pouſtie*, exclude his apparent heir, by an irrevocable deed containing reſerved faculties, the heir cannot be heard to quarrel the exerciſe of theſe faculties on death-bed.

42. In a competition between the creditors of the deceaſed and of the heir, our law has juſtly preferred the creditors of the deceaſed, as every man's eſtate ought to be liable, in the firſt place, for his own debt. But this preference is, by the ſtatute, limited to the caſe where the creditors of the deceaſed have uſed diligence againſt their debtor's eſtate, within three years from his death; and therefore the heir's creditors may, after that period, affect it for their own payment. All diſpoſitions by an heir, of the anceſtor's eſtate, within a year after his death, are null, in ſo far as they are hurtful to the creditors of the anceſtor. This takes place, though theſe creditors ſhould have uſed no diligence, and even where the diſpoſitions are granted after the year: It is thought they are ineffectual againſt the creditors of the deceaſed who have uſed diligence within the three years.

Tit. 28. *Of Succeſſion in Moveables.*

In the ſucceſſion of moveable rights, it is an univerſal rule,

rule, that the next in degree to the deceafed (or next of kin) fucceeds to the whole; and if there are two or more equally near, all of them fucceed by equal parts, without that prerogative, which takes place in heritage, of the eldeft fon over the younger, or of males over females. Neither does the right of reprefentation, explained Tit. xxvii. 4 obtain in the fucceffion of moveables, except in the fingle cafe of a competition between the full blood and the half blood; for a niece by the full blood will be preferred before a brother by the half blood, though fhe is by one degree more remote from the deceafed than her uncle. Where the eftate of a perfon deceafed confifts partly of heritage, and partly of moveables, the heir in the heritage has no fhare of the moveables, if there are others as near in degree to the deceafed as himfelf: But where the heir, in fuch cafe, finds it his intereft to renounce his exclufive claim to the heritage, and betake himfelf to his right as one of the next of kin, he may collate or communicate the heritage with the others, who in their turn muft collate the moveables with him; fo that the whole is thrown into one mafs, and divided equally among all of them. This doctrine holds, not only in the line of defcendents, but of collaterals; for it was introduced, that the heir might in no cafe be worfe than the other next of kin.

2. One may fettle his moveable eftate upon whom he pleafes, excluding the legal fucceffor, by a teftament; which is a written declaration of what a perfon wills to be done with his moveable eftate after his death. No teftamentary deed is effectual, till the death of the teftator; who may therefore revoke it at pleafure, or make a new one, by which the firft lofes its force; and hence teftaments are called, laft or latter wills. Teftaments, in their ftrict acceptation, muft contain a nomination of executors, *i. e.* of perfons appointed to adminifter the fucceffion according to the will of the deceafed: Yet nothing hinders one from making a fettlement of moveables, in favour of an univerfal legatee, though he fhould not have appointed executors; and on the other part, a teftament where executors are appointed, is valid, though the perfon who is to have the right of fucceffion fhould not be named. In this laft cafe, if the executor nominated be a ftranger, *i. e.* one who has no legal intereft in the moveable eftate, he is merely a truftee, accountable to the next of kin; but he may retain a third of the dead's part (explained § 6.) for his trouble in executing the teftament; in payment of which, legacies, if any be left to him, muft be imputed. The heir, if he be named executor, has right to the third as a ftranger; but if one be named, who has an intereft in the legal fucceffion, he has no allowance, unlefs fuch intereft be lefs than a third. Nuncupative or verbal teftaments are not, by the law of Scotland, effectual for fupporting the nomination of an executor, let the fubject of the fucceffion be ever fo fmall: But verbal legacies, not exceeding *L.* 100 *Scots*, are fuftained; and even where they are granted for more, they are ineffectual only as to the excefs.

3. A legacy is a donation by the deceafed, to be paid by the executor to the legatee. It may be granted, either in the teftament, or in a feparate writing. Legacies are not due till the granter's death; and confequently they can tranfmit no right to the executors of the legatee, in the event that the granter furvives him.

4. Legacies, where they are general, *i. e.* of a certain fum of money indefinitely, give the legatee no right in any one debt or fubject; he can only infift in a perfonal action againft the executor, for payment out of the teftator's effects. A fpecial legacy, *i. e.* of a particular debt due to the deceafed, or of a particular fubject belonging to him, is of the nature of an affignation, by which the property of the fpecial debt or fubject vefts, upon the teftator's death, in the legatee, who can therefore directly fue the debtor or poffeffor: Yet as no legacy can be claimed till the debts are paid, the executor muft be cited in fuch procefs, that it may be known, whether there are free effects fufficient for anfwering the legacy. Where there is not enough for payment of all the legacies, each of the general legatees muft fuffer a proportional abatement: But a fpecial legatee gets his legacy entire, though there fhould be nothing over for payment of the reft; and on the contrary, he has no claim, if the debt or fubject bequeathed fhould perifh, whatever the extent of the free executry may be.

5. Minors, after puberty, can teft without their curators, wives without their hufbands, and perfons interdicted without their interdictors; but baftards cannot teft, except in the cafes afterwards fet forth, Tit. xxix. 3. As a certain fhare of the goods, falling under the communion that is confequent on marriage, belongs, upon the hufband's deceafe, to his widow, *jure relictæ*, and a certain fhare to the children, called the legitime, portion-natural, or bairns part of gear; one who has a wife or children, though he be the abfolute adminiftrator of all thefe goods during his life, and confequently may alien them by a deed *inter vivos* in *liege pouftie*, even gratuitoufly, if no fraudulent intention to difappoint the wife or children fhall appear, yet cannot impair their fhares gratuitoufly on deathbed; nor can he difpofe of his moveables to their prejudice by teftament, though it fhould be made in *liege pouftie*; fince teftaments do not operate till the death of the teftator, at which period the divifion of the goods in communion have their full effect in favour of the widow and children.

6. If a perfon deceafed leaves a widow, but no child, his teftament, or, in other words, the goods in communion, divide in two; one half goes to the widow, the other is the dead's part, *i. e.* the abfolute property of the deceafed, on which he can teft, and which falls to his next of kin, if he dies inteftate. Where he leaves children, one or more, but no widow, the children get one half as their legitime; the other half is the dead's part, which falls alfo to the children, if the father has not tefted upon it. If he leaves both widow and children, the divifion is tripartite; the wife takes one third by herfelf; another falls, as legitime, to the children equally among them, or even to an only child, though he fhould fucceed to the heritage; the remaining third is the dead's part. Where the wife predeceafes without children, one half is retained by the hufband, the other falls to her next of kin: Where fhe leaves children, the divifion ought alfo to be bipartite, by the common rules of fociety, fince no legitime is truly due on a mother's death;

yet

yet it is in practice tripartite; two thirds remain with the surviving father, as if one third were due to him *proprio nomine*, and another as administrator of the legitime for his children; the remaining third, being the wife's share, goes to her children, whether of that or any former marriage, for they are all equally her next of kin.

7. Before a testament can be divided, the debts owing by the deceased are to be deducted; for all executry must be free. As the husband has the full power of burdening the goods in communion, his debts affect the whole, and so lessen the legitime and the share of the relict, as well as the dead's part. His funeral charges, and the mournings and alimony due to the widow, are considered as his proper debts but the legacies, or other gratuitous rights, granted by him on deathbed, affect only the dead's part. Bonds bearing interest, due by the deceased. cannot diminish the relict's share, because such bonds when due to the deceased. do not increase it The funeral charges of the wife predeceasing, fall wholly on her executors who have right to her share. Where the deceased leaves no family, neither husband, wife, nor child, the testament suffers no division, but all is the dead's part.

8. The whole issue of the husband, not only by that marriage which was dissolved by his death, but by any former marriage, has an equal interest in the legitime; otherwise the children of the first marriage would be cut out, as they could not claim the legitime during their father's life. But no legitime is due, 1. Upon the death of a mother. 2. Neither is it due to grandchildren, upon the death of a grandfather. Nor, 3. To children forisfamiliated, *i. e.* to such as, by having renounced the legitime, are no longer considered as *in familia*, and so are excluded from any farther share of the moveable estate than they have already received.

9 As the right of legitime is strongly founded in nature, the renunciation of it is not to be inferred by implication. Renunciation by a child of his claim of legitime has the same effect as his death, in favour of the other children intitled thereto; and consequently the share of the renouncer divides among the rest; but he does not thereby lose his right to the dead's part, if he does not also renounce his share in the father's executry Nay, his renunciation of the legitime, where he is the only younger child, has the effect to convert the whole subject thereof into dead's part, which will therefore fall to the renouncer himself as next of kin, if the heir be not willing to collate the heritage with him.

10 For preserving an equality among all the children, who continue intitled to the legitime, we have adopted the Roman doctrine of *collatio bonorum*; whereby the child, who has got a provision from his father, is obliged to collate it with the others, and impute it towards his own share of the legitime; but if, from the deed of provision, the father shall appear to have intended it as a *præcipuum* to the child, collation is excluded. A child is not bound to collate an heritable subject provided to him, because the legitime is not impaired by such provision As this collation takes place only in questions among children who are intitled to the legitime, the relict is not bound to collate donations given her by her husband, in order to increase the legitime; and on the other part, the children are not obliged to collate their provisions, in order to increase her share.

11. As an heir in heritage must compleat his titles by entry, so an executor is not vested in the right of the moveable estate of the deceased without confirmation. Confirmation is a sentence of the Commissary or Bishop's court, impowering an executor, one or more, upon making inventory of the moveables pertaining to the deceased, to recover, possess, and administer them, either in behalf of themselves, or of others interested therein. Testaments must be confirmed in the commissariot where the deceased had his principal dwelling house at his death. If he had no fixed residence, or died in a foreign country, the confirmation must be at *Edinburgh*, as the *commune forum*; but if he went abroad with an intention to return, the commissariot within which he resided, before he left Scotland, is the only proper court.

12. Confirmation proceeds upon an edict, which is affixed on the door of the parish-church where the deceased dwelt, and serves to intimate to all concerned the day of confirmation, which must be nine days at least after publishing the edict. In a competition for the office of executor, the Commissary prefers, *primo loco*, the person named to it by the deceased himself, whose nomination he ratifies or confirms, without any previous decerniture; this is called the confirmation of a testament-testamentary. In default of an executor named by the deceased, universal disponees are by the present practice preferred; after them, the next of kin; then the relict; then creditors; and lastly, special legatees All these must be decerned executors, by a sentence called a decree-dative; and if afterwards they incline to confirm, the Commissary authorises them to administer, upon their making inventory, and giving security to make the subject thereof forthcoming to all having interest; which is called the confirmation of a testament-dative.

13. A creditor, whose debtor's testament is already confirmed, may sue the executor, who holds the office for all concerned, to make payment of his debt. Where there is no confirmation, he himself may apply for the office, and confirm as executor creditor; which intitles him to sue for, and receive the subject confirmed, for his own payment: And where one applies for a confirmation, as executor-creditor, every co-creditor may apply to be conjoined with him in the office. As this kind of confirmation is simply a form of diligence, creditors are exempted from the necessity of confirming more than the amount of their debts.

14 A creditor, whose debt has not been constituted, or his claim not closed by decree, during the life of his debtor, has no title to demand directly the office of executor *qua* creditor; but he may charge the next of kin who stands off, to confirm, who must either renounce within twenty days after the charge, or be liable for the debt; and if the next of kin renounces, the pursuer may constitute his debt, and obtain a decree *cognitionis causa*, against the *hereditas jacens* of the moveables, upon which he may confirm as executor creditor to the deceased. Where one is creditor, not to the deceased. but to his next of kin who stands off from confirming, he may affect the moveables of the deceased, by obtaining himself decerned

decerned executor dative to the deceafed, as if he were creditor to him, and not to his next of kin.

15. Where an executor has either omitted to give up any of the effects belonging to the deceafed in inventory, or has eftimated them below their juft value, there is place for a new confirmation, *ad omiffa, vel male appretiata*, at the fuit of any having intereft; and if it appears that he has not omitted or undervalued any fubject *dolofé*, the Commiffary will ordain the fubjects omitted, or the difference between the eftimations in the principal teftament and the true values, to be added thereto; but if dole fhall be prefumed, the whole fubject of the teftament *ad omiffa vel male appretiata*, will be carried to him who confirms it, to the exclufion of the executor in the principal teftament.

16. The legitime and relict's fhare, becaufe they are rights arifing *ex lege*, operate *ipfo jure*, upon the father's death, in favour of the relict and children; and confequently pafs from them, though they fhould die before confirmation, to their next of kin: Whereas the dead's part, which falls to the children or other next of kin in the way of fucceffion, remains, if they fhould die before confirming, *in bonis* of the firft deceafed; and fo does not defcend to their next of kin, but may be confirmed by the perfon who, at the time of confirmation, is the next of kin to the firft deceafed. Special affignations, though neither intimated, nor made public, during the life of the granter, carry to the affigney the full right of the fubjects affigned, without confirmation. Special legacies are really affignations, and fo fall under this rule. The next of kin, by the bare poffeffion of the *ipfa corpora* of moveables, acquires the property thereof without confirmation, and tranfmits it to his executors.

17. The confirmation of any one fubject by the next of kin, as it proves his right of blood, has been adjudged to carry the whole executry out of the teftament of the deceafed, even what was omitted, and to tranfmit all to his own executors. The confirmation of a ftranger, who is executor nominated, as it is merely a truft for the next of kin, has the effect to eftablifh the right of the next of kin to the fubjects confirmed, in the fame manner as if himfelf had confirmed them.

18. Executry, though it carries a certain degree of reprefentation of the deceafed, is properly an office: Executors therefore are not fubjected to the debts due by the deceafed, beyond the value of the inventory; but, at the fame time, they are liable in diligence for making the inventory effectual to all having intereft. An executor-creditor who confirms more than his debt amounts to, is liable in diligence for what he confirms. Executors are not liable in intereft, even upon fuch bonds recovered by them as carried intereft to tbe deceafed, becaufe their office obliges them to retain the fums they have made effectual, in order to a diftribution thereof among all having intereft. This holds though they fhould again lend out the money upon intereft, as they do it at their own rifk.

19 There are certain debts of the deceafed called privileged debts, which were always preferable to every other. Under that name are comprehended, medicines furnifhed to the deceafed on death-bed, phyficians fees during that period, funeral charges, and the rent of his houfe, and his fervant's wages for the year or term current at his death. Thefe the executors are in fafety to pay on demand. All the other creditors, who either obtain themfelves confirmed, or who cite the executor already confirmed, within fix months after their debtor's death, are preferred, *pari paffu*, with thofe who have done more timely diligence; and therefore no executor can either retain for his own debt, or pay a teftamentary debt, fo as to exclude any creditor, who fhall ufe diligence within the fix months, from the benefit of the *pari paffu* preference; neither can a decree for payment of debt be obtained, in that period, againft an executor, becaufe, till that term be elapfed, it cannot be known how many creditors may be intitled to the fund in his hands. If no diligence be ufed within the fix months, the executor may retain for his own debt, and pay the refidue *primo venienti*. Such creditors of the deceafed as have ufed diligence within a year after their debtor's death, are preferable on the fubject of his teftament to the creditors of his next of kin.

20. The only paffive title in moveables is vitious intromiffion, which may be defined, an unwarrantable intermeddling with the moveable eftate of a perfon deceafed, without the order of law. This is not confined, as the paffive titles in heritage are, to the perfons interefted in the fucceffion, but ftrikes againft all intromitters whatever. Where an executor confirmed, intromits with more than he has confirmed, he incurs a paffive title, fraud being in the common cafe prefumed from his not giving up in inventory the full fubject intermeddled with. Vitious intromiffion is alfo prefumed, where the repofitories of a dying perfon are not fealed up, as foon as he becomes incapable of fenfe, by his neareft relations; or, if he dies in a houfe not his own, they muft be fealed by the mafter of fuch houfe, and the keys delivered to the Judge-ordinary, to be kept by him, for the benefit of all having intereft.

21. The paffive title of vitious intromiffion does not take place where there is any probable title or circumftance that takes off the prefumption of fraud. In confequence of this rule, neceffary intromiffion, or *cuftodiæ caufa*, by the wife or children, who only continue the poffeffion of the deceafed, in order to preferve his goods for the benefit of all concerned, infers no paffive title. And upon the fame principle, an intromitter, by confirming himfelf executor, and thereby fubjecting himfelf to account, before action be brought againft him on the paffive titles, purges the vitiofity of his prior intromiffion: And where the intromitter is one who is interefted in the fucceffion, *e. g.* next of kin, his confirmation, at any time within a year from the death of the deceafed, will exclude the paffive title, notwithftanding a prior citation. As this paffive title was intended only for the fecurity of creditors, it cannot be fued upon by legatees; and fince it arifes *ex delicto*, it cannot be pleaded againft the heir of the intromitter. As in delicts, any one of many delinquents may be fubjected to the whole punifhment, fo any one of many intromitters may be fued *in folidum* for the purfuer's debt, without calling the reft; but the intromitter who pays, has an action of relief againft the others for their fhare of it. If the intromitters are fued jointly,

jointly, they are liable, not *pro rata* of their ſeveral intromiſſions, but *pro virili.*

28. The whole of a debtor's eſtate is ſubjected to the payment of his debts; and therefore, both his heirs and executors are liable for them, in a queſtion with creditors; but as ſucceſſion is by law divided into the heritable and the moveable eſtate, each of theſe ought, in a queſtion between the ſeveral ſucceſſors, to bear the burdens which naturally affect it. Action of relief is accordingly competent to the heir who has paid a moveable debt, againſt the executor; and *vice verſa.* This relief is not cut off by the deceaſed's having diſponed either his land-eſtate or his moveables, with the burden of his *whole* debts; for ſuch burden is not to be conſtrued as an alteration of the legal ſucceſſion, but merely as a farther ſecurity to creditors, unleſs the contrary ſhall be preſumed from the ſpecial ſtyle of the diſpoſition.

Tit. 29. *Of laſt Heirs and Baſtards.*

By our ancient practice, feudal grants taken to the vaſſal, and to a ſpecial order of heirs, without ſettling the laſt termination upon *heirs whatſoever*, returned to the ſuperior, upon failure of the ſpecial heirs therein contained, but now that feus are become patrimonial rights, the ſuperior is, by the general opinion, held to be fully diveſted by ſuch grant, and the right deſcends to the vaſſal's heirs at law. And even where a vaſſal dies, without leaving any heir who can prove the remoteſt propinquity to him, it is not the ſuperior, as the old law ſtood, but the King, who ſucceeds as laſt heir, both in the heritable and moveable eſtate of the deceaſed, in conſequence of the rule, *Quod nullius eſt, cedit domino Regi.*

2. If the lands, to which the King ſucceeds, be holden immediately of himſelf, the property is conſolidated with the ſuperiority, as if reſignation had been made in the Sovereign's hands. If they are holden of a ſubject, the King, who cannot be vaſſal to his own ſubject, names a donatory; who, to complete his title, muſt obtain decree of declarator; and thereafter he is preſented to the ſuperior, by letters of preſentation from the King under the quarter-ſeal, in which the ſuperior is charged to enter the donatory. The whole eſtate of the deceaſed is, in this caſe, ſubjected to his debts, and to the widow's legal proviſions. Neither the King nor his donatory is liable beyond the value of the ſucceſſion. A perſon who has no heir to ſucceed to him, cannot alien his heritage *in lecto*, to the prejudice of the King, who is intitled to ſet aſide ſuch deed, in the character of *ultimus heres.*

3. A baſtard can have no legal heirs, except thoſe of his own body; ſince there is no ſucceſſion but by the father, and a baſtard has no certain father. The King therefore ſucceeds to him, failing his lawful iſſue, as laſt heir. Though the baſtard, as abſolute proprietor of his own eſtate, can diſpoſe of his heritage in *liege pouſtie*, and of his moveables by any deed *inter vivos;* yet he is diſabled, *ex defectu natalium*, from bequeathing by teſtament, without letters of legitimation from the Sovereign. If the baſtard has lawful children, he may teſt, without ſuch letters, and name tutors and curators to his iſſue. Letters of legitimation, let their clauſes be ever ſo ſtrong, cannot enable the baſtard to ſucceed to his natural father, to the excluſion of lawful heirs.

4. The legal rights of ſucceſſion, being founded in marriage, can be claimed only by thoſe who are born in lawful marriage; the iſſue therefore of an unlawful marriage are incapable of ſucceſſion. A baſtard is excluded, 1. From his father's ſucceſſion; becauſe law knows no father, who is not marked out by marriage. 2. From all heritable ſucceſſion, whether by the father or mother; becauſe he cannot be pronounced lawful heir by the inqueſt, in terms of the brief; and, 3. From the moveable ſucceſſion of his mother; for, though the mother be known, the baſtard is not her lawful child, and legitimacy is implied in all ſucceſſion conferred by law. A baſtard, though he cannot ſucceed *jure ſanguinis*, may ſucceed by deſtination, where he is ſpecially called to the ſucceſſion by an entail or teſtament.

5. Certain perſons, though born in lawful marriage, are incapable of ſucceſſion. Aliens are, from their allegiance to a foreign prince, incapable of ſucceeding in *feudal rights*, without naturalization. Children born in a foreign ſtate, whoſe fathers were natural born ſubjects, and not attainted, are held to be natural-born ſubjects. Perſons educated in, or profeſſing the Popiſh religon, if they ſhall neglect, upon their attaining the age of fifteen, to renounce its doctrines by a ſigned declaration, cannot ſucceed in *heritage*; but muſt give place to the next Proteſtant heir, who will hold the eſtate irredeemably, if the Popiſh heir does not, within ten years after incurring the irritancy, ſign the *formula* preſcribed by the ſtatute 1700, *c.* 3.

Tit. 30. *Of Actions.*

Hitherto of *perſons* and *rights*, the two firſt objects of law; *actions* are its third object, whereby perſons make their rights effectual. An action may be defined, a demand regularly made and inſiſted in, before the judge competent, for the attaining or recovering of a right; and it ſuffers ſeveral diviſions, according to the different natures of the rights purſued upon.

2. Actions are either real or perſonal. A real action, is that which ariſes from a right in the thing itſelf, and which therefore may be directed againſt all poſſeſſors of that thing: Thus, an action for the recovery, even of a moveable ſubject, when founded on a *jus in re*, is in the proper acceptation real; but real actions are, in vulgar ſpeech, confined to ſuch as are directed againſt heritable ſubjects. A perſonal action is founded only on an obligation undertaken for the performance of ſome fact, or the delivery of ſome ſubject; and therefore can be carried on againſt no other than the perſon obliged, or his heirs.

3 Actions are either ordinary or reſciſſory. All actions are, in the ſenſe of this diviſion, ordinary, which are not reſciſſory. Reſciſſory actions are divided, 1. Into actions of proper improbation. 2. Actions of reduction-improbation. 3. Actions of ſimple reduction. Proper improbations, which are brought for declaring writings falſe or forged, are treated of below, Tit. 33.

Reduction-

Reduction-improbation is an action, whereby a perfon who may be hurt or affected by a writing, infifts for producing or exhibiting it in court, in order to have it fet afide, or its effect afcertained, under the certification that the writing, if not produced, fhall be declared falfe and forged. This certification is a fiction of law, introduced that the production of writings may be the more effectually forced, and therefore it operates only in favour of the purfuer. Becaufe the fummons in this action proceeds on alledged grounds of falfehood, his Majefty's Advocate, who is the public profecutor of crimes, muft concur in it.

4. As the certification in this procefs draws after it fo heavy confequences, two terms are affigned to the defenders for production. After the fecond term is elapfed, intimation muft be made judicially to the defender, to fatisfy the production within ten days; and till thefe are expired, no certification can be pronounced. Certification cannot pafs againft deeds recorded in the books of Seffion, if the defender fhall, before the fecond term, offer a condefcendence of the dates of their regiftration, unlefs falfehood be objected; in which cafe, the original muft be brought from the record to the court. But an extract from the inferior court is no bar to certification; the principal writing muft be laid before the court of Seffion on a proper warrant.

5. In an action of fimple reduction the certification is only temporary, declaring the writings called for, null, until they be produced; fo that they recover their full force after production, even againft the purfuer himfelf; for which reafon, that procefs is now feldom ufed. Becaufe its certification is not fo fevere as in reduction-improbation, there is but on term affigned to the defender for producing the deeds called for.

6. The moft ufual grounds of reductions of writings are, the want of the requifite folemnities; that the granter was minor, or interdicted, or inhibited; or that he figned the deed on death-bed, or was compelled or frightened into it, or was circumvented; or that he granted it in prejudice of his lawful creditors.

7. In reductions on the head of force, or fear, or fraud and circumvention, the purfuer muft libel the particular circumftances from which his allegation is to be proved. Reduction is not competent upon every degree of force or fear; it muft be fuch as would fhake a man of conftancy and refolution. Neither is it competent, on that fear which arifes from the juft authority of hufbands or parents over their wives or children, nor upon the fear arifing from the regular execution of lawful diligence by caption, provided the deeds granted under that fear relate to the ground of debt contained in the diligence; but if they have no relation to that debt, they are reducible *ex metu*.

8. Alienations granted by debtors after contracting of lawful debts, in favour of conjunct or confident perfons, without juft and neceffary caufes, and without a juft price really paid, are null. One is deemed a prior creditor, whofe ground of debt exifted before the right granted by the debtor; though the written voucher of the debt fhould bear a date pofterior to it. Perfons are accounted conjunct, whofe relation to the granter is fo near, as to bar them from judging in his caufe. Confident perfons are thofe who appear to be in the granter's confidence, by being employed in his affairs, or about his perfon; as a doer, fteward, or domeftic fervant.

9. Rights, though gratuitous, are not reducible, if the granter had, at the date thereof, a fufficient fund for the payment of his creditors. Provifions to children are, in the judgment of law, gratuitous; fo that their effect, in a queftion with creditors, depends on the folvency of the granter: But fettlements to wives, either in marriage contracts, or even after marriage, are onerous, in fo far as they are rational; and confequently are not reducible, even though the granter was infolvent. This rule holds alfo in rational tochers contracted to hufbands: But it muft, in all cafes, be qualified with this limitation, *if the infolvency of the granter was not publicly known*; for if it was, fraud is prefumed in the receiver of the right, by contracting with the bankrupt.

10. The receiver of the deed, if he be a conjunct or confident perfon, muft aftruct or fupport the onerous caufe of his right, not merely by his own oath, but by fome circumftances or adminicles. But where a right is granted to a ftranger, the narrative of it expreffing an onerous caufe, is fufficient *per fe* to fecure it againft reduction.

11. All voluntary payments or rights made by a bankrupt to one creditor, to difappoint the more timeous diligence of another, are reducible at the inftance of that creditor who has ufed the prior diligence. A creditor, though his diligence be but begun by citation, may infift in a reduction of all pofterior voluntary rights granted to his prejudice; but the creditor who neglects to complete his begun diligence within a reafonable time, is not intitled to reduce any right granted by the debtor, after the time that the diligence is confidered as abandoned.

12. A prohibited alienation, when conveyed by the receiver to another who is not privy to the fraud, fubfifts in the perfon of the *bona fide* purchafer. In the cafe of moveable rights, this nullity is receivable by exception; but it muft be declared by reduction, where the right is heritable.

13. By act 1696, *c.* 5. all alienations by a bankrupt, within fixty days before his bankruptcy, to one creditor in preference to another, are reducible, at the inftance even of fuch co-creditors as had not ufed the leaft ftep of diligence. A bankrupt is there defcribed by the following characters; diligence ufed againft him by horning and caption; and infolvency, joined either with imprifonment, retiring to the fanctuary, abfconding, or forcibly defending himfelf from diligence. It is fufficient that a caption is raifed againft the debtor, though it be not executed, provided he has retired to fhun it. It is provided, that all heritable bonds or rights on which feifin may follow, fhall be reckoned, in a queftion with the granter's other creditors upon this act, to be of the date of the feifin following thereon. But this act was found to relate only to fecurities for former debts, and not to *nova debita*.

14. Actions are divided into *rei perfecutoriæ*, and *pœnales*. By the firft, the purfuer infifts barely to recover the fubject that is his, or the debt due to him; and this includes

includes the damage suſtained; for one is as truly a sufferer in his patrimonial intereſt by that damage, as by the loſs of the ſubject itſelf. In penal actions, which always ariſe *ex delicto*, ſomething is alſo demanded by way of penalty.

15. Actions of ſpuilzie, ejection, and intruſion, are penal. An action of ſpuilzie is competent to one diſpoſſeſſed of a moveable ſubject violently, or without order of law, againſt the perſon diſpoſſeſſing; not only for being reſtored to the poſſeſſion of the ſubject, if extant, or for the value, if it be deſtroyed, but alſo for the violent profits, in caſe the action be brought within three years from the ſpoliation. Ejection and intruſion are, in heritable ſubjects, what ſpuilzie is in moveables. The difference between the two firſt is, that in ejection, violence is uſed; whereas the intruder enters into the void poſſeſſion, without either a title from the proprietor, or the warrant of a judge. The actions ariſing from all the three are of the ſame general nature.

16. The action of contravention of law-borrows is alſo penal. It proceeds on letters of law-borrows, (from *borgh* a cautioner), which contain a warrant to charge the party complained upon, that he may give ſecurity, not to hurt the complainer in his perſon, family, or eſtate. Theſe letters do not require the previous citation of the party complained upon, becauſe the caution which the law requires is only for doing what is every man's duty; but, before the letters are executed againſt him, the complainer muſt make oath that he dreads bodily harm from him. The penalty of contravention is aſcertained to a ſpecial ſum, according to the offender's quality; the half to be applied to the fiſk, and the half to the complainer. Contravention is not incurred by the uttering of reproachful words, where they are not accompanied, either with acts of violence, or at leaſt a real injury; and as the action is penal, it is elided by any probable ground of excuſe.

17 Penalties are the conſequences of delict, or tranſgreſſion; and as no heir ought to be accountable for the delict of his anceſtor, farther than the injured perſon has really ſuffered by it, penal actions die with the delinquent, and are not tranſmiſſible againſt heirs. Yet the action, if it has been commenced, and litiſconteſted in the delinquent's lifetime, may be continued againſt the heir, though the delinquent ſhould die during the dependence. Some actions are *rei perſecutoriæ* on the part of the purſuer, when he inſiſts for ſimple reſtitution; which yet may be penal in reſpect of the defender; *e. g.* the action on the paſſive title of vitious intromiſſion, by which the purſuer frequently recovers the debt due to him by the deceaſed, though it ſhould exceed the value of the goods intermeddled with by the defenders.

18. The moſt celebrated diviſion of actions in our law, is into *petitory*, *poſſeſſory*, and *declaratory*. *Petitory* actions are thoſe, where ſomething is demanded from the defender, in conſequence of a right of property, or of credit in the purſuer: Thus, actions for reſtitution of moveables, actions of poinding, of forthcoming, and indeed all perſonal actions upon contracts or quaſi-contracts, are petitory. *Poſſeſſory* actions are thoſe which are founded, either upon poſſeſſion alone, as ſpuilzies; or upon poſſeſſion joined with another title, as removings; and they are competent either for getting into poſſeſſion, for holding it, or for recovering it; analogous to the interdicts of the Roman law, *quorum bonorum*, *uti poſſidetis*, and *unde vi*.

16. An action of moleſtation is a poſſeſſory action, competent to the proprietor of a land-eſtate, againſt thoſe who diſturb his poſſeſſion. It is chiefly uſed in queſtions of commonty, or of controverted marches. Where a declarator of property is conjoined with a proceſs of moleſtation, the ſeſſion alone is competent to the action. Actions on brieves of perambulation, have the ſame tendency with moleſtations, *viz.* the ſettling of marches between conterminous lands.

20 The action of mails and duties is ſometimes petitory, and ſometimes poſſeſſory. In either caſe, it is directed againſt the tenants and natural poſſeſſors of land-eſtates, for payment to the purſuer of the rents remaining due by them for paſt crops, and of the full rent for the future. It is competent, not only to a proprietor whoſe right is perfected by ſeiſin, but to a ſimple diſponee, for a diſpoſition of lands includes a right to the mails and duties; and conſequently to an adjudger, for an adjudication is a judicial diſpoſition. In the petitory action, the purſuer, ſince he founds upon right, not poſſeſſion, muſt make the proprietor, from whom the tenants derive their right, party to the ſuit; and he muſt ſupport his claim by titles of property or diligences, preferable to thoſe in the perſon of his competitor. In the poſſeſſory, the purſuer, who libels that he, his anceſtors or authors, have been ſeven years in poſſeſſion, and that therefore he has the benefit of a poſſeſſory judgment, need produce no other title than a ſeiſin, which is a title ſufficient to make the poſſeſſion of heritage lawful; and it is enough, if he calls the natural poſſeſſors, though he ſhould neglect the proprietor. A poſſeſſory judgment founded on ſeven years poſſeſſion, in conſequence either of a ſeiſin or a tack, has this effect, that though one ſhould claim under a title preferable to that of the poſſeſſor, he cannot compete with him in the poſſeſſion, till in a formal proceſs of reduction he ſhall obtain the poſſeſſor's title declared void.

21. A *declaratory* action is that, in which ſome right is craved to be declared in favour of the purſuer, but nothing ſought to be paid or performed by the defender, ſuch as declarators of marriage, of irritancy, of expiry of the legal reverſion, *&c.* Under this claſs may be alſo comprehended reſciſſory actions, which, without any perſonal concluſion againſt the defender, tend ſimply to ſet aſide the rights or writings libelled, in conſequence of which a contrary right or immunity ariſes to the purſuer. Decrees upon action that are properly declaratory confer no new right; they only declare what was the purſuer's right before, and ſo have a retroſpect to the period at which that right firſt commenced. Declarators, becauſe they have no perſonal concluſion againſt the defender, may be purſued againſt an apparent heir without a previous charge given him to enter to his anceſtor; unleſs where ſpecial circumſtances require a charge.

22. An action for proving the tenor, whereby a writing, which is deſtroyed or amiſſing, is endeaved to be revived, is in effect declaratory. In obligations that are extinguiſhable

extinguishable barely by the debtor's retiring or cancelling them, the pursuer, before a proof of the tenor is admitted, must condescend on such a *casus amissionis*, or accident by which the writing was destroyed, as shews it was lost when in the creditor's possession; otherwise bonds that have been cancelled by the debtor on payment, might be reared up as still subsisting against him: But in writings which require contrary deeds to extinguish their effect, as assignations, dispositions, charters, *&c.* it is sufficient to libel that they were lost, even *casu fortuito*.

23. Regularly, no deed can be revived by this action, without some adminicle in writing, referring to that which is libelled; for no written obligation ought to be raised up barely on the testimony of witnesses. If these adminicles afford sufficient conviction, that the deed libelled did once exist, the tenor is admitted to be proved by witnesses, who must depose, either that they were present at signing the deed, or that they afterwards saw it duly subscribed. Where the relative writings contain all the substantial clauses of that which is lost, the tenor is sometimes sustained without witnsses. In a writing which is libelled to have contained uncommon clauses, all these must appear by the adminicles. Actions of proving the tenor are, on account of their importance, appropriated to the court of Session; and, by the old form, the testimony of the witnesses could not be received, but in presence of all the judges.

24. The action of double or multiple poinding may be also reckoned declaratory. It is competent to a debtor, who is distressed, or threatened with distress, by two or more persons claiming right to the debt, and who therefore brings the several claimants into the field, in order to debate and settle their several preferences, that so he may pay securely to him whose right shall be found preferable. This action is daily pursued by an arrestee, in the case of several arrestments used in his hands for the same debt; or by tenants in the case of several adjudgers, all of whom claim right to the same rents. In these competitions, any of the competitors may bring an action of multiple-poinding in name of the tenants, or other debtors, without their consent, or even though they should disclaim the process; since the law has introduced it as the proper remedy for getting such competitions determined: And while the subject in controversy continues *in medio*, any third person who conceives he has a right to it, may, though he should not be cited as a defender, produce his titles, as if he were an original party to the suit, and will be admitted for his interest in the competition.

25. Certain actions may be called accessory, because they are merely preparatory or subservient to other actions. Thus, exhibitions *ad deliberandum*, at the instance of an heir against the creditors or custodiers of his ancestor's writings, are intended only to pave the way for future processes. An action of transference is also of this sort, whereby an action, during the pendency of which the defender happens to die, is craved to be transferred against his representative, in the same condition in which it stood formerly. Upon the pursuer's death, his heir may insist in the cause against the defender, upon producing, either a retour or a confirmed testament, according as the subject is heritable or moveable. Transferences being but incidental to other actions, can be pronounced by that inferior judge alone before whom the principal cause depended; but where the representatives of the deceased live in another territory, it is the supreme court which must transfer. Obligations may be now registred summarily after the creditor's death; which before was not admitted, without a separate process of registration, to which the granter was necessarily to be made a party.

26. A process of wakening is likewise accessory. An action is said to sleep, when it lies over, not insisted in for a year, in which case its effect is suspended; but even then it may, at any time within the years of prescription, be revived or wakened by a summons, in which the pursuer recites the last step of the process, and concludes that it may be again carried on as if it had not been discontinued. An action that stands upon any of the inner-house rolls cannot sleep; nor an action in which decree is pronounced, because it has got its full completion: Consequently the decree may be extracted after the year, without the necessity of a wakening.

27. An action of transumpt falls under the same class. It is competent to those, who have a partial interest in writings that are not in their own custody, against the possessors thereof, for exhibiting them, that they may be transumed for their behoof. Though the ordinary title in this process be an obligation by the defender to grant transumpts to the pursuer, it is sufficient if the pursuer can show that he has an interest in the writings; but, in this case, he must transume them on his own charges. Actions of transumpt may be pursued before any judge-ordinary. After the writings to be transumed are exhibited, full duplicates are made out, collated, and signed, by one of the clerks of court, which are called transumpts, and are as effectual as an extract from the register.

28. Actions proceeded anciently upon brieves issuing from the chancery, directed to the justiciary or judge-ordinary, who tried the matter by a jury, upon whose verdict judgment was pronounced: And to this day, we retain certain brieves, as of *inquest*, *terce*, *ideotry*, *tutory*, *perambulation*, and perhaps two or three others: But summonses were, immediately upon the institution of the College of Justice, introduced in the place of brieves. A summons, when applied to actions pursued before the session, is a writ in the King's name, issuing from his signet upon the pursuer's complaint, authorising messengers to cite the defender to appear before the court, and make his defences; with certification if he fail to appear, that decree will be pronounced against him in terms of the certification of the summons.

29. The days indulged by law to a defender, between his citation and appearance, to prepare for his defence, are called *induciæ legales*. If he is within the kingdom, twenty one and six days, for the first and second diets of appearance, must be allowed him for that purpose; and if out of it, sixty and fifteen. Defenders residing in Orkney or Zetland must be cited on forty days. In certain summonses which are priviledged, the *induciæ* are shortened: Spuilzies and ejections proceed on fifteen days;

wakenings

wakenings and transferences, being but incidental, on fix; fee the lift of privileged fummonfes, in act of federunt June 29. 1672. A fummons muft be executed, *i. e.* ferved againft the defender, fo as the laft diet of appearance may be within a year after the date of the fummons; and it muft be called within a year after that diet, otherwife it falls for ever. Offence againft the authority of the court, acts of malverfation in office by any member of the college of juftice, and acts of violence and oppreffion committed during the dependence of a fuit by any of the parties, may be tried without a fummons, by a fummary complaint.

30 Where an action is in part penal, *e. g.* a removing fpuilzie, *&c.* a purfuer who reftricts his demand to, and obtains decree merely for reftitution, cannot thereafter bring a new procefs for the violent profits. Yet the fame fact may be the foundation both of a criminal and civil action, becaufe thefe two are intended for different purpofes; the one for fatisfying the public juftice, the other for indemnifying the private party: And though the defender fhould be abfolved in the criminal trial, for want of evidence, the party injured may bring an action *ad civilem effectum*, in which he is intitled to refer the libel to the defender's oath.

31. One libel or fummons may contain different conclufions on the fame ground of right, refciffory, declaratory, petitory, *&c.* if they be not repugnant to each other: Nay, though different fums be due to one, upon diftinct grounds of debt, or even by different debtors, the creditor may infift againft them all in the fame fummons.

32. Defences are pleas offered by a defender for eliding an action. They are either dilatory, which do not enter into the caufe itfelf, and fo can only procure an abfolviture from the *lis pendens:* Or peremptory, which entirely cut off the purfuer's right of action. The firft, becaufe they relate to the forms of proceeding, muft be offered *in limine judicii*, and all of them at once. But peremptory defences may be proponed at any time before fentence.

33. A caufe, after the parties had litigated it before the judge, was faid by the Romans to be litifcontefted. By litifconteftation a judicial contract is underftood to be entered into by the litigants, by which the action is perpetuated againft heirs, even when it arifes *ex delicto*. By our law, litifconteftation is not formed till an act is extracted, admitting the libel or defences to proof.

Tit. 31. *Of Probation.*

All allegations by parties to a fuit, muft be fupported by proper proof. Probation is either by writing, by the party's own oath, or by witneffes. In the cafe of allegations, which may be proved by either of the three ways, a proof is faid to be admitted *prout de jure;* becaufe, in fuch cafe, all the legal methods of probation are competent to the party: If the proof he brings by writing be lame, he may have recourfe either to witneffes or to his adverfary's oath; but, if he fhould firft take himfelf to the proof by oath, he cannot thereafter ufe any other probation, for the reafon affigned § 3. and, on the contrary, a purfuer, who has brought a proof by witneffes, on an extracted act, is not allowed to recur to the oath of the defender. Single combat, as a fort of appeal to Providence, was, by our ancient law, admitted as evidence, in matters both civil and criminal. It was afterwards reftricted to the cafe of fuch capital crimes where no other proof could be had; fome traces of this blind method of trial remained even in the reign of *J.* VI. who, by 1600. *c.* 12. might authorife duels on weighty occafions.

2. As obligations or deeds figned by the party himfelf, or his anceftors or authors, muft be, of all evidence, the leaft liable to exception; therefore every debt or allegation may be proved by proper evidence in writing. The folemnities effential to probative deeds have been already explained, Tit. xxi. 3. *et feq.* Books of account kept by merchants, tradefmen, and other dealers in bufinefs, though not fubfcribed, are probative againft him who keeps them; and, in cafe of furnifhings by a fhop-keeper, fuch books, if they are regularly kept by him, fupported by the teftimony of a fingle witnefs, afford a *femiplena probatio* in his favour, which becomes full evidence by his own oath in fupplement. Notorial inftruments and executions by meffengers bear full evidence, that the folemnities therein fet forth were ufed, not to be invalidated otherwife than by a proof of falfehood; but they do not prove any other extrinfic facts therein averred, againft third parties.

3. Regularly, no perfon's right can be proved by his own oath, nor taken away by that of his adverfary; becaufe thefe are the bare averments of parties in their own favour. But, where the matter in iffue is referred by one of the parties to the oath of the other, fuch oath, though made in favour of the deponent himfelf, is decifive of the point; becaufe the reference is a virtual contract between the litigants, by which they are underftood to put the iffue of the caufe upon what fhall be depofed: And this contract is fo ftrictly regarded, that the the party who refers to the oath of the other cannot afterwards, in a civil action, plead upon any deed againft the party depofing, inconfiftent with his oath. To obviate the fnares that may be laid for perjury, he, to whofe oath of verity a point is referred, may refufe to depofe, till his adverfary fwear that he can bring no other evidence in proof of his allegation.

4. A defender, though he cannot be compelled to fwear to facts in a libel properly criminal; yet may, in trefpaffes, where the conclufion is limited to a fine, or to damages. In general, an oath of party cannot either hurt or benefit third parties; being, as to them, *res inter alios acta.*

5. An oath upon reference, is fometimes qualified by fpecial limitations reftricting it. The qualities which are admitted by the judge as part of the oath, are called intrinfic; thofe which the judge rejects or feparates from the oath, extrinfic. Where the quality makes a part of the allegation which is relevantly referred to oath, it is intrinfic. Thus, becaufe a merchant, fuing for furnifhings after the three years, muft, in order to make a relevancy, offer to prove by the defender's oath, not only the delivery of the goods, but that the price is ftill due; there-

fore, though the defender ſhould acknowledge upon oath his having received the goods, yet, if he adds, that he paid the price, this laſt part, being a denial that the debt ſubſiſts, is intrinſic, ſince it is truly the point referred to oath. Where the quality does not import an extinction of the debt, but barely a counter-claim, or *mutua petitio*, againſt the purſuer, it is held as extrinſic, and muſt be proved *aliunde*. Neither can a defender who in his oath admits the conſtitution of a debt, get off by adjecting the quality of payment, where the payment ought by its nature to be vouched by written evidence.

6. Oaths of verity are ſometimes deferred by the judge to either party, *ex officio*; which becauſe they are not founded on any implied contract between the litigants, are not finally deciſive, but may be traverſed on proper evidence afterwards produced. Theſe oaths are commonly put by the judge for ſupplying a lame or imperfect proof, and are therefore called oaths in ſupplement. See § 2.

7. To prevent groundleſs allegations, oaths of calumny have been introduced, by which either party may demand his adverſary's oath, that he believes the fact contained in his libel or defences to be juſt and true. As this is an oath, not of verity, but only of opinion, the party who puts it to his adverſary, does not renounce other probation; and therefore no party is bound to give an oath of calumny, on recent facts of his own, for ſuch oath is really an oath of verity. Theſe oaths have not been ſo frequent ſince the act of ſederunt, Feb. 1. 1715, whereby any party, againſt whom a fact ſhall be alledged, is obliged, without making oath, to confeſs or deny it; and in caſe of calumnious denial, is ſubjected to the expence that the other party has thereby incurred.

8. In all oaths, whether of verity or calumny, the citation carries, or at leaſt implies, a certification, that if the party does not appear at the day aſſigned for depoſing, he ſhall be held *pro confeſſo*; from a preſumption of his conſciouſneſs, that the fact upon which he declines to ſwear makes againſt him; but no party can be held *pro confeſſo*, if he be in the kingdom, without a previous perſonal citation uſed againſt him. Though an oath which reſolves into a *non memini*, cannot be ſaid to prove any point; yet where one ſo depoſes upon a recent fact, to which he himſelf was privy, his oath is conſidered as a diſſembling of the truth, and he is held *pro confeſſo*, as if he had refuſed to ſwear.

9. An oath *in litem*, is that which the judge defers to a purſuer, for aſcertaining either the quantity or the value of goods which have been taken from him by the defender without order of law, or the extent of his damages. An oath *in litem*, as it is the affirmation of a party in his own behalf, is only allowed where there is proof that the other party has been engaged in ſome illegal act, or where the public policy has made it neceſſary, ſee Tit. xx. 11. This oath, as to the quantities, is not admitted, where there is a concurring teſtimony of witneſſes brought in proof of it. When it is put as to the value of goods, it is only an oath of credulity; and therefore it has always been ſubject to the modification of the court.

10. The law of Scotland rejects the teſtimony of witneſſes, 1. In payment of any ſum above *L.* 100 *Scots*, all which muſt be proved either *ſcripto vel juramento*. 2. In all gratuitous promiſes, though for the ſmalleſt trifle. 3. In all contracts, where writing is either eſſential to their conſtitution, (ſee Tit. xxi. 2) or where it is uſually adhibited, as in the borrowing of money. And it is a general rule, ſubject to the reſtrictions mentioned in the next §, that no debt or right, once conſtituted by writing, can be taken away by witneſſes.

11. On the other part, probation by witneſſes is admitted to the extent of *L.* 100 *Scots*, in payments, nuncupative legacies, and verbal agreements which contain mutual obligations. And it is received to the higheſt extent, 1. In all bargains which have known engagements naturally ariſing from them, concerning moveable goods. 2 In facts performed in ſatisfaction, even of a written obligation, where ſuch obligation binds the party preciſely to the performance of them. 3. In facts which with difficulty admit of a proof by writing, even though the effect of ſuch proof ſhould be the extinction of a written obligation, eſpecially if the facts import fraud or violence; thus, a bond is reducible *ex dolo*, on a proof by witneſſes. Laſtly, all intromiſſion by a creditor with the rents of his debtor's eſtate payable in grain, may be proved by witneſſes; and even intromiſſion with the ſilver-rent, where the creditor has entered into the total poſſeſſion of the debtor's lands.

12. No perſon, whoſe near relation to another bars him from being a judge in his cauſe, can be admitted as a witneſs for him; but he may, againſt him, except a wife or child, who cannot be compelled to give teſtimony againſt the huſband or parent, *ob reverentiam perſonæ, et metum perjurii*. Though the witneſs, whoſe propinquity to one of the parties is objected to, be as nearly related to the other, the objection ſtands good.

13. The teſtimony of infamous perſons is rejected, *i. e.* perſons who have been guilty of crimes that law declares to infer infamy, or who have been declared infamous by the ſentence of a judge; but *infamia facti* does not diſqualify a witneſs. Pupils are inhabile witneſſes; being, in the judgment of law, incapable of the impreſſions of an oath. The teſtimony of women is ſeldom admitted, where other witneſſes can be had. And in general witneſſes otherwiſe exceptionable may, where there is a penury of witneſſes ariſing from the nature or circumſtances of the fact, be received *cum nota*; that is, their teſtimony, though not quite free from ſuſpicion, is to be conjoined with the other evidence, and to have ſuch weight given it as the judge ſhall think it deſerves.

14. All witneſſes, before they are examined in the cauſe, are purged of partial counſel; that is, they muſt declare, that they have no intereſt in the ſuit, nor have given advice how to conduct it; that they have got neither bribe nor promiſe, nor have been inſtructed how to depoſe; and that they bear no enmity to either of the parties. Theſe, becauſe they are the points put to a witneſs before his making oath, are called *initialia teſtimonii*. Where a party can bring preſent proof of a witneſs's partial counſel, in any of the above particulars, he ought to offer it before the witneſs be ſworn; but, becauſe ſuch objection, if it cannot be inſtantly verified, will be no bar to the examination, law allows the party in that caſe to proteſt

protest for *reprobator*, before the witness is examined; *i. e.* that he may be afterwards allowed to bring evidence of his enmity, or other inhability. Reprobator is competent even after sentence, where protestation is duly entered; but in that case, the party insisting must consign *L.* 100 *Scots*, which he forfeits if he succumb. This action must have the concurrence of the King's Advocate, because the conclusion of it imports perjury; and for this reason, the witness must be made a party to it.

15. The interlocutory sentence or warrant, by which parties are authorised to bring their proof, is either by way of act, or of incident diligence. In an act, the Lord Ordinary who pronounces it, is no longer judge in the process; but in an incident diligence, which is commonly granted upon special points, that do not exhaust the cause, the Lord ordinary continues judge. If a witness does not appear at the day fixed by the warrant of citation, a second warrant is granted of the nature of a caption, containing a command to messengers to apprehend and bring him before the court. Where the party to whom a proof is granted, brings none within the term allowed by the warrant, an interlocutor is pronounced, circumducing the term, and precluding him from bringing evidence thereafter. Where evidence is brought, if it be upon an act, the Lord Ordinary on the acts, after the term for proving is elapsed declares the proof concluded, and thereupon a state of the case is prepared by the Ordinary on concluded causes, which must be judged by the whole Lords; but if the proof be taken upon an incident diligence, the import of it may be determined by the Lord Ordinary in the cause.

16. Where facts do not admit a direct proof, presumptions are received as evidence which, in many cases, make as convincing a proof as the direct. Presumptions are consequences deduced from facts known or proved, which infer the certainty, or at least a strong probability, of another fact to be proved. This kind of probation is therefore called artificial because it requires a reasoning to infer the truth of the point in question, from the facts that already appear in proof. Presumptions are either, 1. *juris et de jure*; 2. *juris*; or 3. *hominis* or *judicis*. The first sort obtains, where statute or custom establishes the truth of any point upon a presumption; and it is so strong, that it rejects all proof that may be brought to elide it in special cases. Thus, the testimony of a witness, who forwardly offers himself without being cited, is, from a presumption of his partiality, rejected, let his character be ever so fair; and thus also, a minor, because he is by law presumed incapable of conducting his own affairs, is, upon that presumption, disabled from acting without the consent of his curators, though he should be known to behave with the greatest prudence. Many such presumptions are fixed by statute.

17 *Præsumptiones juris* are those, which our law books or decisions have established, without founding any particular consequence upon them, or statuting *super præsumpto*. Most of this kind are not proper presumptions inferred from positive facts, but are founded merely on the want of a contrary proof; thus, the legal presumptions for freedom, for life, for innocence, *&c* are in effect so many negative propositions, that servitude, death, and guilt, are not to be presumed, without evidence brought by him who makes the allegation. All of them, whether they be of this sort, or proper presumptions, as they are only conjectures formed from what commonly happens, may be elided, not only by direct evidence, but by other conjectures, affording a stronger degree of probability to the contrary. *Præsumptiones hominis* or *judicis*, are those which arise daily from the circumstances of particular cases; the strength of which is to be weighed by the judge.

18. A *fictio juris* differs from a presumption. Things are presumed, which are likely to be true; but a fiction or law assumes for truth what is either certainly false, or, at least, is as probably false as true. Thus, an heir is feigned or considered in law as the same person with his ancestor. Fictions of law must, in their effects, be always limited to the special purposes of equity, for which they were introduced; see an example, Tit. xxx. 3.

Tit. 32. *Of Sentences and their Execution.*

Property would be most uncertain, if debateable points might, after receiving a definitive judgment, be brought again in question, at the pleasure of either of the parties: Every state has therefore affixed the character of final to certain sentences or decrees, which in the Roman law are called *res judicatæ*, and which exclude all review or rehearing

2. Decrees of the court of Session, are either *in foro contradictorio*, where both parties have litigated the cause, or in absence of the defender. Decrees of the Session *in foro* cannot, in the general case, be again brought under the review of the court, either on points which the parties neglected to plead before sentence (which we call competent and omitted), or upon points pleaded and found insufficient (proponed and repelled.) But decrees, though *in foro*, are reversible by the court, where either they labour under essential nullities; *e g.* where they are *ultra petita*, or not conformable to their grounds and warrants, or founded on an error in calcul, *&c.*; or where the party against whom the decree is obtained has thereafter recovered evidence sufficient to overturn it, of which he knew not before.

3. As parties might formerly reclaim against the sentences of the session, at any time before extracting the decree, no judgment was final till extract; but now, a sentence of the inner-house, either not reclaimed against within six federunt-days after its date, or adhered to upon a reclaiming bill, though it cannot receive execution till extract, makes the judgment final as to the court of Session. And, by an order of the house of Lords, March 24. 1725, no appeal is to be received by them from sentences of the Session after five years from extracting the sentence; unless the person entitled to such appeal be minor, clothed with a husband, *non compos mentis*, imprisoned, or out of the kingdom. Sentences pronounced by the Lord Ordinary have the same effect, if not reclaimed against, as if they were pronounced in presence; and all petitions against the interlocutor of an Ordinary must be preferred within eight federunt-days after signing such interlocutor.

4. De-

4. Decrees, in abfence of the defender, have not the force of *res judicatæ* as to him; for where the defender does not appear, he cannot be faid to have fubjected himfelf by the judicial contract which is implied in litifconteftation: A party therefore may be reftored againft thefe, upon paying to the other his cofts in recovering them. The fentences of inferior courts may be reviewed by the court of Seffion, before decree, by advocation, and after decree, by fufpenfion or reduction; which two laft are alfo the methods of calling in queftion fuch decrees of the Seffion itfelf as can again be brought under the review of the court.

5. Reduction is the proper remedy, either where the decree has already received full execution by payment, or where it decrees nothing to be paid or performed, but fimply declares a right in favour of the purfuer. Sufpenfion is that form of law by which the effect of a fentence condemnatory, that has not yet received execution, is ftayed or poftponed, till the caufe be again confidered. The firft ftep towards fufpenfion is a bill preferred to the Lord Ordinary on the bills. This bill, when the defire of it is granted, is a warrant for iffuing letters of fufpenfion which pafs the fignet; but, if the prefenter of the bill fhall not, within fourteen days after paffing it, expedite the letters, execution may proceed on the fentence. Sufpenfions of decrees *in foro* cannot pafs, but by the whole Lords in time of feffion, and by three in vacation time: but other decrees may be fufpended by any one of the judges.

6. As fufpenfion has the effect of ftaying the execution of the creditor's legal diligence, it cannot, in the general cafe, pafs without caution given by the fufpender to pay the debt, in the event it fhall be found due. Where the fufpender cannot, from his low or fufpected circumftances, procure unqueftionable fecurity, the Lords admit juratory caution, *i. e.* fuch as the fufpender fwears is the beft he can offer; but the reafons of fufpenfion are, in that cafe, to be confidered with particular accuracy at paffing the bill. Decrees in favour of the clergy, of univerfities, hofpitals, or parifh fchool mafters, for their ftipends, rents, or falaries, cannot be fufpended, but upon production of difcharges, or on configuration of the fums charged for. A charger, who thinks himfelf fecure without a cautioner, and wants difpatch, may, where a fufpenfion of his diligence is fought, apply to the court to get the reafons of fufpenfion fummarily difcuffed on the bill.

7. Though he, in whofe favour the decree fufpended is pronounced, be always called the charger, yet a decree may be fufpended before a charge be given on it. Nay, fufpenfion is competent even where there is no decree, for putting a ftop to any illegal act whatfoever: Thus, a building, or the exercife of a power which one affumes unwarrantably, is a proper fubject of fufpenfion. Letters of fufpenfion are confidered merely as a prohibitory diligence; fo that the fufpender, if he would turn provoker, muft bring an action of reduction. If upon difcuffing the letters of fufpenfion, the reafons fhall be fuftained, a decree is pronounced, fufpending the letters of diligence on which the charge was given *fimpliciter*; which is called a decree of fufpenfion, and takes off the effect of the decree fufpended. If the reafons of fufpenfion be repelled, the court find the letters of diligence orderly proceeded, *i. e.* regularly carried on; and they ordain them to be put to farther execution.

8. Decrees are carried into execution, by diligence, either againft the perfon, or againft the eftate of the debtor. The firft ftep of perfonal execution is by letters of horning, which pafs, by warrant of the court of Seffion, on the decrees of magiftrates of boroughs, fheriffs, admirals, and commiffaries. If the debtor does not obey the will of the letters of horning within the days of the charge, the charger, after denouncing him rebel, and regiftring the horning, may apply for letters of caption, which contain a command, not only to meffengers, but to magiftrates, to apprehend and imprifon the debtor. All meffengers and magiftrates, who refufe their affiftance in executing the caption, are liable *fubfidarie* for the debt; and fuch fubfidiary action is fupported by the execution of the meffenger employed by the creditor, expreffing that they were charged to concur, and would not. Letters of caption contain an exprefs warrant to the meffenger, in cafe he cannot get accefs, to break open all doors, and other lock faft places.

9. Law fecures peers, married women, and pupils, againft perfonal execution by caption upon civil debts. No caption can be executed againft a debtor within the precincts of the King's palace of Holyroodhoufe: But this privilege of fanctuary afforded no fecurity to criminals, as that did which was, by the canon law, conferred on churches and religious houfes. Where the perfonal prefence of a debtor, under caption, is neceffary in any of our fupreme courts, the judges are empowered to grant him a protection, for fuch time as may be fufficient for his coming and going, not exceeding a month.

10. After a debtor is imprifoned, he ought not to be indulged the benefit of the air, not even under a guard; for creditors have an intereft, that their debtors be kept under clofe confinement, that, by the *fqualor carceris*, they may be brought to pay their debt: And any magiftrate or jailor, who fhall fuffer the prifoner to go abroad, without a proper atteftation, upon oath, of the dangerous ftate of his health. is liable *fubfidarie* for the debt. Magiftrates are in like manner liable, if they fhall fuffer a prifoner to efcape, through the infufficiency of their prifon: But, if he fhall efcape under night, by the ufe of inftruments, or by open force, or by any other accident which cannot be imputed to the magiftrates or jailor, they are not chargeable with the debt; provided they fhall have, immediately after his efcape, made all poffible fearch for him. Regularly, no prifoner for debt upon letters of caption, though he fhould have made payment, could be releafed without letters of fufpenfion, containing a charge to the jailor to fet him at liberty; becaufe the creditor's difcharge could not take off the penalty incurred by the debtor for contempt of the King's authority: But to fave unneceffary expence to debtors in fmall debts, jailors are empowered to let go prifoners where the debt does not exceed 200 merks *Scots*, upon production of a difcharge, in which the creditor confents to his releafe.

11. Our

11. Our law, from a confideration of compaffion, allows infolvent debtors to apply for a releafe from prifon, upon a *ceffio bonorum*, *i. e.* upon their making over to the creditors all their eftate, real and perfonal. This muft be infifted for, by way of action, to which all the creditors of the prifoner ought to be made parties. The prifoner muft, in this action, which is cognifable only by the court of Seffion, exhibit a particular inventory of his eftate, and make oath that he has no other eftate than is therein contained, and that he has made no conveyance of any part of it, fince his imprifonment, to the hurt of his creditors. He muft alfo make oath, whether he has granted any difpofition of his effects before his imprifonment, and condefcend on the perfons to whom, and on the caufe of granting it; that the court may judge, whether, by any collufive practice, he has forfeited his claim to liberty.

12. A fraudulent bankrupt is not allowed this privilege; nor a criminal who is liable in an affythment or indemnification to the party injured or his executors, though the crime itfelf fhould be extinguifhed by a pardon. A difpofition granted on a *ceffio bonorum* is merely in farther fecurity to the creditors, not in fatisfaction or *in folutum* of the debts. If therefore, the debtor fhall acquire any eftate after his releafe, fuch eftate may be attached by his creditors, as if there had been no *ceffio*, except in fo far as is neceffary for his fubfiftence. Debtors, who are fet free on a *ceffio bonorum*, are obliged to wear a habit proper to dyvours or bankrupts. The Lords are prohibited to difpenfe with this mark of ignominy, unlefs, in the fummons and procefs of *ceffio*, it be libelled, fuftained, and proved, that the bankruptcy proceeds from misfortune. And bankrupts are condemned to fubmit to the habit, even where no fufpicion of fraud lies againft them, if they have been dealers in an illicite trade.

13. Where a prifoner for debt declares upon oath, before the magiftrate of the jurifdiction, that he has not wherewith to maintain himfelf, the magiftrate may fet him at liberty, if the creditor, in confequence of whofe diligence he was imprifoned, does not aliment him within ten days after intimation made for that purpofe. But the magiftrate may, in fuch cafe, detain him in prifon, if he chufes to bear the burden of the aliment, rather than releafe him. The ftatute authorifing this releafe, which is ufually called the act of grace, is limited to the cafe of prifoners for civil debts.

14. Decrees are executed againft the moveable eftate of the debtor by arreftment or poinding; and againft his heritable eftate, by inhibition, or adjudication. If one be condemned, in a removing or other procefs, to quit the poffeffion of lands, and refufes, notwithftanding a charge, letters of ejection are granted of courfe, ordaining the fheriff to eject him, and to enter the obtainer of the decree into poffeffion. Where one oppofes by violence the execution of a decree, or of any lawful diligence, which the civil magiftrate is not able by himfelf and his officers to make good, the execution is enforced *manu militari*.

15. A decree-arbitral, which is a fentence proceeding on a fubmiffion to arbiters, has fome affinity with a judicial fentence, though in moft refpects the two differ. A fubmiffion is a contract entered into, by two or more parties who have difputable rights or claims, whereby they refer their differences to the final determination of an arbiter or arbiters, and oblige themfelves to acquiefce in what fhall be decided. Where the day within which the arbiters are to decide, is left blank in the fubmiffion, practice has limited the arbiters power of deciding to a year. As this has proceeded from the ordinary words of ftyle, empowering the arbiters to determine betwixt and the day of next to come; therefore, where a fubmiffion is indefinite, without fpecifying any time, like all other contracts or obligations, it fubfifts for forty years. Submiffions, like mandates, expire by the death of any of the parties-fubmitters before fentence. As arbiters are not vefted with jurifdiction, they cannot compel witneffes to make oath before them, or havers of writings to exhibit them; but this defect is fupplied by the court of Seffion, who, at the fuit of the arbiters, or of either of the parties, will grant warrant for citing witneffes, or for the exhibition of writings. For the fame reafon, the power of arbiters is barely to decide; the execution of the decree belongs to the judge. Where the fubmitters confent to the regiftration of the decree-arbitral, performance may be enforced by fummary diligence.

16. The power of arbiters is wholly derived from the confent of parties. Hence, where their powers are limited to a certain day, they cannot pronounce fentence after that day. Nor can they fubject parties to a penalty higher than that which they have agreed to in the fubmiffion. And where a fubmiffion is limited to fpecial claims, fentence pronounced on fubjects not fpecified in the fubmiffion is null, as being *ultra vires compromiffi*.

17. But, on the other part, as fubmiffions are defigned for a moft favourable purpofe, the amicable compofing of differences, the powers thereby conferred on arbiters receive an ample interpretation. Decrees-arbitral are not reducible upon any ground, except corruption, bribery, or falfehood.

Tit. 26. *Of Crimes.*

THE word *crime*, in its moft general fenfe, includes every breach, either of the law of God, or of our country; in a more reftricted meaning, it fignifies fuch tranfgreffions of law as are punifhable by courts of juftice. Crimes were, by the Roman law, divided into public and private. Public crimes were thofe that were exprefsly declared fuch by fome law or conftitution, and which, on account of their more atrocious nature and hurtful confequences, might be profecuted by any member of the community. Private crimes could be purfued only by the party injured, and were generally punifhed by a pecuniary fine to be applied to his ufe. By the law of Scotland, no private party, except the perfon injured, or his next of kin, can accufe criminally: but the King's Advocate, who in this queftion reprefents the community, has a right to profecute all crimes *in vindictam publicam*, though the party injured fhould refufe to concur. Smaller offences, as petty riots, injuries, *&c.* which do not de-

mand the public vengeance, paſs generally by the appellation of delicts, and are puniſhed either by fine or impriſonment.

2. The eſſence of a crime is, that there be an intention in the actor to commit it; for an action in which the will of the agent has no part, is not a proper object either of rewards or puniſhments: Hence ariſes the rule, *crimen dolo contrahitur*. Simple negligence does not therefore conſtitute a proper crime. Yet where it is extremely groſs, it may be puniſhed arbitrarily. Far leſs can we reckon in the number of crimes, thoſe committed by an ideot or furious perſon: But leſſer degrees of fatuity, which only darken reaſon, will not afford a total defence, though they may ſave from the *pœna ordinaria*. Actions committed in drunkenneſs are not to be conſidered as involuntary, ſeeing the drunkenneſs itſelf, which was the firſt cauſe of the action, is both voluntary and criminal.

3. On the ſame principle, ſuch as are in a ſtate of infancy, or in the confines of it, are incapable of a criminal action, dole not being incident to that age; but the preciſe age at which a perſon becomes capable of dole, being fixed neither by nature nor by ſtatute, is by our practice to be gathered by the judge, as he beſt can, from the underſtanding and manners of the perſon accuſed. Where the guilt of a crime ariſes chiefly from ſtatute, the actor, if he is under puberty, can hardly be found guilty; but, where nature itſelf points out its deformity, he may, if he is *proximus pubertati*, be more eaſily preſumed capable of committing it: Yet, even in that caſe, he will not be puniſhed *pœna ordinaria*.

4. One may be guilty of a crime, not only by perpetrating it himſelf, but by being acceſſory to a crime committed by another; which laſt is by civilians ſtyled *ope et conſilio*, and, in our law-phraſe, art and part. A perſon may be guilty, art and part, either by giving advice or counſel to commit the crime; or, 2. By giving warrant or mandate to commit it; or, 3. By actually aſſiſting the criminal in the execution. It is generally agreed by doctors, that, in the more atrocious crimes, the adviſer is equally puniſhable with the criminal; and that, in the ſlighter, the circumſtances ariſing from the adviſer's leſſer age, the jocular or careleſs manner of giving advice, *&c.* may be received as pleas for ſoftening the puniſhment. One who gives mandate to commit a crime, as he is the firſt ſpring of action, ſeems more guilty than the perſon employed as the inſtrument in executing it; yet the actor cannot excuſe himſelf under the pretence of orders which he ought not to have obeyed.

5. Aſſiſtance may be given to the committer of a crime, not only in the actual execution, but previous to it, by furniſhing him, intentionally, with poiſon, arms, or the other means of perpetrating it. That ſort of aſſiſtance which is not given till after the criminal act, and which is commonly called abetting, though it be of itſelf criminal, does not infer art and part of the principal crime; as if one ſhould favour the eſcape of a criminal knowing him to be ſuch. or conceal him from juſtice.

6. Thoſe crimes that are, in their conſequences, moſt hurtful to ſociety, are puniſhed capitally, or by death; others eſcape with a leſſer puniſhment, ſometimes fixed by ſtatute, and ſometimes arbitrary, *i. e.* left to the diſcretion of the judge, who may exerciſe his juriſdiction, either by fine, impriſonment, or a corporal puniſhment. Where the puniſhment is left, by law, to the diſcretion of the judge, he can in no caſe extend it to death. The ſingle eſcheat of the criminal falls on conviction, in all capital trials, though the ſentence ſhould not expreſs it.

7. Certain crimes are committed more immediately againſt God himſelf; others, againſt the ſtate; and a third kind, againſt particular perſons. The chief crime in the firſt claſs, cogniſable by temporal courts, is *blaſphemy*, under which may be included atheiſm. This crime conſiſts in the denying or vilifying the Deity, by ſpeech or writing. All who curſe God or any of the perſons of the bleſſed Trinity, are to ſuffer death, even for a ſingle act; and thoſe who deny him, if they perſiſt in their denial. The denial of a providence, or of the authority of the holy Scriptures, is puniſhable capitally for the third offence.

8. No proſecution can now be carried on for witchcraft or conjuration. But all who undertake, from their ſkill in any occult ſcience, to *tell fortunes, or diſcover ſtolen goods*, are to ſuffer impriſonment for a year, ſtand in the pillory four times in that year, and find ſurety for their future good behaviour.

9. Some crimes againſt the ſtate are levelled directly againſt the ſupreme power, and ſtrike at the conſtitution itſelf; others diſcover ſuch a contempt of law, as tends to baffle authority, or ſlacken the reins of government. *Treaſon, crimen majeſtatis*, is that crime which is aimed againſt the majeſty of the ſtate; and can be committed only by thoſe who are ſubjects of that ſtate either by birth or reſidence. Soon after the union of the two kingdoms in 1707, the laws of treaſon, then in force in England, were made ours by 7 *An. c.* 21. both with regard to the facts conſtituting that crime, to the forms of trial, the corruption of blood, and all the penalties and forfeitures conſequent on it.

10. It is high treaſon, by the law of England, to imagine the death of the King, Queen-conſort, or of the heir apparent of the crown; to levy war againſt the King, or adhere to his enemies; to counterfeit the King's coin, or his great or privy ſeal; to kill the chancellor, treaſurer, or any of the twelve judges of England, while they are doing their offices; which laſt article is by the forenamed act 7. *An.* applied to Scotland, in the caſe of ſlaying any judge of the Seſſion or of Juſticiary ſitting in judgment. Thoſe who waſh, clip, or lighten the proper money of the realm, who adviſedly affirm by writing or printing, that the Pretender has any right to the crown, that the King and Parliament cannot limit the ſucceſſion to it, or who hold correſpondence with the Pretender or any perſon employed by him, are alſo guilty of treaſon.

11. The forms of proceeding in the trial of treaſon, whether againſt Peers or Commoners, are ſet forth in a ſmall treatiſe, publiſhed by order of the houſe of Lords in 1709, ſubjoined to a collection of ſtatutes concerning treaſon. By the conviction upon this trial, the whole eſtate of the traitor forfeits to the crown. His blood is alſo corrupted, ſo that, on the death of an anceſtor, he cannot inherit;

herit; and the eſtate which he cannot take, falls to the immediate ſuperior as eſcheat, *ob defectum heredis*, without diſtinguiſhing whether the lands hold of the crown, or of a ſubject. No attainder for treaſon ſhall, after the death of the Pretender and all his ſons, hurt the right of any perſon, other than that of the offender, during his natural life; The rights of creditors and other third parties in the caſe of forfeiture on treaſon, muſt be determined by the law of England.

12. *Miſpriſion of treaſon*, from *Meprendre*, is the overlooking or concealing of treaſon. It is inferred by one's bare knowledge of the crime, and not diſcovering it to a magiſtrate or other perſon intitled by his office to take examinations; though he ſhould not in the leaſt degree aſſent to it. The foreſaid act 7. *An.* makes the Engliſh law of miſpriſion ours. Its puniſhment is, by the law of England, perpetual impriſonment, together with the forfeiture of the offender's moveables, and of the profits of his heritable eſtate, during his life; that is, in the ſtyle of our law, his ſingle and liferent eſcheat.

13. The crime of *ſedition* conſiſts in the raiſing commotions or diſturbances in the ſtate. It is either verbal or real. Verbal ſedition, or leaſing-making, is inferred from the uttering of words tending to create diſcord between the King and his people. It is puniſhed either by impriſonment, fine, or baniſhment, at the diſcretion of the judge. Real ſedition is generally committed, by convocating together any conſiderable number of people, without lawful authority, under the pretence of redreſſing ſome public grievance, to the diſturbing of the public peace. Thoſe who are convicted of this crime are puniſhed by the confiſcation of their goods; and their lives are at the King's will. If any perſons, to the number of twelve, ſhall aſſemble, and being required by a magiſtrate or conſtable to diſperſe, ſhall neverthelefs continue together for an hour after ſuch command, the perſons diſobeying ſhall ſuffer death and the confiſcation of moveables.

14. Judges, who, wilfully or through corruption, uſe their authority as a cover to injuſtice or oppreſſion, are puniſhed with the loſs of honour, fame, and dignity. Under this head, may be claſſed *theftbote* (from *bote*, compenſation), which is the taking a conſideration in money or goods from a thief to exempt him from puniſhment, or connive at his eſcape from juſtice. A ſheriff or other judge, guilty of this crime, forfeits his life and goods. And even a private perſon, who takes theftbote, ſuffers as the principal thief. The buying of diſputed claims, concerning which there is a pending proceſs, by any judge or member either of the Seſſion, or of an inferior court, is puniſhed by the loſs of the delinquent's office, and all the privileges thereto belonging.

15. Deforcement is the oppoſition given, or reſiſtance made, to meſſengers or other officers, while they are employed in executing the law. The court of Seſſion is competent to this crime. It is puniſhable with the confiſcation of moveables, the one half to the King, and the other to the creditor at whoſe ſuit the diligence was uſed. Armed perſons, to the number of three or more, aſſiſting in the illegal running, landing, or exporting of prohibited or uncuſtomed goods, or any who ſhall reſiſt, wound, or maim any officer of the revenue in the execution of office, are puniſhable with death and the confiſcation of moveables.

16. *Breach of arreſtment*, (ſee Tit. xxv. 5.) is a crime of the ſame nature with deforcement, as it imports a contempt of the law and of our judges. It ſubjects to an arbitrary corporal puniſhment, and the eſcheat of moveables; with a preference to the creditor for his debt, and for ſuch farther ſum as ſhall be modified to him by the judge. Under this head of crimes againſt good government and police, may be reckoned the *foreſtalling of markets*; that is, the buying of goods intended for a public market, before they are carried there; which for the third criminal act, infers the eſcheat of moveables; as alſo ſlaying ſalmond in forbidden time, deſtroying plough-graith in time of tillage, ſlaying or houghing horſes or cows in time of harveſt, and deſtroying or ſpoiling growing timber; as to the puniſhment of which, ſee ſtatutes 1503, *c.* 72,—1587, *c.* 82, and 1698, *c.* 16—1. *Geo.* I. *St.* 2. *c.* 48.

17. Crimes againſt particular perſons may be directed, either againſt life, limb, liberty, chaſtity, goods, or reputation. *Murder* is the wilful taking away of a perſon's life, without a neceſſary cauſe. Our law makes no diſtinction betwixt premeditated and ſudden homicide; both are puniſhed capitally. Caſual homicide, where the actor is in ſome degree blameable, and homicide in ſelf-defence, where the juſt bounds of defence have been exceeded, are puniſhed arbitrarily; but the ſlaughter of night-thieves, houſe-breakers, aſſiſtants in maſterful depredations, or rebels denounced for capital crimes, may be committed with impunity. The crime of *demembration*, or the cutting off of a member, is joined with that of murder; but in practice, its puniſhment has been reſtricted to the eſcheat of moveables, and an aſſythment or indemnification to the party. *Mutilation*, or the diſabling of a member, is puniſhed at the diſcretion of the judge.

18. *Self-murder* is as highly criminal as the killing our neighbour; and for this reaſon, our law has, contrary to the rule, *crimina morte extinguuntur*, allowed a proof of the crime, after the offender's death, that his ſingle eſcheat might fall to the King or his donatory. To this end, an action muſt be brought, not before the Juſticiary, but the Seſſion, becauſe it is only intended *ad civilem effectum*, for proving and declaring the ſelf-murder; and the next of kin to the deceaſed muſt be made a party to it.

19. The puniſhment of parricide, or of the murder of a parent, is not confined, by our law, to the criminal himſelf. All his poſterity in the right line are declared incapable of inheriting; and the ſucceſſion devolves on the next collateral heir. Even the curſing or beating of a parent infers death, if the perſon guilty be above fixteen years; and an arbitrary puniſhment, if he be under it. A preſumptive or ſtatutory murder is conſtituted by 1690, *c.* 21. by which any woman who ſhall conceal her pregnancy, during its whole courſe, and ſhall not call for, or make uſe of help in the birth, is to be reputed the murderer, if the child be dead, or amiſſing. This act was intended to diſcourage the unnatural practice of wo-

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men making away with their children begotten in fornication, to avoid church-cenſures.

20. *Duelling*, is the crime of fighting in ſingle combat, on previous challenges given and received. Fighting in a duel, without licence from the King, is puniſhable by death; and whatever perſon, principal or ſecond, ſhall give a challenge to fight a duel, or ſhall accept a challenge, or otherwiſe engage therein, is puniſhed by baniſhment and eſcheat of moveables, though no actual fighting ſhould enſue.

21. *Haimſucken*, (from *haim*, home, and *ſocken*, to ſeek or purſue,) is the aſſaulting or beating of a perſon in his own houſe. The puniſhment of this crime is no where defined, except in the books of the Majeſty, which make it the ſame as that of a rape; and it is, like rape, capital by our practice. The aſſault muſt be made in the proper houſe of the perſon aſſaulted, where he lies and riſes daily and nightly, ſo that neither a public houſe, nor even a private, where one is only tranſiently, falls within the law.

22. Any party to a law-ſuit, who ſhall ſlay, wound, or otherways invade his adverſary, at any period of time between executing the ſummons and the compleat execution of the decree, or ſhall be acceſſory to ſuch invaſion, ſhall loſe his cauſe. The ſentence pronounced on this trial, againſt him who has committed the battery, is not ſubject to reduction, either on the head of minority, or any other ground whatever: And if the perſon proſecuted for this crime ſhall be denounced for not appearing, his liferent, as well as ſingle eſcheat, falls upon the denunciation.

23. The crime of *wrongous impriſonment* is inferred, by granting warrants of commitment in order to trial, proceeding on informations not ſubſcribed, or without expreſſing the cauſe of commitment; by receiving or detaining priſoners on ſuch warrants; by refuſing to a priſoner a copy of the warrant of commitment; by detaining him in cloſe confinement, above eight days after his commitment; by not releaſing him on bail, where the crime is bailable; and by tranſporting perſons out of the kingdom, without either their own conſent, or a lawful ſentence. The perſons guilty of a wrongous impriſonment, are puniſhed by a pecuniary mulct, from L. 6000 down to L. 400 *Scots*, according to the rank of the perſon detained: and the judge or other perſon guilty, is over and above ſubjected to pay to the perſon detained a certain ſum *per diem*. proportioned to his rank, and is declared incapable of public truſt. All theſe penalties may be inſiſted for by a ſummary action before the ſeſſion, and are ſubject to no modification.

24. *Adultery*, is the crime by which the marriage-bed is polluted. This crime could, neither by the Roman nor Jewiſh law, be committed, but where the guilty woman was the wife of another: By ours, it is adultery, if either the man or woman be married. We diſtinguiſh between ſimple adultery, and that which is notorious or manifeſt. Open and manifeſt adulterers, who continue incorrigible, notwithſtanding the cenſures of the church, are puniſhed capitally. This crime is diſtinguiſhed by one or other of the following characters; where there is iſſue procreated between the adulterers; or where they keep bed and company together notoriouſly; or where they give ſcandal to the church, and are, upon their obſtinate refuſing to liſten to their admonitions, excommunicated. The puniſhment of ſimple adultery, not being defined by ſtatute, is left to the diſcretion of the judge; but cuſtom has made the falling of the ſingle eſcheat one of its penalties.

25. *Bigamy*, is a perſon's entering into the engagements of a ſecond marriage, in violation of a former marriage vow ſtill ſubſiſting. Bigamy. on the part of the man, has been tolerated in many ſtates, before the eſtabliſhment of Chriſtianity, even by the Jews themſelves; but it is prohibited by the precepts of the goſpel, and it is puniſhed by our law, whether on the part of the man, or of the woman, with the pains of perjury.

26. *Inceſt*, is committed by perſons who ſtand within the degrees of kindred forbidden in *Lev*. xviii. and is puniſhed capitally. The ſame degrees are prohibited in affinity, as in conſanguinity, *Lev*. xviii. 13. *et ſeq*. As this crime is repugnant to nature, all children, whether lawful or natural, ſtand on an equal footing: *Civilis ratio civilia jura corrumpere poteſt, non vero naturalia*. It is difficult indeed to bring a legal proof of a relation merely natural, on the ſide of the father; but the mother may be certainly known without marriage.

26. There is no explicite ſtatute making rape, or the raviſhing of women, capital; but it is plainly ſuppoſed in act 16 12, *c*. 4. by which the raviſher is exempted from the pains of death, only in the caſe of the woman's ſubſequent conſent, or her declaration that ſhe went off with him of her own free-will; and even then, he is to ſuffer an arbitrary puniſhment, either by impriſonment, confiſcation of goods, or a pecuniary fine.

28. *Theft* is defined, a fraudulent intermedling with the property of another, with a view of making gain. Our ancient law proportioned the puniſhment of the theft to the value of the goods ſtolen; heightening it gradually, from a ſlight corporal puniſhment to a capital, if the value amounted to thirty two pennies Scots, which in the reign of David I. was the price of two ſheep. In ſeveral later acts, it is taken for granted, that this crime is capital. But where the thing ſtolen is of ſmall value, we conſider it, not as theft, but as pickery, which is puniſhed either corporally or by baniſhment. The breaking of orchards, and the ſtealing of green wood, is puniſhed by a fine, which riſes as the crime is repeated.

29. Theft may be aggravated into a capital crime, though the value of the thing ſtolen be trifling; as theft twice repeated, or committed in the night, or by landed men; or of things ſet apart for ſacred uſes. The receivers and concealers of ſtolen goods, knowing them to be ſuch, ſuffer as thieves. Thoſe who barely harbour the perſon of the criminal within forty-eight hours either before or after committing the crime, are puniſhed as partakers of the theft. Such as ſell goods belonging to thieves or lawleſs perſons who dare not themſelves come to market, are puniſhed with baniſhment and the eſcheat of moveables.

30. Theft attended with violence, is called *robbery*; and in our old ſtatutes, *rief or ſtouthrief*, under which claſs may be included *forning*, or the taking of meat and drink by force, without paying for it, Stouthrief came at

at laſt to be committed ſo audaciouſly, by bands of men aſſociated together, that it was thought neceſſary to veſt all our freeholders with a power of holding courts upon ſorners and rievers, and condemning them to death. Nay, all were capitally puniſhed, who, to ſecure their lands from depredation, paid to the rievers a yearly contribution, which got the name of *black-mail*. An act alſo paſſed, commanding to baniſhment a band of ſorners, who were originally from *Egypt*, called *Gypſies*, and adjudging to death all that ſhould be reputed *Egyptians*, if found thereafter within the kingdom. Robbery committed on the ſeas, is called *piracy*, and is puniſhed capitally by the high admiral. Several of the facts which conſtitute this crime are ſet forth in a Britiſh ſtatute, 8. *Geo.* I. *c* 24.

31. *Falſehood*, in a large ſenſe, is the fraudulent imitation or ſuppreſſion of truth, to the damage of another. The lateſt ſtatute againſt this crime, puniſhes it by confiſcation of moveables. That particular ſpecies of falſehood, which conſiſts in the falſifying of writings, paſſes by the name of *forgery*. Our practice has now of a long time, agreeably to the Roman law, made this crime capital; unleſs the forgery be of executions, or other writings of ſmaller moment; in which caſe, it is puniſhed arbitrarily.

32. The writing muſt not only be fabricated, but put to uſe or founded on, in order to infer this crime. And though it be ſtrictly criminal, yet the trial of it is proper to the court of Seſſion; but where improbation is moved againſt a deed by way of exception, the inferior judge, before whom the action lies, is competent to it *ad civilem effectum*. When it is pleaded as an exception, our practice, to diſcourage affected delays, obliges the defender, who moves it, to conſign L. 40 Scots; which he forfeits, if his plea ſhall appear calumnious.

33. Where a perſon, found guilty of forgery by the court of Seſſion, is by them remitted to the Juſticiary, an indictment is there exhibited againſt him, and a jury ſworn, before whom the decree of Seſſion is produced, in place of all other evidence of the crime, in reſpect of which the jury find the pannel guilty; ſo that that decree, being pronounced by a competent court, is held as full proof, or, in the ſtyle of the bar, as *probatio probata*.

34. *Perjury*, which is the judicial affirmation of a falſehood on oath, really conſtitutes the *crimen falſi*; for he who is guilty of it does, in the moſt ſolemn manner, ſubſtitute falſehood in the place of truth. To conſtitute this crime, the violation of truth muſt be deliberately intended by the ſwearer; and therefore reaſonable allowances ought to be given to forgetfulneſs or miſapprehenſion, according to his age, health, and other circumſtances. The breach of a promiſſory oath does not infer this crime; for he who promiſes on oath, may ſincerely intend performance when he ſwears, and ſo cannot be ſaid to call on God to atteſt a falſehood. Though an oath, however falſe, if made upon reference in a civil queſtion, concludes the cauſe, the perſon perjured is liable to a criminal trial; for the effect of the reference can go no farther than the private right of the parties.

35. Notwithſtanding the miſchievous conſequences of perjury to ſociety, it is not puniſhed capitally, but by confiſcation of moveables, impriſonment for a year, and infamy. The court of Seſſion is competent to perjury *incidenter*, when in any examination upon oath, taken in a cauſe depending before them, a perſon appears to have ſworn falſely; but in the common caſe, that trial is proper to the Juſticiary. *Subornation of perjury* conſiſts in tampering with perſons who are to ſwear in judgment, by directing them how they are to depoſe; and it is puniſhed with the pains of perjury.

36. The crime of *ſtellionate*, from *ſtellio*, includes every fraud which is not diſtinguiſhed by a ſpecial name; but is chiefly applied to conveyances of the ſame numerical right, granted by the proprietor to different diſponees. The puniſhment of ſtellionate muſt neceſſarily be arbitrary, to adapt it to the various natures and different aggravations of the fraudulent acts. The perſons guilty of that kind of it, which conſiſts in granting double conveyances, are by our law declared infamous, and their lives and goods at the King's mercy. The cogniſance of *fraudulent bankruptcy* is appropriated to the court of Seſſion, who may inflict any puniſhment on the offender, that appears proportioned to his guilt, death excepted.

37. The crime of *uſury*, before the reformation, conſiſted in the taking of *any* intereſt for the uſe of money; and now in taking an higher rate of intereſt than is authoriſed by law. It is divided into *uſura manifeſta*, or direct; and *velata*, or covered. One may be guilty of the firſt kind, either where he covenants with the debtor for more than the lawful intereſt on the loan-money; or where one receives the intereſt of a ſum before it is due, ſince thereby he takes a conſideration for the uſe of money before the debtor has really got the uſe of it. Where a debt is clogged with an uncertain condition, by which the creditor runs the hazard of loſing his ſum, he may covenant for an higher intereſt than the legal, without the crime of uſury; for there, the intereſt is not given merely in conſideration of the uſe of the money, but of the danger undertaken by the creditor.

38. Covered uſury, is that which is committed under the maſk, not of a loan, but of ſome other contract; *e. g.* a ſale, or an improper wadſet. And in general, all obligations entered into with an intention of getting more than the legal intereſt for the uſe of money, however they may be diſguiſed, are uſurious. As a farther guard againſt this crime, the taking more than the legal intereſt for the forbearance of payment of money, merchandiſe, or other commodities, by way of loan, exchange, or other contrivance whatever; or the taking a bribe for the loan of money, or for delaying its payment when lent, is declared uſury. Where uſury is proved, the uſurious obligation is not only declared void, but the creditor, if he has received any unlawful profits, forfeits the treble value of the ſums or goods lent. Uſury, when it is to be purſued criminally, muſt be tried by the Juſticiary; but where the libel concludes only for voiding the debt or reſtitution, the ſeſſion is the proper court.

39. *Injury*, in its proper acceptation, is the reproaching or affronting our neighbour. Injuries are either verbal or real. A verbal injury, when directed againſt a private perſon, conſiſts in the uttering contumelious words, which tend to expoſe our neighbour's character by making him little or ridiculous. It does not ſeem that the twit-

ting one with natural defects, without any farcaftical reflections, though ir be inhuman, falls under this defcription, as thefe imply no real reproach in the juft opinion of mankind. Where the injurious expreffions have a tendency to blacken one's moral character, or fix fome particular guilt upon him, and are deliberately repeated in different companies, or handed about in whifpers to confidents, it then grows up to the crime of flander: and where a perfon's moral character is thus attacked, the *animus injuriandi* is commonly inferred from the injurious words themfelves, unlefs fpecial circumftances be offered to take off the prefumption; *ex. gr.* that the words were uttered in judgment in one's own defence, or by way of information to a magiftrate, and had fome foundation in fact. Though the cognizance of flander is proper to the commiffaries, who, as the *judices Chrifti anitatis*, are the only judges of fcandal; yet for fome time paft, bare verbal injuries have been tried by other criminal judges, and even by the Seffion. It is punifhed either by a fine, proportioned to the condition of the perfons injuring and injured, and the circumftances of time and place; or if the injury import fcandal by publicly acknowledging the offence; and frequently the two are conjoined. The calling one a bankrupt is not, in ftrict fpeech, a verbal injury, as it does not affect the perfon's moral character; yet as it may hurt his credit in the way of bufinefs, it founds him in an action of damages, which muft be brought before the judge ordinary. A real injury is inflicted by any fact by which a perfon's honour or dignity is affected; as ftriking one with a cane, or even aiming a blow without ftriking; fpitting in one's face; affuming a coat of arms, or any other mark of diftinction proper to another, *&c.* The compofing and publifhing defamatory libels may be reckoned of this kind. Real injuries are tried by the judge-ordinary, and punifhed, either by fine or imprifonment, according to the demerit of the offenders.

40. After having fhortly explained the feveral crimes punifhable by our law, this treatife may be concluded, with a few obfervations on criminal jurifdiction, the forms of trial, and the methods by which crimes may be extinguifhed. Criminal jurifdiction is founded, 1. *Ratione domicilii*, if the defender dwells within the territory of the judge. Vagabonds, who have no certain domicile, may be tried where-ever they are apprehended. 2. *Ratione delicti*, if the crime was committed within the territory. Treafon is triable, by the Englifh law, in any county that the King fhould appoint; and by a temporary act now expired, treafon committed in certain Scots counties, was made triable by the court of Jufticiary, where-ever it fhould fit.

41. No criminal trial can proceed, unlefs the perfon accufed is capable of making his defence. Abfents therefore cannot be tried; nor fatuous nor furious perfons, *durante furore*, even for crimes committed, while they were in their fenfes. For a like reafon, minors who had no curators could not, by the Roman law, be tried criminally; but our practice confiders every perfon who is capable of dole, to be alfo fufficiently qualified for making his defence in a criminal trial.

42. No perfon can be imprifoned in order to ftand trial for any crime, without a warrant in writing expreffing the caufe, and proceeding upon a fubfcribed information, unlefs in the cafe of indignities done to judges, riots, and the other offences fpecially mentioned in 1701, *c.* 6. Every prifoner committed in order to trial, if the crime of which he is accufed be not capital, is entitled to be releafed upon bail, the extent of which is to be modified by the judge, not exceeding 12000 merks Scots for a Nobleman, 6000 for a landed gentleman, 2000 for any other gentleman or burgefs, and 600 for any other inferior perfon. That perfons who, either from the nature of the crime with which they are charged, or from their low circumftances, cannot procure bail, may not lie for ever in prifon untried, it is lawful to every fuch prifoner, to apply to the criminal judge, that his trial may be brought on. The judge muft, within twenty-four hours after fuch application, iffue letters directed to meffengers, for intimating to the profecutor to fix a diet for the prifoner's trial, within fixty days after the intimation, under the pain of wrongous imprifonment: And if the profecutor does not infift within that time, or if the trial is not finifhed in forty days more, when carried on before the Jufticiary, or in thirty, when before any other judge; the prifoner is, upon a fecond application, fetting forth that the legal time is elapfed, entitled to his freedom, under the fame penalty.

43. Upon one's committing any of the groffer crimes, it is ufual for a juftice of the peace, fheriff, or other judge, to take a precognition of the facts, *i. e.* to examine thofe who were prefent at the criminal act, upon the fpecial circumftances attending it, in order to know whether there is ground for a trial, and to ferve as a direction to the profecutor, how to fet forth the facts in the libel; but the perfons examined may infift to have their declarations cancelled, before they give teftimony at the trial. Juftices of the peace, fheriffs, and magiftrates of boroughs, are alfo authorifed to receive informations, concerning crimes to be tried in the circuit-courts; which informations are to be tranfmitted to the juftice clerk forty days before the fitting of the refpective courts. To difcourage groundlefs criminal trials, all profecutors, where the defender was abfolved, were condemned by ftatute, in cofts, as they fhould be modified by the judge, and befides were fubjected to a fmall fine to be divided between the fifk and the defender: And where the King's advocate was the only purfuer, his informer was made liable. This fufficiently warrants the prefent practice of condemning vexatious profecutors in a pecuniary mulct, though far exceeding the ftatutory fum.

44. The forms of law upon criminal accufations, differ much from thofe obferved in civil actions, if we except the cafe of fuch crimes as the court of Seffion is competent to, and of leffer offences tried before inferior courts. The trial of crimes proceeds, either upon indictment, which is fometimes ufed, when the perfon to be tried is in prifon; or by crinal letters iffuing from the fignet of the Jufticiary. In either cafe, the defender muft be ferved with a full copy of the indictment or letters, and with a lift of the witneffes to be brought againft him, and of the perfons who are to pafs on the inqueft, and fifteen free days muft intervene, between his being

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ſo ſerved, and the day of appearance. When the trial proceeds upon criminal letters, the private proſecutor muſt give ſecurity, at raiſing the letters, that he will report them duly executed to the Juſticiary, in terms of 1535, *c.* 35; and the defender, if he be not already in priſon, is, by the letters, required to give caution, within a certain number of days after his citation, for his appearance upon the day fixed for his trial: And if he gives none within the days of the charge, he may be denounced rebel, which infers the forfeiture of his moveables.

45. That part of the indictment, or of the criminal letters, which contains the ground of the charge againſt the defender, and the nature or degree of the puniſhment he ought to ſuffer, is called the libel. All libels muſt be ſpecial, ſetting forth the particular facts inferring the guilt, and the particular place where theſe facts were done. The time of committing the crime may be libelled in more general terms, with an alternative as to the month, or day of the month: but as it is not practicable in moſt caſes, to libel upon the preciſe circumſtances of acceſſion that may appear in proof, libels againſt acceſſories are ſufficient, if they mentioned, in general, that the perſons proſecuted are guilty art and part.

46. The defender, in a criminal trial, may raiſe letters of exculpation, for citing witneſſes in proof of his defences againſt the libel, or of his objections againſt any of the jury or witneſſes; which muſt be executed, to the ſame day of appearance, with that of the indictment or criminal letters.

47. The diets of appearance, in the court of Juſticiary, are peremptory; the criminal letters muſt be called on the very day to which the defender is cited; and hence, if no accuſer appears, their effect is loſt, *inſtantia perit*, and new letters muſt be raiſed. If the libel, or any of the executions, ſhall to the proſecutor appear informal, or if he be diffident of the proof, from the abſconding of a neceſſary witneſs, the court will, upon a motion made by him, deſert the diet *pro loco et tempore*; after which new letters become alſo neceſſary. A defender, who does not appear on the day to which he is cited, is declared fugitive; in conſequence of which, his ſingle eſcheat falls. The defender, after his appearance in court, is called the pannel.

48. The two things to be chiefly regarded in a criminal libel, are, 1. The relevancy of the facts, *i. e.* their ſufficiency to infer the concluſion; 2. Their truth. The conſideration of the firſt belongs to the judge of the court; that of the other, to the jury or aſſize. If the facts libelled be found irrelevant, the pannel is diſmiſſed from the bar; if relevant, the court remits the proof thereof to be determined by the jury; which muſt conſiſt of 15 men picked out by the court from a greater number not exceeding 45, who have been all ſummoned, and given in liſt to the defender at ſerving him with a copy of the libel.

49. Crimes cannot, like debts, be referred to the defender's oath; for no perſon is compellable to ſwear againſt himſelf, where his life, limb, liberty, or eſtate is concerned, nor even in crimes which infer infamy; becauſe one's good name is, in right eſtimation, as valuable as his life. There is one exception however to this rule in trying the crime of uſury, which may be proved by the uſurer's own oath, notwithſtanding the rule, *nemo tenetur jurare in ſuam turpitudinem*. Crimes therefore are in the general caſe proveable only by the defender's free confeſſion, or by writing, or by witneſſes. No extrajudicial confeſſion, unleſs it is adhered to by the pannel in judgment, can be admitted as evidence.

50. All objections relevant againſt a witneſs in civil caſes, are alſo relevant in criminal. No witneſs is admitted, who may gain or loſe by the event of the trial. *Socii criminis*, or aſſociates in the ſame crime, are not admitted againſt one another, except either in crimes againſt the ſtate, as treaſon; in occult crimes, where other witneſſes cannot be had, as forgery; or in thefts or depredations committed in the Highlands. The teſtimony of the private party injured may be received againſt the pannel, where the King's Advocate is the only proſecutor, if, from the nature of the crime, there muſt needs be a penury of witneſſes, as in rape, robbery, *&c.*

51. After all the witneſſes have been examined in court, the jury are ſhut up in a room by themſelves, where they muſt continue, excluded from all correſpondence, till their verdict or judgment be ſubſcribed by the foreman (or chancellor), and clerk; and according to this verdict, the court pronounces ſentence, either abſolving or condemning. It is neceſſary, by the law of Scotland, that a jury ſhould be unanimous in finding a perſon guilty; the narroweſt majority is as ſufficient againſt the pannel, as for him. Juries cannot be puniſhed on account of an erroneous verdict, either for or againſt the pannel.

52. Though the proper buſineſs of a jury be to inquire into the truth of the facts found relevant by the court, for which reaſon they are ſometimes called the inqueſt; yet, in many caſes, they judge alſo in matters of law or relevancy. Thus, though an objection againſt a witneſs ſhould be repelled by the court, the jury are under no neceſſity to give more credit to his teſtimony than they think juſt: And in all trials of art and part, where ſpecial facts are not libelled, the jury, if they return a general verdict, are indeed judges, not only of the truth, but of the relevancy of the facts that are ſworn to by the witneſſes. A general verdict, is that which finds, in general terms, that the pannel is guilty or not guilty, or that the libel or defences are proved or not proved. In a ſpecial verdict, the jury finds certain facts proved, the import of which is to be afterwards conſidered by the court.

53. Criminal judges muſt now ſuſpend for ſome time the execution of ſuch ſentences as affect life or limb, that ſo condemned criminals, whoſe caſes deſerve favour, may have acceſs to apply to the king for mercy. No ſentence of any court of judicature, ſouth of the river Forth, importing either death or demembration, can be executed in leſs than thirty days; and, if north of it, in leſs than forty days, after the date of the ſentence. But corporal puniſhments, leſs than death or diſmembering, *e. g.* whipping, pillory, *&c.* may be inflicted eight days after ſentence on this ſide Forth, and twelve days after ſentence beyond it.

54. Crimes are extinguiſhed, 1. By the death of the criminal; both becauſe a dead perſon can make no defence, ſo that his trial is truly a judging upon the hearing of

of one fide; and becaufe, though his guilt fhould be ever fo notorious, he is after death carried beyond the reach of human penalties: Such trials therefore can have no effect, but to punifh the innocent heir, contrary to that moft equitable rule, *culpa tenet fuos auctores*. 2. Crimes may be extinguifhed by a remiffion from the Sovereign. But a remiffion, though it fecures the delinquent from the public refentment, the exercife of which belongs to the Crown, cannot cut off the party injured from his claim of damages, over which the Crown has no prerogative. Whoever therefore founds on a remiffion, is liable in damages to the private profecutor, in the fame manner, as if he had been tried and found guilty. Even general acts of indemnity paffed in parliament, though they fecure againft fuch penalties as law inflicts upon the criminal, merely *per modum pœnæ*, yet do not againft the payment of any pecuniary fine, which is given by ftatute to the party injured, nor againft the demand of any claim competent to him in name of damages.

55. Leffer injuries, which cannot be properly faid to affect the public peace, may be extinguifhed, either by the private party's exprefsly forgiving them, or by his being reconciled to the offender, after receiving the injury. Hence arifes the rule, *diffimulatione tollitur injuria*. But where the offence is of a higher nature, the party injured, though he may pafs from the profecution, in fo far as his private intereft is concerned, cannot preclude the King's Advocate, or Procurator-fifcal, from infifting *ad vindictam publicam*.

56. Crimes are alfo extinguifhed by prefcription, which operates by the mere lapfe of time, without any act, either of the Sovereign or of the private fufferer. Crimes prefcribe in twenty years; but in particular crimes, the prefcription is limited by ftatute to a fhorter time. No perfon can be profecuted upon the act againft wrongous imprifonment, after three years. High treafon, committed within his Majefty's dominions, fuffers likewife a triennial prefcription, if indictment be not found againft the traitor within that time. All actions, brought upon any penal ftatute made or to be made, where the penalty is appropriated to the Crown, expire in two years after committing the offence; and where the penalty goes to the Crown or other perfecutor, the profecutor muft fue within one year, and the Crown within two years after the year ended. Certain crimes are, without the aid of any ftatute, extinguifhed by a fhorter prefcription than twenty years. By our old law, in the cafes of rape, robbery, and hame-fucken, the party injured was not heard, after a filence of twenty four hours; from a prefumption, that perfons could not be fo grofsly injured, without immediately complaining: And it is probable, that a profecution for thefe crimes, if delayed for any confideraby time, would be caft even at this day, or at leaft the punifhment reftricted. Leffer injuries fuffer alfo a fhort prefcription; law *prefuming* forgivenefs, from the nature of the offence, and the filence of the party. The particular fpace of time fufficient to eftablifh this prefumption muft be determined by the judge, according to circumftances.

LAWBURROWS, in Scots Law. See LAW, Tit xxx. 16.

LAWLESS COURT, a court faid to be held annually on King's hill, at Rochford, in Effex, on the Wednefday morning after Michaelmas day, at cock-crowing, where they whifper, and have no candle nor any pen and ink, but only a coal. Perfons who owe fuit, or fervice, and do not appear, forfeit double their rent every hour they are miffing.

This fervile attendance, Cambden informs us, was impofed on the tenants for confpiring at the like unfeafonable time to raife a commotion. The court belongs to the honour of Raleigh, and to the earl of Warwick; and is called lawlefs, from its being held at an unlawful hour.

LAWN, a fpacious plain in a park, or adjoining to a noble feat.

LAWSONIA, in botany, a genus of the octandria monogynia clafs. The calix confifts of four fegments, and the corolla of four petals; the ftamina are difpofed in pairs; and there are four capfules containing a great many feeds. There are two fpecies, both natives of India.

LAWYER fignifies a counfellor, or one that is learned or fkilled in the law.

LAY-BROTHERS, among the Romanifts, thofe pious, but illiterate perfons, who devote themfelves, in fome convent, to the fervice of the religious, They wear a different habit from that of the religious, but never enter into the choir, nor are prefent at the chapters; nor do they make any other vow, except of conftancy and obedience. In nunneries, there are alfo lay-fifters.

LAY-MAN, one who follows a fecular employment, or has not entered into holy orders.

LAYERS, in gardening, are tender fhoots, or twigs of trees, laid or buried in the ground; till having ftruck root, they are feparated from the parent-tree, and become diftinct plants.

LAZAR-HOUSE, or LAZARETTO, a public-building, in the nature of an hofpital, to receive the poor and thofe afflicted with contagious diftempers. In fome places, lazarettos are appointed for the performance of quarrantine; in which cafe, thofe are obliged to be confined in them who are fufpected to have come from places infected with the plague.

LAZARITES, or *Fathers of St* LAZARUS, a religious congregation of regular clerks, inftituted in France in the feventeenth century, by M. Vincent. They take their name from a houfe in the fuburbs of Paris, where they have a feminary, called the feminary of good children. The vows they make are fimple; and, upon occafion, may be difpenfed with.

LAZULI, *or Lapis* LAZULI, in natural hiftory, one of the ores of copper, the bafis of which is a cryftalline matter, coloured with that elegant blue which copper gives to all alkaline liquors.

The

The lapis lazuli is found in many parts of the world; but that of Aſia and Africa is much ſuperior both in beauty and real value to the Bohemian and German kind, which is too often ſold in its place.

Its great uſe, beſide the poliſhing as a gem, is the making the fine blue uſed in painting called ultramarine, which is obtained from it by calcination.

LEAD. See CHEMISTRY, p. 84, 186.

LEAF, *folium*, in the natural hiſtory of plants. See BOTANY, ſect. 2.

LEAF, in clocks and watches, an appellation given to the notches of their pinions. See WATCH.

LEAGUE, a meaſure of length, containing more or leſs geometrical paces, according to the different uſages and cuſtoms of countries. A league at ſea, where it is chiefly uſed by us, being a land-meaſure moſtly peculiar to the French and Germans, contains three thouſand geometrical paces, or three Engliſh miles.

LEAGUE alſo denotes an alliance or confederacy between princes and ſtates for their mutual aid, either in attacking ſome common enemy, or in defending themſelves.

LEAK, among ſeamen, is a hole in the ſhip through which the water comes in. To ſpring a leak, is ſaid of a ſhip that begins to leak. To ſtop a leak, is to fill it with a plug wrapt in oakam and well tarred, or putting in a tarpawling clout to keep the water out; or nailing a-piece of ſheet-lead upon the place.

LEAKAGE, the ſtate of a veſſel that leaks, or lets water or other liquid ouze in or out.

LEAKAGE, in commerce, is an allowance of 12 *per cent.* in the cuſtoms, allowed to importers of wines for the waſte and damage it is ſuppoſed to have received in the paſſage: an allowance of two barrels in twenty-two is alſo made to the brewers of ale and beer, by the exciſe-office.

LEAOTUNG, the moſt northerly part of China, in Aſia.

LEAP, in muſic, is when the ſong does not proceed by conjoint degrees, as when between each note there is an interval of a third, fourth, fifth, *&c.*

LEAP-YEAR. See ASTRONOMY, p. 489.

LEARMOUTH, a market-town of Northumberland, ſituated forty eight miles north-weſt of Newcaſtle, and twelve ſouth-weſt of Berwick.

LEASING-MAKING, in Scots law, the uttering of words tending to excite diſcord between the King and his people; alſo called verbal ſedition.

LEATHER, the ſkin of ſeveral ſorts of beaſts dreſſed and prepared for the uſe of the various manufacturers, whoſe buſineſs it is to make them up. See TANNING.

Colouring of LEATHER.

To colour white leather. Hang the ſkins in chalk or lime-water, till they are grown ſupple, that the hair or wool may be ſtripped off; ſtretch them on tenters, or by means of lines, and ſmooth them over: then bruſh them over with alum-water very warm, and colour them with the colour you would have them, and dry them in the ſun, or in ſome warm houſe, and they will be uſeful on ſundry occaſions, without any further trouble.

To colour black leather the German way. Take of the bark of the elder two pounds, of the filings or ruſt of iron the ſame quantity; put them into two gallons of rain-water, and ſtop them up cloſe in a caſk or veſſel, and let them ſtand for the ſpace of two months: then add to that the liquid part of a pound of nut-galls, beaten to powder, and a quarter of a pound of copperas, heating them over the fire, and ſuffering them to ſtand 24 hours after; and then uſe the liquor with a bruſh till the ſkin has taken a fine black.

To colour leather a fair red. Firſt rub the leather well in alum-water, or alum it; boil ſtale urine, ſcum it till half of it is waſted: then put in an ounce of the fineſt lake, the like quantity of brazil in powder, one ounce of alum, and half an ounce of ſal-armoniac; mix them well, and keep them ſtirring over a gentle fire about two hours; and ſo uſe the liquid part, to colour or tinge the ſkins.

To colour leather of a curious French yellow. Take one part of chalk, and another of wood-aſhes, and make of them a good lye; then ſtrain out the fine liquor, and ſet it in a veſſel over the fire, and put into it turmeric in powder, and a little ſaffron; and let it ſimmer, till it becomes pretty thick; then ſet it a cooling, to be uſed as occaſion requires.

To make white leather blue. Take a quart of elderberries, ſtrain out the juice, and boil it with an ounce of powder of alum, and half an ounce of indigo, or ſmalt-blue, and bruſh over the leather with a fine bruſh dipped in it three times, ſuffering it to dry between whiles, and the buſineſs will be effected.

To colour Spaniſh leather, &c. Take that which the Dutch call pomplemelch, warm it, and rub the leather with it; then take of Venice tot appelen; and having pounded it ſmall, put a quantity of water to it, and let it ſoften over a gentle fire; then preſs out the water, and rub or waſh out the ſkin in it; repeating the ſame ſeveral times; and after that, take the fineſt ſhoemakers black, and rub the ſkin over with it, having in the melting added a little vitriol or copperas; and letting it dry, take gooſe or hog's greaſe, and with a woollen cloth rub the ſkin over for a good while, where there is a good fire to ſupple it, and afterwards rub it over with your hands, till it diſappear; or inſtead of greaſe, you may uſe linſeed or train-oil, and ſo in caſe of any other colour, according to the colours you deſign.

Dying of LEATHER.

A reddiſh colour. Firſt waſh the ſkins in water, and wring them out well, and afterwards wet them with a ſolution of tartar and bay-ſalt in fair water, and wring them out again; then to the former diſſolution add aſhes of crab-ſhells, and rub the ſkins very well with this: afterwards, waſh them in common water, and wring them out; then waſh them with tincture of madder in the ſolution of tartar and alum and the crab-ſhell aſhes: and if they prove not red enough after all, waſh them with the tincture of brazil.

A pure yellow. Take of fine aloes two ounces, of linſeed-oil four pounds; diſſolve or melt them; then ſtrain the liquor, and beſmear the ſkins with it, and being dry varniſh them over.

An orange. Boil fuftic-berries in alum-water: but for a deep orange, ufe turmeric-root.

Blue. Boil elder-berries, or dwarf-elder, in water; then fmear or wafh the fkins with it; wring them out; then boil the berries as before in a folution of alum-water, and wet the fkins in the fame water once or twice; dry them, and they will be very blue.

A pure fky-colour. For each fkin take indigo one ounce; put it into boiling water, let it ftand one night; then warm it a little, and with a brufh-pencil befmear the fkin twice over.

Purple. Diffolve roch-alum in warm water, wet the fkins with it, dry them; then boil rafped brazil well in water; let it ftand to cool: do this three times, and afterwards rub the dye over the fkins with your hand; and when they are dry, polifh them.

Green. Take fap-green and alum-water, of each a fufficient quantity; mix and boil them a little; if you would have the colour darker, add a little indigo.

Proceffes for dying LEATHER Red *and* Yellow, *as practifed in* Turkey; *with directions for preparing and tanning the fkins, as communicated by Mr* Philippo, *a native of* Armenia, *who received from the Society for the Encouragement of Arts,* &c. *one hundred pounds, and alfo the gold medal of the Society, as a reward for difcovering this fecret.*

1. *Firft preparation of the Skins, both for Red and Yellow Leather, by dreffing them in lime.* Let the fkins, dried with the hair on, be firft laid to foak in clean water for three days; let them then be broken over the flefh fide, put into frefh water for two days longer, and afterwards hung up to drain half an hour. Let them now be broken again on the flefh fide, limed in cold lime on the fame fide, and doubled together with the grain fide outward. In this ftate they muft be hung up within doors over a frame for five or fix days, till the hair be loofe; which muft be then taken off, and the fkins returned into the lime-pit, for about three weeks. Take them out, and let them be well worked flefh and grain, every fixth or feventh day during that time: after which, let them be wafhed ten times in clear water, changing the water at each wafhing. They are next to be prepared in drench, as below mentioned.

2. *Second preparation of the Skins for both the Red and Yellow Dyes by drenching.* After fqueezing the water out of the fkins, put them into a mixture of bran and water, warm as new milk, in the following proportions, *viz.* about three pounds of bran for five fkins, and water fufficient to make the mixture moderately fluid, which will be about a gallon to each pound of bran. In this drench let the fkins lie three days; at the end of which time they muft be well worked, and afterwards returned into the drench two days longer. They muft then be taken out and rubbed between the hands; the water fqueezed from them, and the bran fcraped off clear from both fides of the fkins. After this they muft be again wafhed ten times in clear water, and the water fqueezed out of them.

Thus far the preparatory procefs of all the fkins, whether intended to be dyed red or yellow, is the fame; but afterwards thofe which are to be dyed red, muft be treated as follows.

3. *Preparation in honey and bran of the fkins that are to be dyed red.* Mix one pound of honey with three pints of luke-warm water, and ftirr them together till the honey is diffolved. Then add two double handfuls of bran; and taking four fkins (for which the above quantity of the mixture will be fufficient) work them well in it one after another. Afterwards fold up each fkin feparately into a round form, with the flefh fide inwards, and lay them in an earthen-pan, or other proper veffel; if in the fummer, by the fide of each other; but in the winter, on the top of each other. Place the veffel in a floping pofition, fo that fuch part of the fluid as may fpontaneoufly drain from the fkins, may drain from them. An acid fermentation will then rife in the liquor, and the fkins will fwell confiderably. In this ftate they muft continue for feven or eight days; but the moifture that drains from them, muft be poured off, once or twice a-day, as occafion may require. After this a further preparation in falt is neceffary; and which muft be performed in the following manner.

4. *Preparation in falt, of the fkins to be dyed red.* After the fkins have been fermented in the honey and bran, as abovementioned, let them be taken out of that mixture on the eighth or ninth day, and well rubbed with dry common fea-falt, in the proportion of about half a pound to each fkin; the falt muft be well rubbed and worked with them. This will make them contract again, and part with a further confiderable quantity of moifture; which muft be fqueezed out by drawing each fkin feparately through the hands. They muft next be fcraped clean on both fides from the bran, fuperfluous falt, and moifture that may adhere to them. After which, dry falt muft be ftrewed over the grain fide, and well rubbed in with the hand. They are then to be doubled with the flefh fide outwards, lengthways from neck to tail, and a little more dry falt muft be thinly ftrewed over the flefh fide, and rubbed in; for the two laft operations about a pound and a half of falt will be fufficient for each fkin. They muft then be put, thus folded on each other, between two clean boards, placed floping, breadthways; and a heavy weight laid on the upper board, in order gradually to prefs out what moifture they will thus part with. In this ftate of preffure, they muft be continued two days or longer, till it is convenient to dye them, for which they will then be duely prepared.

5. *Preparation of the Red Dye, in a proper proportion for four fkins.* Put eight gallons of water into a copper, with feven ounces of fhenan *, tied up in a linen bag. Light

* Shenan is a drug much ufed by dyers in the Eaft; and may eafily be procured at any of the ports of Syria and Africa, in the Levant. It is the Eaftern-jointed cali, called by botanifts felicornia; and grows in great plenty in thofe and other parts of the Eaft. There is a leffer fpecies of the felicornia on our coaft, which, from its great affinity with the fhenan, might be prefumed to have the fame qualities. On fome trials, however, it has not appeared to anfwer the intention

Light a fire under a copper, and when the water has boiled about a quarter of an hour, take out the bag of ſhenan, and put into the boiling fluid or lixivium, 1ſt, two drams of alum; 2dly, two drams of pomegranate bark; 3dly, three quarters of an ounce of turmeric; 4thly, three ounces of cochineal; 5thly, two ounces of loaf-ſugar. Let the whole mixture boil about ſix minutes, then cover the fire, and take out a quart of liquor, putting it into a flat earthen pan; and when it is as cold as new milk, take one ſkin, folded lengthways, the grain ſide outwards, and dip it in the liquor, rubbing it gently with the hands. Then taking out the ſkin, hang it up to drain, and throw away the ſuperfluous dye. Proceed in the ſame manner with the remaining three ſkins; repeating the operation on each ſkin ſeparately, eight times, ſqueezing the ſkins by drawing them through the hands before each freſh dipping. Lay them now on one ſide of a large pan, ſet ſloping, to drain off as much of the moiſture as will run from them without preſſure, for about two hours, or till they are cold; then tan them as below directed.

6. *Tanning the Red Skins.* Powder four ounces of the beſt white galls in a marble mortar, ſifting it through a fine ſieve. Mix the powder with about three quarts of water, and work the ſkins well in this mixture for half an hour or more, folding up the ſkins four-fold. Let them lie in this tan twenty-four hours; when they muſt be worked again as before; then taken out, ſcraped clean on both ſides from the firſt galls, and put into a like quantity of freſh galls and water. In this freſh mixture they muſt be again well worked for three quarters of an hour; then folded up as before, and left in the freſh tan for three days. On the fourth day they muſt be taken out, waſhed clean from the galls, in ſeven or eight freſh quantities of water, and then hung up to dry.

7. *Manner of dreſſing the ſkins after they are tanned.* When the ſkins have been treated as above, and are very near dry, they ſhould be ſcraped with the proper inſtrument or ſcraper on the fleſh ſide, to reduce them to a proper degree of thickneſs. They are then to be laid on a ſmooth board, and glazed by rubbing them with a ſmooth glaſs. After which they muſt be oiled, by rubbing them with olive oil, by means of a linen rag, in the proportion of one ounce and an half of oil for four ſkins: then they are to be grained on a graining board, lengthways, breadthways, and cornerways, or from corner to corner.

8. *Preparation with Galls, for the Skins to be dyed yellow.* After the four ſkins are taken out of the drench of bran, and clean waſhed as before directed in the ſecond article, they muſt be very well worked, half an hour or more, in a mixture of a pound and a half of the beſt white galls, finely powdered, with two quarts of clean water. The ſkins are then to be ſeparately doubled lengthways; rolled up with the fleſh ſide outwards, laid in the mixture, and cloſe preſſed down on each other, in which ſtate they muſt continue two whole days. On the third day let them be again worked in the tan; and afterwards ſcraped clean from the galls, with an ivory or braſs inſtrument (for no iron muſt touch them.) They muſt then be put into a freſh tan, made of two pounds of galls finely powdered, with about three quarts of water, and well worked therein fifteen times. After this they muſt be doubled, rolled up as before, and laid in the ſecond tan for three days. On the third day a quarter of a pound of white ſea-ſalt muſt be worked into each ſkin; and the ſkins doubled up as before, and returned into the tan, till the day following, when they are to be taken out, and well waſhed ſix times in cold water; and four times in water lukewarm. The water muſt be then well ſqueezed out, by laying the ſkins under preſſure, for about half an hour, between two boards, with a weight of about two or three hundred pounds laid upon the uppermoſt board, when they will be ready for the dye.

9. *Preparation of the Yellow Dye, in the proper proportion for four ſkins.* Mix ſix ounces of caſſiari gehira*, or dgehira, or the berries of the eaſtern rhamnus, with the ſame quantity of alum, and pound them together till they be fine, in a marble or braſs mortar, with a braſs peſtle. Then dividing the materials, thus powdered, into three equal parts of four ounces each, put one of thoſe three parts into about a pint and a half of water, in a china or earthern veſſel; and ſtir the mixture together. Let the fluid ſtand to cool, till it will not ſcald the hand. Then ſpreading one of the ſkins flat on a table, in a warm room, with the grain ſide uppermoſt, pour a fourth part of the tinging liquor, prepared as above directed, over the upper or grain ſide, ſpreading it equally over the ſkin with the hand, and rubbing it well in. Afterwards do the like with the other three ſkins, for which the mixture firſt made will be ſufficient.

This operation muſt be repeated twice more on each ſkin ſeparately, with the remaining eight ounces of the powder of the berries, and alum, with the abovementioned due proportions of hot water, put to them as before directed.

The ſkins, when dyed, are to be hung up on a wooden frame, without being folded, with the grain ſide outwards, about three quarters of an hour to drain, when they muſt be carried to a river or ſtream of running water, and well waſhed therein ſix times or more. After this, they muſt be put under preſſure for about an hour, till the water be well ſqueezed out; afterwards the ſkins muſt be hung up to dry in a warm room.

This being done, the ſkins are to be dreſſed and grained as before directed for thoſe dyed red; except the oiling, which muſt be omitted.

Gilding

tention of the ſhenan; but it will be prudent to purſue the examination of this further, as ſome unknown circumſtances in the collecting or uſing the Engliſh ſelicornia might occaſion the miſcarriage. But be this as it may, the Eaſtern ſhenan may, at all events, be eaſily procured in any quantity, at a very trifling expence, by any of the captains of Turkey ſhips, at Aleppo, Smyrna, *&c.*

* The caſſiari gehira is the berries of an Eaſtern rhamnus, or buckthorn tree, and may be had at Aleppo, and other parts of the Levant, at a ſmall price. The common Avignon, or yellow berries, may be ſubſtituted, but not with ſo good an effect; the caſſiari gehira being a ſtronger and brighter yellow dye, both for this uſe, and alſo that of colouring paper hangings, *&c.*

Gilding of LEATHER. Take glair of the whites of eggs, or gum-water, and with a bruſh rub over the leather with either of them; then lay on the gold or ſilver, and letting them dry, burniſh them. See the articles GILDING and BURNISHING.

To dreſs or cover leather with ſilver or gold. Take brown red, grind or move it on a ſtone with a muller, adding water and chalk; and when the latter is diſſolved, rub, or lighty dawb the leather over with it, till it looks a little whitiſh; and then lay on the leaf, ſilver or gold, before the leather is quite dry, laying the leaves a little over each other, that there may not be the leaſt part uncovered; and when they have well cloſed with the leather, and are ſufficiently dried on, and hardened, rub them over with an ivory poliſher, or the fore-tooth of a horſe.

LEAVEN, a piece of ſour dough, uſed to ferment and render light a much larger quantity of dough or paſte.

LECHEA, in botany, a genus of the triandria trigynia claſs. The calix conſiſts of three leaves, and the corolla of three linear petals; and the capſules are three, with three valves, and one ſeed. There are two ſpecies, both natives of Canada.

LECTICA, in Roman antiquity, a vehicle in which people were carried in a reclining poſture.

LECTISTERNIUM, a religious feaſt or banquet of the ancient Romans. In times of public danger or calamity, or of thankſgiving for ſome happy event, the republic ordered ſolemn feaſts to be made for the gods; and this ſolemnity was called lectiſternium, becauſe on this occaſion they ſpread tables, and placed beds around them, on which their heavenly gueſts were to lie and eat.

LECTURERS, in England, are an order of preachers in pariſh-churches, diſtinct from the rector or vicar. They are choſen by the veſtry, or chief inhabitants of the pariſh, and are uſually the afternoon preachers.

LEDBURY, a market-town of Hereford-ſhire, thirteen miles eaſt of Hereford.

LEDGER, the principal book wherein merchants enter their accounts. See BOOK-KEEPING.

LEDUM, the MARSH-CISTUS, in botany, a genus of the decandria monogynia claſs. The calix conſiſts of five ſegments, and the corolla of five plain petals; and the capſule has five cells, opening at the baſe. There is but one ſpecies, a native of the northern parts of Europe.

LEE, in the ſea-language, a word of various ſignifications; though it is generally underſtood to mean the part oppoſite to the wind. Thus *lee-ſhore*, is that ſhore againſt which the wind blows. *Lee-latch*, or have a care of the lee-latch, is, take care that the ſhip do not go to the leeward, or too near the ſhore. *A lee the helm*, put it to the leeward ſide of the ſhip. *To lie by the lee*, or to come up to the lee, is to bring the ſhip ſo, that all her ſails may lie flat againſt her maſts and ſhrouds, and that the wind may come right upon her broad ſide.

LEE-WAY, is the angle that the rhumbline, upon which the ſhip endeavours to ſail, makes with the rhumb upon which ſhe really ſails. See NAVIGATION.

LEECH, in zoology. See HIRUDO.

LEEDS, a large market town, in the weſt riding of Yorkſhire, ſituated on the river Aire, twenty-miles ſouth-weſt of York; it has a very great woolen trade.

LEEK. See ALLIUM.

LEERDAM, a town in the province of Holland, ſeventeen miles north eaſt of Dort: E. long. 5°, N. lat. 51° 50′.

LEERWICK, a town of Scotland, in Mainland, one of the iſlands of Shetland, in the county of Orkney: W. long. 30′, N. lat. 61° 20′.

LEES, are the more groſs and ponderous parts of liquors, which, being ſeparated by fermentation, fall to the bottom.

LEET, a little court held within a manor, and called the king's court, on account that its authority to puniſh offences originally belonged to the Crown, from whence it is derived to inferior perſons.

LEEWARD, at ſea, the ſide oppoſite to that on which the wind blows.

LEEWARD-ISLANDS, in America, a name given to the Caribbees.

LEG, in anatomy. See ANATOMY, Part I. and II. *&c.*

LEGACY, in Scots law, a donation by one perſon to another, to be paid by the giver's executor after his death. See LAW, Tit. xxviii. 3.

LEGATEE, in Scots law, the perſon to whom a legacy is provided.

LEGATE, a cardinal or biſhop, whom the pope ſends as his ambaſſador to ſovereign princes.

LEGATUS, in roman antiquity, a military officer who commanded as deputy of the chief general.

LEGEND, any idle or ridiculous ſtory told by the Romaniſts concerning their ſaints, and other perſons, in order to ſupport the credit of their religion.

The legend was originally a book uſed in the old Romiſh churches, containing the leſſons to be read at divine ſervice; hence the lives of the ſaints and martyrs came to be called legends, becauſe chapters were read out of them at matins, and in the refectories of religious houſes. Among theſe the golden legend, which is a collection of the lives of the ſaints, was received by the church with great applauſe, which it maintained for two hundred years; though it is ſo full of ridiculous and romantic ſtories, that the Romaniſts themſelves are now aſhamed of it.

LEGER-LINE, in muſic, one added to the ſtaff of five lines, when the aſcending or deſcending notes run very high or low: there are ſometimes many of theſe lines both above and below the ſtaff, to the number of four or five.

LEGGIARDO, or LEGGIARDAMEMTE, in muſic, ſignifies to play or ſing in a lively, briſk, and gay manner.

LEGHORN, or LIVORNO, a port town of Italy, in the duchy of Tuſcany, ſituated on the Tuſcan ſea, forty miles weſt of Florence: E. long. 11°, N. lat. 43° 30′.

LEGION, in Roman antiquity, a body of foot which conſiſted of ten cohorts.

The exact number contained in a legion, was fixed by Romulus at three thouſand; though Plutarch aſ-

fures us, that after the reception of the Sabines into Rome, he encreafed it to fix thoufand. The common number afterwards, in the firft times of the free ftate, was four thoufand; but in the war with Hannibal, it arofe to five thoufand; and after this it is probable that it funk again to four thoufand, or four thoufand two hundred, which was the number in the time of Polybius.

LEGISLATOR, a law giver, or perfon who eftablifhes the polity and laws of a ftate. Such was Mofes, among the Jews; Lycurgus, among the Lacedæmonians, *&c.*

LEGITIMATION, an act whereby illegitimate children are rendered legitimate.

LEGITIME, in Scots law, that fhare of the moveable effects belonging to a hufband and wife, which upon the hufband's death falls to the children. See LAW, Tit. xxviii. 5.

LEGUME. See BOTANY, p. 637.

LEGUMINOUS, an appellation given to all plants whofe fruit is a legume.

LEICESTER, the county-town of Leicefterfhire. It fends two members to parliament. W. long. 1° 5′, and N. lat. 52° 40′.

LEININGEN, a town of Germany, feventeen miles fouth of Worms.

LEINSTER, a province of Ireland, the capital of which is Dublin.

LEIPSIC, a rich and populous city of Germany, in the circle of Upper Saxony and province of Mifnia: E. long. 12° 40′, N. lat. 51° 20′.

LEITH, a port-town of Scotland, about two miles north of Edinburgh.

LEMBURG, LEOPOLIS, a city of Poland, and capital of the province of Red Ruffia: E. long. 24°, N. lat. 49°.

LEMMA, in mathematics, a propofition which ferves previoufly to prepare the way for the more eafy apprehenfion of the demonftration of fome theorem, or conftruction of fome problem.

LEMNA, in botany, a genus of the monœcia diandria clafs. The calix of both male and female confifts of one leaf; neither of them have any corolla; the female has one ftylus, and the capfule confifts of one cell. There are four fpecies, three of which are natives of Britain, *viz.* the trifulca, or ivy-leaved duck's-meat; the minor, or leaft duck's meat; and the polyrhiza, or greater duck's-meat.

LEMNOS, an ifland of the Archipelago, fituated forty-miles fouth-weft of the entrance of the Hellefpont; E. lon. 26°, N. lat. 29°.

LEMON, in botany. See CITRUS.

LEMONADE, a liquor prepared of water, fugar, and lemon or citron juice: it is very cooling and grateful.

LEMUR, in zoology, a genus of quadrupeds belonging to the order of primates, the characters of which are thefe: There are four fore-teeth in the upper jaw, the intermediate ones being remote; and fix long, compreffed, parallel teeth in the under jaw; the dog-teeth are folitary, and the grinders are fomewhat labated. There are five fpecies, *viz.*

1. The tardigradus, is a fmall animal, about eight inches long; and is found in Ceylon. The head is roundifh, with a prominent nofe; the legs are long and thick; and the feet refemble thofe of a monkey; the eyes are round, and near each other; the ears are long, and fituate very low on the head. The hair on the top of the head, the ears, the neck, the fhoulders, the back, the fides, and the outer parts of the thighs and legs, are of a reddifh afh-colour; there is a white line betwixt the ears; the under jaw, the throat, the breaft, and the belly, are mixed with white and an afh colour. It has no tail. This animal is of a very fingular conftruction. It is perhaps longer in proportion to its thicknefs than any other quadruped: But its natural hiftory is but imperfectly known.

2. The mongoz, is of a greyifh colour above, and white below; his body is about a foot and a half in length; and the tail is as long as the body. This animal is very troublefome when kept in a domeftic ftate. He takes every opportunity of efcaping, and flies to the woods in queft of fruits, and it is very difficult to catch him. He bites in a cruel manner thofe with whom he is leaft acquainted. He has a great averfion at cold and moifture. He lives upon bread and fruits. His motions are brifk and lively. He is a native of Madagafcar.

3. The macaco has a long tail, with about 30 alternate rings of black and white, and a barbed collar. He is about a foot and four inches long, and the tail is longer than the body. His general figure very much refembles that of a monkey, excepting the head, which is fomewhat triangular. The mocaco is a beautiful and elegant animal. Although his figure refembles the monkey, his difpofitions and manners are very different. He is gentle and inoffenfive in a domeftic ftate. In a natural ftate, he is fond of fociety: In the ifland of Madagafcar, troops of 30 or 40 of them are generally found together in the woods.

4. The catta has likewife a long tail, with black and white rings. This is a very gentle animal; it lives upon fruits and roots; its motion is flow; and it makes a placid murmuring noife like a cat. It is likewife a native of Madagafcar.

5. The volans, refembles a bat, being furnifhed with a ftrong membrane, like that animal, by which it is enabled to fly. It is a native of Afia; but its hiftory is not fufficiently known.

LEMURIA, a feftival of the ancient Romans, folemnized on the ninth of May, to pacify the manes of the dead, who were the lemures or phantoms that came in the night to torment the living.

LENA, a great river of Siberia running north from N. lat. 55° to 72°.

LENÆA, in antiquity, a feftival of Bacchus, firnamed Lenæus from a vine-prefs. Befides the ufual ceremonies at feafts facred to this god, it was remarkable for poetical contentions, and tragedies acted at this time.

LENS, in dioptrics, properly fignifies a fmall roundifh glafs, of the figure of a lentil; but is extended to any optic glafs, not very thick, which either collects the rays of light into a point, in their paffage through it, or

or difperfes them further apart, according to the laws of refraction. See OPTICS.

LENT, a folemn time of fafting in the Chriftian church, obferved as a time of humiliation before Eafter, the great feftival of our Saviour's refurrection.

Thofe of the Romifh church, and fome of the Proteftant communion, maintain, that it was always a faft of forty days, and, as fuch, of apoftolical inftitution. Others think it was only of ecclefiaftical inftitution, and that it was varioufly obferved in different churches, and grew by degrees from a faft of forty hours, to a faft of forty days. This is the fentiment of Morton, bifhop Taylor, du Maulin, Daillee, and others.

LENTISCUS, in botany. See PISTACIA.

LEO, in zoology. See FELIS.

LEO, in aftronomy. See ASTRONOMY, p. 467.

St LEO, a town and bifhop's fee of Italy, twenty miles north-weft of Urbino.

LEON, the capital of the province of Leon, in Spain, fituated on the river Efla: W. long. 6° 5', N. lat. 43°.

LEON is alfo the capital of the province of Nicaragua, in Mexico, fituated at the weft end of the Lake Nicaragua: W. long, 91°, N. lat. 11° 30'.

St LEONARD, a town of France, in the province of Guiennes, and territory of Limofin: E. long. 1° 45', N. lat. 45° 50'.

St. LEONHART, a town of Germany, in the circle of Auftria, and duchy of Carinthia: E. long. 15°, N. lat. 47°.

LEONTICE, in botany, a genus of the hexandria monogynia clafs. The corolla confifts of fix petals, and the nectarium of fix leaves inferted into the ungues of the corolla, and having an open limbus; and the calix has fix deciduous leaves. There are four fpecies, none of them natives of Britain.

LEONTINI, a town of Sicily, twenty miles north-weft of Syracufe.

LEONTODON, in botany, a genus of the fyngenefia polygamia æqualis clafs. The receptacle is naked; the calix is caliculated; the pappus is fimple; and the flofculi are in a fimple feries. There are nine fpecies, three of them natives of Britain, *viz.* the taraxacum, or dandelion; the hifpidum, or rough dandelion; and the autumnale, or yellow devil's-bit. The root of the taraxacum is efteemed a good cathartic.

LEONURUS, LION'S TAIL, in botany, a genus of the didynamia gymnofpermia clafs. The antheræ are interfperfed with fhining glands. There are five fpecies, only one of them, *viz.* the cardiaca, or mother-wort, is a native of Britain.

LEOPARD. See FELIS.

LEOPARD'S BANE, in botany. See DORONICUM.

LEPANTO, a port-town of European Turky, eighty miles weft of the ifthmus of Corinth; whence the gulph of Lepanto takes its name.

LEPASTRUM, in natural hiftory, a genus of felenitæ, compofed of plates difpofed in the form of a radiated ftar.

LEPIDIUM, in botany, a genus of the tetradynamia filiculofa clafs. The pod is emarginated, cordated, and contains many feeds. There are 17 fpecies, three of them natives of Britain, *viz.* the latifolium, or dittander: the ruderale, narrow-leaved wild crefs, or dittander; and the petræum, or mountain dittander.

LEPIDOPTERA, in zoology, an order of infects, with four wings, which are covered with imbricated fquamulæ. See NATURAL HISTORY.

LEPIUM, in natural hiftory, a genus of foffils of the harder gypfum, compofed of very fmall particles, and of a lefs glittering hue.

There is only one fpecies of this genus, being one of the leaft valuable and moft impure of the clafs of gypfums. It is of an extremely rude, irregular, coarfe and unequal ftructure; a little foft to the touch, of a very dull appearance, and of different degrees of a greyifh white. It is burnt in plaifter for the coarfer works; it calcines very flowly and unequally, and makes but a very coarfe and ordinary plaifter.

LEPROSY, a foul cutaneous difeafe, appearing in dry, white, thin, fcurfy fcabs, either on the whole body, or only fome part of it, and ufually attended with a violent itching and other pains. See MEDICINE.

LEPTODECORHOMBES, in natural hiftory, a genus of foffils of the order of the felenitæ; confifting of ten planes, each fo nearly equal to that oppofite to it as very much to approach to a decahedral parallelopiped, though never truly or regularly fo.

Of this genus there are only five known fpecies. 1. A thin, fine, pellucid, and flender ftreaked one, with tranfverfe ftriæ, found in confiderable quantities in the ftrata of clay in moft parts of England, particularly near Heddington in Oxfordfhire. 2. A thin, dull-looking opake, and flender ftreaked one, more fcarce than the former, and found principally in Leicefterfhire and Staffordfhire. 3. A thin fine ftreaked one, with longitudinal ftriæ, found in the clay-pits at Richmond, and generally lying at great depths. This has often on its top and bottom a very elegant fmaller rhomboide, defcribed by four regular lines. 4. A rough kind, with thick tranfverfe ftriæ, and a fcabrous furface, very common in Leicefterfhire and Yorkfhire. And, 5. a very fhort kind, with thick plates, common in the clay-pits of Northamptonfhire and Yorkfhire.

LEPTOPOLYGINGLIMI, in Natural Hiftory, a genus of foffil fhells, diftinguifhed by a number of minute teeth at the cardo; whereof we find great numbers at Harwick cliff, and in the marle-pits of Suffex.

LEPTURA, in zoology, a genus of infects belonging to the order of coleoptera, the characters of which are thefe:—The feelers are briftly; the elytra are attenuated towards the apex; and the thorax is fomewhat cylindrical. There are 25 fpecies, principally diftinguifhed by their colour.

LEPUS, in zoology, a genus of quadrupeds belonging to the order of glires. The characters are thefe: they have two fore-teeth in each jaw; thofe in the upper jaw are double, the interior ones being fmalleft. There are four fpecies, *viz.*

1. The timidus, or hare, has a fhort tail; the points of the ears are black; the upper-lip is divided up to the

the noſtrils; the length of the body is generally about a foot and a half; and the colour of the hair is reddiſh, interſperſed with white. The hare is naturally a timid animal. He ſleeps in his form, or ſeat, during the day, and feeds, copulates, *&c.* in the night. In a moon-light evening, a number of them are ſometimes ſeen ſporting together, leaping and purſuing each other: But the leaſt motion, the falling of a leaf, alarms them; and then they all run off ſeparately, each taking a different route. They are extremely ſwift in their motion, which is a kind of gallop, or a ſucceſſion of quick leaps. When purſued, they always take to the higher grounds: as their fore-feet are much ſhorter than the hind ones, they run with more eaſe up hill than down hill. The hare is endowed with all thoſe inſtincts which are neceſſary for his own preſervation. In winter he chuſes a form expoſed to the ſouth, and in ſummer to the north. He conceals himſelf among vegetables of the ſame colour with himſelf. Mr Fouilloux ſays, that he obſerved a hare, as ſoon as he heard the ſound of the horn, or the noiſe of the dogs, although at a mile's diſtance, riſe from her ſeat, ſwim acroſs a rivulet, then lie down among the ruſhes, and by this means evade the ſcent of the dogs. After being chaſed for a couple of hours, a hare will ſometimes puſh another from his form, and lie down in it himſelf. When hard preſſed, the hare will mingle with a flock of ſheep, run up an old wall and conceal himſelf among the graſs on the top of it, or croſs a river ſeveral times at ſmall diſtances. He never runs againſt the wind, or ſtraight forward; but conſtantly doubles about, in order to make the dogs loſe their ſcent.

It is remarkable, that the hare, although ever ſo frequently purſued by the dogs, ſeldom leaves the place where ſhe was brought forth, or even the form in which ſhe uſually ſits. It is common to find them in the ſame place next day, after being long and keenly chaſed the day before. The females are more groſs than the males, and have leſs ſtrength and agility; they are likewiſe more timid, and never allow the dogs to approach ſo near their form before riſing as the males. They likewiſe practiſe more arts, and double more frequently, than the males.

The hare is diffuſed almoſt over every climate; and, notwithſtanding they are every where hunted, their ſpecies never diminiſhes. They are in a condition of propagating the firſt year of their lives; the females go with young about 30 days, and produce four or five at a time; and as ſoon as they have brought forth, they again admit the embraces of the male; ſo that they may be ſaid to be always pregnant. The eyes of the young are open at birth; the mother ſuckles them about 20 days, after which they ſeparate from her and procure their own food. The young never go far from the place where they were brought forth; but ſtill they live ſolitary, and make forms about thirty paces diſtant from each other: Thus, if a young hare be found any where, you may almoſt be certain of finding ſeveral others within a very ſmall diſtance. The hare is not ſo ſavage as his manners would indicate. He is gentle, and ſuſceptible of a kind of education. He is pretty eaſily tamed, and will even ſhow a kind of attachment to the people of the houſe: But ſtill this attachment is not ſo ſtrong or laſting as to engage him to become altogether domeſtic; for although taken when very young, and brought up in the houſe, he no ſooner arrives at a certain age, than he takes the firſt opportunity of recovering his liberty and flying to the fields. The hare lives about ſeven or eight years. He feeds upon graſs, and other vegetables. His fleſh is excellent food. See Plate CIII. fig. 2.

2. The cuniculus, or rabbit, has a very ſhort tail, and naked ears. The rabbit, though it has a great reſemblance to the hare, is very different in his manners; and they have ſuch a rooted antipathy to one another, that no art can engage them to have any ſexual intercourſe. The fecundity of the rabbit is ſtill greater than that of the hare; they multiply ſo prodigiouſly in ſome countries, that the product of the fields is hardly ſufficient to maintain them. They devour herbage of all kinds, roots, grain, fruits, *&c.* They are in a condition for producing at the age of ſix months; like the hare, the female is almoſt conſtantly in ſeaſon; ſhe goes with young about 30 days, and brings forth from four to eight at a litter. A few days before littering, ſhe digs a new hole in the earth, not in a ſtraight line, but in a zigzag form; the bottom of the hole ſhe enlarges every way; ſhe the npulls off a great quantity of hair from her belly, of which ſhe makes a kind of bed for her young. During the two firſt days after birth, ſhe never leaves them, but when preſſed with hunger, and and then ſhe eats quickly and returns: In this manner ſhe ſuckles and attends her young for ſix weeks. All this time, both the hole and the young are concealed from the male; ſometimes when the female goes out, in order to deceive the male, ſhe fills up the mouth of the hole with earth mixed with her own urine. But when the young ones begin to come to the mouth of the hole, and to eat ſuch herbs as the mother brings to them, the father ſeems to know them; he takes them betwixt his paws, ſmooths their hair, and careſſes them with great fondneſs. The rabbit is ſuppoſed not to be a native of the northern parts of Europe, but to have been originally brought from Greece and Spain. The rabbit lives about ſeven years, and his fleſh is good. Their colour is various, ſome of them being red, others white, but the moſt general colour is grey. See Plate CIII. fig. 3.

3. The capenſis, has a tail about the length of his head, and red legs. It is a native of the Cape of Good Hope.

4. The braſilienſis has no tail. It is found in South America.

LEPUS, in aſtronomy. See ASTRONOMY, p. 487.

LERIA, a city and biſhop's ſee of Portugal: W. long. 9° 15′, and N. lat. 39° 30′.

LERIDA, a city and biſhop's ſee of Catalonia in Spain: E. long. 5′, N. lat. 41° 20′.

LERINS, two iſlands on the coaſt of Provence, five or ſix miles ſouth of Antibes, called St. Margaret and St. Honorat.

LERNEA, the SEA-HARE, in zoology, a ſea-inſect of the order of the gymnarthria, the body of which is of an oblong cylindric figure, and is perforated in the forehead; the tentacula reſemble ears. See GYMNARTHRIA.

LE ROY LE VEUT, the king's aſſent to public bills. See the articles BILL, STATUTE, and PARLIAMENT.

LESBOS, or METELIN, an iſland of the Archipelago, ſixty miles north-weſt of Smyrna. Its chief town is Caſtro.

LESCAR, a city and biſhop's ſee of France, forty miles eaſt of Bayonne.

LESCARD, a borough-town of Cornwal, fifteen miles weſt of Launceſton, which ſends two members to parliament.

LESSINES, a town of the Auſtrian Netherlands, fourteen miles north of Mons.

LESSONS, among eccleſiaſtical writers, portions of the Holy Scriptures, read in Chriſtian churches, at the time of divine ſervice.

LESTWITHIEL, a borough-town of Cornwal, twenty three miles ſouth-weſt of Launceſton, which ſends two members to parliament.

LETHARGY, in medicine. See MEDICINE.

LETHE, in the ancient mythology, one of the rivers of hell, ſignifying oblivion or forgetfulneſs; its waters having, according to poetical fiction, the peculiar quality of making thoſe who drank of them forget every thing that was paſt.

LETRIM, or LEITRIM, a county of Ireland, in the province of Connaught; bounded by Fermanagh on the north, by Cavan on the eaſt, by Roſcommon on the ſouth, and by Sligo on the weſt.

LETTER, a character uſed to expreſs one of the ſimple ſounds of the voice; and as the different ſimple ſounds are expreſſed by different letters, theſe, by being differently compounded, become the viſible ſigns or characters of all the modulations and mixtures of ſounds uſed to expreſs our ideas in a regular language.

LETTER *of attorney*, in law, is a writing by which one perſon authoriſes another to do ſome lawful act in his ſtead; as, to give ſeiſin of lands, to receive debts, ſue a third perſon, *&c.*

The nature of this inſtrument is to transfer to the perſon to whom it is given, the whole power of the maker, to enable him to accompliſh the act intended to be performed. It is either general or ſpecial; and ſometimes it is made revocable, which is when a bare authority is only given; and ſometimes it is irrevocable, as where debts, *&c.* are aſſigned from one perſon to another. It is generally held, that the power granted to the attorney muſt be ſtrictly purſued; and that where it is made to three perſons, two cannot execute it. In moſt caſes, the power given by a letter of attorney determines upon the death of the perſon who gave it. No letter of attorney made by any ſeaman, *&c.* in any ſhip of war, or having letters of marque, or by their executors, *&c.* in order to impower any perſon to receive any ſhare of prizes, or bounty-money, ſhall be valid, unleſs the ſame be made revocable, and for the uſe of ſuch ſeamen, and be ſigned and executed before, and atteſted by, the captain and one other of the ſigning officers of the ſhip, or the mayor or chief magiſtrate of ſome corporation.

LETTER *of mart*, or *marque*, a letter granted to one of the king's ſubjects, under the privy ſeal, impowering him to make repriſals for what was formerly taken from him by the ſubjects of another ſtate contrary to the law of mart. See the article MARQUE.

LETTERS-PATENT, are writings ſealed with the great ſeal; ſo called, becauſe they are open, with the ſeal affixed to them. Theſe are granted to authoriſe a man to do or enjoy what of himſelf he could not do.

LETTUCE, in botany. See LACTUCA.

LEVANT, a name given to the eaſt part of the Mediterranean ſea, bounded by Natolia or the leſſer Aſia on the north, by Syria and Paleſtine on the eaſt, by Egypt and Barca on the ſouth, and by the iſland of Candia and the other part of the Mediterranean on the weſt.

LEVATOR, in anatomy, a name given to ſeveral muſcles. See ANATOMY, Part II.

LEUCADENDRON, in botany, a genus of the tetrandria monogynia claſs. The floſculi have two petals, one of them being divided into ſegments; the receptacle is ſomewhat hairy; it has no proper calix; and the antheræ are joined together. There are 15 ſpecies, none of them natives of Britain.

LEUCOIUM, the GREAT SNOW-DROP, in botany, a genus of the hexandria monogynia claſs. The corolla is bell-ſhaped, and divided into ſix ſegments; and the ſtigma is ſimple. There are three ſpecies, none of them natives of Britain.

LEUCOMA, in ſurgery, a diſtemper of the eye, otherwiſe called albugo. See ALBUGO and MEDICINE.

LEUCOPHLEGMATIA, in medicine, a kind of dropſy, otherwiſe called anaſarca. See ANASARCA and MEDICINE.

LEVEL, an inſtrument wherewith to draw a line parallel to the horizon, by means of which the true level, or the difference of aſcent or deſcent between ſeveral places, may be found for conveying water, draining fens, *&c.*

There are ſeveral inſtruments of different contrivance and matter, invented for the perfection of levelling; all of which, for the practice, may be reduced to thoſe that follow.

Air LEVEL, that which ſhews the line of level by means of a bubble or air incloſed with ſome liquor in a glaſs-tube of an indeterminate length and thickneſs, whoſe two ends are hermetically ſealed. When the bubble fixes itſelf at a certain mark, made exactly in the middle of the tube, the plane or ruler wherein it is fixed is level. When it is not level, the bubble will riſe to one end. This glaſs tube may be ſet in another of braſs, having an aperture in the middle, whence the buble of air may be obſerved. The liquor wherewith the tube is filled, is oil of tartar, or aqua ſecunda; thoſe not being liable to freeze as common water, nor to rarefaction and condenſation, as ſpirit of wine is. There is one of theſe inſtruments with ſights, being an improvement upon that laſt deſcribed, which, by the addition of more apparatus, becomes more commodious and exact. It conſiſts of an air level, (ſee Plate CIV. fig. 1.) n° 1. about eight inches long, and ſeven or eight lines in diameter, ſet in a braſs-tube.

2. with

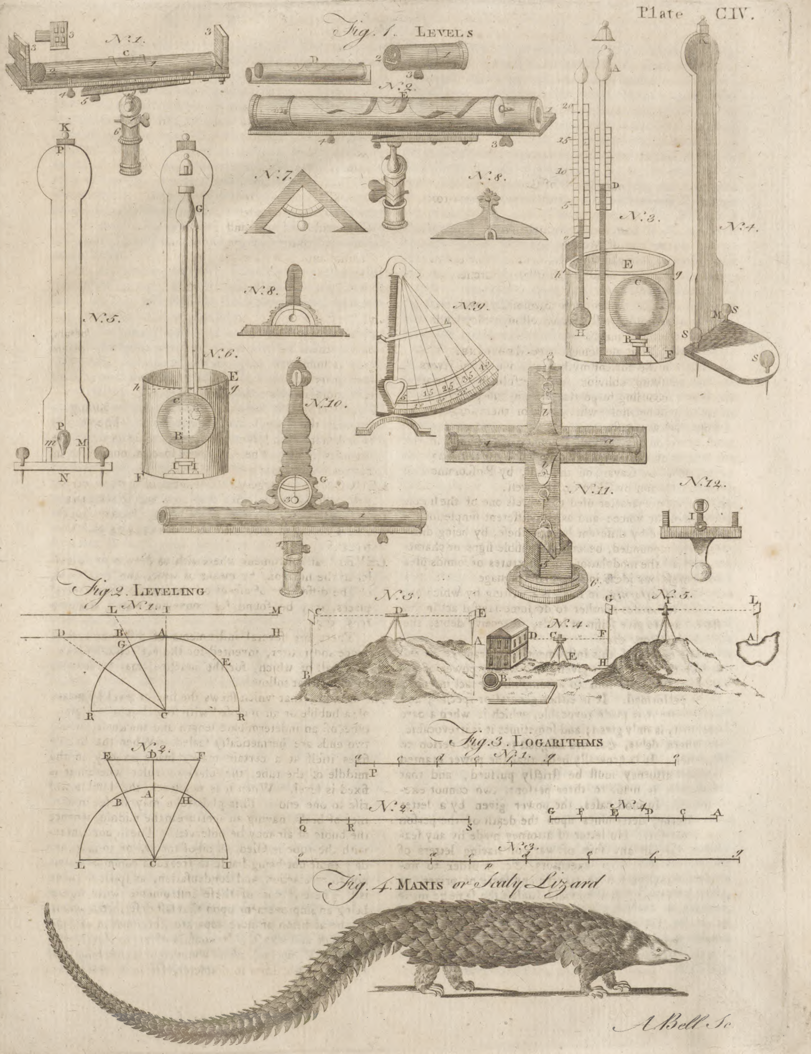
Plate CIV.
Fig. 1. Levels
N.1.
N.2.
N.3.
N.4.
N.5.
N.6.
N.7.
N.8.
N.9.
N.10.
N.11.
N.12.
Fig. 2. Leveling
Fig. 3. Logarithms
Fig. 4. Manis or Scaly Lizard
A Bell Sc.

2. with an aperture in the middle, C. The tubes are carried in a ſtrong ſtraight ruler, a foot long; at whoſe ends are fixed two ſights, 3, 3, exactly perpendicular to the tubes, and of an equal height, having a ſquare hole, formed by two fillets of braſs croſſing each other at right angles; in the middle whereof is drilled a very little hole, through which a point on a level with the inſtrument is deſcried. The braſs-tube is faſtened on the ruler by means of two ſcrews, one whereof, marked 4, ſerves to raiſe or depreſs the tube at pleaſure, for bringing it towards a level. The top of the ball and ſocket is rivetted to a little ruler that ſprings, one end whereof is faſtened with ſcrews to the great ruler, and at the other end has a ſcrew, 5, ſerving to raiſe and depreſs the inſtrument when nearly level.

This inſtrument, however, is yet leſs commodious than the following one; becauſe though the holes be ever ſo ſmall, yet they will ſtill take in too great a ſpace to determine the point of level preciſely.

This inſtrument conſiſts of an air level, with teleſcope ſights: this level (*ibid.* n° 2.) is like the laſt, with this difference, that inſtead of plain ſights, it carries a teleſcope to determine exactly a point of level at a good diſtance. The teleſcope is a little braſs tube, about fifteen inches long, faſtened on the ſame ruler as the level. At the end of the tube of the teleſcope, marked 1, enters the little tube 1, carrying the eye-glaſs and an hair horizontally placed in the focus of the object-glaſs, 2; which little tube may be drawn out, or puſhed into the great one, for adjuſting the teleſcope to different ſights: at the other end of the teleſcope is placed the object-glaſs. The ſcrew 3, is for raiſing or lowering the little fork, for carrying the hair, and making it agree with the bubble of air, when the inſtrument is level; and the ſcrew 4, is for making the bubble of air, D or E, agree with the teleſcope: the whole is fitted to a ball and ſocket. M Huygens is ſaid to be the firſt inventor of this level, which has this advantage, that it may be inverted by turning the ruler and teleſcope half round; and if then the hair cut the ſame point that it did before, the operation is juſt.

It may be obſerved, that one may add a teleſcope to any kind of level, by applying it upon or parallel to the baſe or ruler, when there is occaſion to take the level of remote objects.

Dr Deſaguliers contrived an inſtrument, by which the difference of level of two places, which could not be taken in leſs than four or five days with the beſt teleſcope-levels, may be taken in as few hours. The inſtrument is as follows: to the ball C (*ibid.* n° 3.) is joined a recurve tube B A, with a very fine bore, and a ſmall bubble at top, A, whoſe upper part is open. It is evident from the make of this inſtrument, that if it be inclined in carrying, no prejudice will be done to the liquor, which will always be right both in the ball and tube when the inſtrument is ſet upright. If the air at C, be ſo expanded with heat, as to drive the liquor to the top of the tube, the cavity A will receive the liquor, which will come down again and ſettle at D, or near it, according to the level of the place where the inſtrument is, as ſoon as the air at C returns to the ſame temperament as to heat and cold. To preſerve the ſame degree of heat, when the different obſervations are made, the machine is fixed in a tin veſſel E F, filled with water up to *g h*, above the ball, and a very ſenſible thermometer has alſo its ball under water, than one may obſerve the liquor at D, in each experiment, when the thermometer ſtands at the ſame height as before. The water is poured out when the inſtrument is carried, which one may do conveniently by means of the wooden frame, which is ſet upright by the three ſcrews S, S, S, *ibid.* n° 4. and a line and plummet P P, n° 5. At the back part of the wooden frame, from the piece at top K, hangs the plummet P, over a braſs point at N; M *m* are brackets, to make the upright board K N continue at right angles with the horizontal one at N. N° 6. repreſents a front view of the machine, ſuppoſing the fore part of the tin-veſſel tranſparent; and here the braſs-ſocket of the recurve tube, into which the ball is ſcrewed, has two wings at I I, fixed to the bottom, that the ball may not break the tube by its endeavour to emerge when the water is poured in as high as *g h*.

After the Dr had contrived this machine, he conſidered, that as the tube is of a very ſmall bore, if the liquor ſhould riſe into the ball at A, n° 3. in carrying the inſtrument from one place to another, ſome of it would adhere to the ſides or the ball A, and upon its deſcent in making the experiment, ſo much might be left behind, that the liquor would not be high enough at D, to ſhew the difference of the level: therefore, to prevent that inconveniency, he contrived a blank ſcrew, to ſhut up the hole at A, as ſoon as one experiment is made, that in carrying the machine, the air in A may balance that in C, ſo that the liquor ſhall not run up and down the tube, whatever degree of heat and cold may act upon the inſtrument, in going from one place to another. Now, becauſe one experiment may be made in the morning, the water may be ſo cold, that when a ſecond experiment is made at noon the water cannot be brought to the ſame degree of cold it had in the morning; therefore, in making the firſt experiment, warm water muſt be mixed with the cold, and when the water has ſtood ſome time before it comes to be as cold as it is likely to be at the warmeſt part of that day, obſerve and ſet down the degree of the thermometer at which the ſpirit ſtands, and likewiſe the degree of the water in the barometer at D; then ſcrew on the cape at A, pour out the water, and carry the inſtrument to the place whoſe level you would know; then pour in your water, and when the thermometer is come to the ſame degree as before, open the ſcrew at top, and obſerve the liquor in the barometer.

The doctor's ſcale for the barometer is ten inches long, and divided into tenths; ſo that ſuch an inſtrument will ſerve for any heights not exceeding ten feet, each tenth of an inch anſwering to a foot in height.

The Dr made no allowance for the decreaſe of denſity in the air, becauſe he did not propoſe this machine for meaſuring mountains, (though with a proper allowance for the decreaſing denſity of the air, it will do very well), but for heights that want to be known in gardens, plantations, and the conveyance of water, where an experiment that anſwers two or three feet in a diſtance of twenty miles, will render this a very uſeful inſtrument.

Artillery Foot-Level is in form of a ſquare, having its two legs or branches of an equal length; at a juncture whereof is a little hole, whence hangs a thread and plummet playing on a perpendicular line in the middle of a quadrant. It is divided into twice 45 degrees from the middle, *ibid* n° 7.

This inſtrument may be uſed on other occaſions, by placing the ends of its two branches on a plane; for when the thread plays perpendicularly over the middle diviſion of the quadrant, that plane is aſſuredly level. To uſe it in gunnery, place the two ends on the piece of artillery, which you may raiſe to any propoſed height, by means of the plummet, whoſe thread will give the degree above the level.

Carpenters and Paviour's Level, conſiſts of a long ruler, in the middle whereof is fitted, at right angles, another ſomewhat bigger, at the top of which is faſtened a line, which, when it hangs over a fiducial line at right angles with the baſe, ſhews that the ſaid baſe is horizontal. Sometimes this level is all of one board. *Ibid.* n° 8.

Gunner's Level, for levelling cannons and mortars, conſiſts of a triangular braſs-plate, about four inches high, *ibid.* 9. at the bottom of which is a portion of a circle, divided into 45 degrees; which number is ſufficient for the higheſt elevation of cannons and mortars, and for giving ſhot the greateſt range: on the center of this ſegment of a circle is ſcrewed a piece of braſs, by means of which it may be fixed or ſcrewed at pleaſure; the end of this piece of braſs is made ſo as to ſerve for a plummet and index, in order to ſhew the different degrees of elevation of pieces of artillery. This inſtrument has alſo a braſs foot, to ſet upon cannons or mortars, ſo as, when thoſe pieces are horizontal, the inſtrument will be perpendicular. The foot of this inſtrument is to be placed on the piece to be elevated, in ſuch a manner, as that the point of the plummet may fall on the proper degree: this is what they call levelling the piece.

Maſon's Level, is compoſed of three rules, ſo joined as to form an iſoceles-rectangle, ſomewhat like a roman A; at the vertex whereof is faſtened a thread, from which hangs a plummet, that paſſes over a fiducial line, marked in the middle of the baſe, when the thing to which the level is applied is horizontal; but declines from the mark, when the thing is lower on one ſide than on the other.

Plumb, or *Pendulum*-Level, that which ſhews the horizontal lines by means of another line perpendicular to that deſcribed by a plummet or pendulum. This inſtrument, *ibid.* n° 10. conſiſts of two legs or branches, joined together at right angles, whereof that which carries the thread and plummet is about a foot and a half long; the thread is hung towards the top of the branch, at the point 2. The middle of the branch where the thread paſſes is hollow, ſo that it may hang free every where: but towards the bottom, where there is a little blade of ſilver, whereon is drawn a line perpendicular to the teleſcope, the ſaid cavity is covered by two pieces of braſs, making as it were a kind of caſe, leſt the wind ſhould agitate the thread; for which reaſon the ſilver blade is covered with a glaſs G, to the end that it may be ſeen when the thread and plummet play upon the perpendicular: the teleſcope is faſtened to the other branch of the inſtrument, and is about two feet long: having an hair placed horizontally acroſs the focus of the object-glaſs, which determines the point of the level. The teleſcope muſt be fitted at right angles to the perpendicular. It has a ball and ſocket, by which it is faſtened to the foot, and was invented by M Picard.

Reflecting Level, that made by means of a pretty long ſurface of water repreſenting the ſame object inverted which we ſee erected by the eye, ſo that the point where theſe two objects appear to meet is a level with the place where the ſurface of the water is found. This is the invention of M. Marriotte.

There is another reflecting level conſiſting of a mirror of ſteel, or the like, well poliſhed, and placed a little before the object-glaſs of a teleſcope, ſuſpended perpendicularly. This mirror muſt make an angle of 45° with the teleſcope, in which caſe the perpendicular line of the ſaid teleſcope is converted into a horizontal line, which is the ſame with the line of level. This is the invention of M. Caſſini.

Water-Level, that which ſhews the horizontal line by means of a ſurface of water or other liquor, founded on this principle, that water always places itſelf level. See the article Fluid.

The moſt ſimple is made of a long wooden trough, or canal, whoſe ſides are parallel to the baſe, ſo that being equally filled with water, its ſurface ſhews the line of level. This is the chorobates of the ancients. See Chorobata.

It is alſo made with two cups fitted to the two ends of a pipe, three or four feet long, about an inch in diameter, by means whereof the water communicates from the one to the other cup; and this pipe being moveable on its ſtand by means of a ball and ſocket, when the two cups become equally full of water, their two ſurfaces mark the line of level.

This inſtrument, inſtead of cups, may alſo be made with two ſhort cylinders of glaſs three or four inches long, faſtened to each extreme of the pipe with wax or maſtic. Into the pipe is poured ſome common or coloured water, which ſhews itſelf through the cylinders, by means whereof the line of level is determined; the height of the water, with reſpect to the center of the earth, being always the ſame in both cylinders: this level, though very ſimple, is yet very commodious for levelling ſmall diſtances.

Level *of Mr Huygens's invention*, conſiſts of a teleſcope *a*, *ibid.* n° 11. in form of a cylinder, going through a ferril, in which it is faſtened by the middle. This ferril has two flat branches *b b*, one above, and the other below; at the ends whereof are faſtened little moving pieces, which carry two rings, by one of which the teleſcope is ſuſpended to an hook at the end of the ſcrew 3, and by the other a pretty heavy weight is ſuſpended, in order to keep the teleſcope in equilibrio. This weight hangs in the box 5, which is almoſt filled with linſeed oil, oil of walnuts, or other matter

that will not eafily coagulate, for more aptly fettling the balance of the weight and telefcope. The inftrument carries two telefcopes clofe and very parallel to each other; the eye glafs of the one being againft the object-glafs of the other, that one may fee each way without turning the level. In the focus of the object-glafs of each telefcope muft a little hair be ftrained horizontally, to be raifed and lowered as occafion requires by a little fcrew. If the tube of the telefcope be not found level when fupended, a ferril or ring, 4, is put on it, and is to be flid along till it fixes to a level. The hook on which the inftrument is hung, is fixed to a flat wooden crofs; at the ends of each arm whereof there is a hook ferving to keep the telefcope from too much agitation in ufing or carriage. To the faid flat crofs is applied another hollow one, that ferves as a cafe for the inftrument; but the two ends are left open, that the telefcope may be fecured from the weather, and always in a condition to be ufed. The foot of this inftrument is a round brafs plate, to which are faftened three brafs ferils, moveable by means of joints wherein are put ftaves, and on this foot is placed the box.

N° 12. marked I, is a balance-level; which being fufpended by the ring, the two fights, when in equilibrio, will be horizontal, or in a level.

LEVELLING, the art of finding a line parallel to the horizon at one or more ftations, in order to determine the height of one place with regard to another. See the preceding article.

A truly level furface is a fegment of a fpherical furface, which is concentric to the globe of the earth. A true line of level is an arch of a great circle, which is imagined to be defcribed upon a truly level furface. The apparent level is a ftraight line drawn tangent to an arch or line of true level. Every point of the apparent level, except the point of contact, is higher than the true level: thus let EAG (Plate CIV. fig. 2. n° 1.) be an arch of a great circle drawn upon the earth; to a perfon who ftands upon the earth at A, the line HD is the apparent level parallel to his rational horizon RR; but this line, the farther it is extended from his ftation A, the farther it recedes from the center; for BC is longer than AC, and DC is longer than BC, *&c.* The common methods of levelling are fufficient for laying pavements of walks, for conveying water to fmall diftances, for placing horizontal dials, or aftronomical inftruments; but in levelling the bottoms of canals which are to convey water to the diftance of many miles, the difference between the apparent and true level muft be taken into the account: thus let IAL (*ibid.* n° 2.) be an arch of a great circle upon the earth: let it be required to cut a canal whofe bottom fhall be a true level from A to B, of the length of 5078 feet: the common method is to place the levelling inftrument in the bottom of the canal at A, and looking through the fights placed horizontally at a ftick fet up perpendicular at B, to make a mark where the vifual ray or point of the apparent level points at E, and then to fink the bottom of the canal at B as much below E as A is below D. But this will not give the true level: for according to Caffini's calculation, at the diftance of 5078 feet the apparent level is feven inches above the true; and therefore, to make a true level, B muft be funk feven inches lower than the apparent level directs; fo that if A be four feet below D, B muft be four feet feven inches below the mark E. We have here mentioned the error which will arife from placing the level at one end of the line to be levelled, and fhewn how to correct it; but in moft cafes it is better to take a ftation in the middle of the line to be levelled: thus, if the points H and B are to be levelled, place the inftrument in the middle at A, and fetting up fticks perpendicular at H and B, make marks upon each ftick where the apparent level points, as E and F; thofe points are level: and if you fink H as much below F, as B is below E, HAB will be a true level.

The operation of levelling is as follows: fuppofe the height of the point A (*ibid.* n° 3.) on the top of a mountain above that of the point B, and at the foot thereof, be required. Place the level about the middle diftance between the two points as in D, and ftaffs in A and B; and let there be perfons inftructed with fignals for raifing and lowering, on the faid ftaffs, little marks of pafteboard or other matter, the level being placed horizontally by the bubble, *&c.* Look towards the ftaff AE, and caufe the mark fo raifed to be lowered till the middle, upper edge, or other moft confpicuous part, appear in the vifual ray. Then meafuring exactly the perpendicular height of the point E above the point A, which fuppofe fix feet four inches; fet that down in your book: then turn the level horizontally about, that the eye-glafs of the telefcope may be ftill next the eye when you look the other way; if you have only plain fights, the inftrument need not be turned; and caufe the perfon at the ftaff B, to raife or lower his mark, till fome confpicuous part of it fall in the vifual ray, as at C: then meafure the perpendicular height of C above B, which fuppofe fixteen feet fix inches: fet this alfo down in the book above the other number of the firft obfervation; fubtract the one from the other, the remainder will be ten feet two inches, which is the difference of the level between A and B, or the height of the point A above the point B.

If the point D, where the inftrument is fixed, be in the middle between the two points A and B, there will be no neceffity for reducing the apparent level to the true level; the vifual ray in that cafe being raifed equally above the true level. If it be further required to know whether there be a fufficient defcent for conveying water from the fpring A (*ibid.* n° 4.) to the point B. Here, in regard the diftance from A to B is confiderable, it is required that feveral operations be made. Having then chofen a proper place for the firft ftation, as at I, fet up a ftaff in the point A, near the fpring, with a proper mark to flide up and down the ftaff, as L, and meafure the diftance from A to I, which fuppofe two thoufand yards. Then the level being adjufted in the point I, let the mark L be raifed and lowered till fuch time as you fpy fome confpicuous part of it through the telefcope or fights of the level, and meafure the height AL, which fuppofe thirteen feet five inches. But in regard the diftance AI is two thoufand yards, you muft have recourfe

to

to your table for a reduction, subtracting eleven inches, which will leave the height of AL twelve feet six inches, and this note down in your book. Now turn the level horizontally about, so that the eye-glass of the telescope may be towards A, and fixing up another staff at H, cause the mark G to be moved up and down till you spy some conspicuous part through the telescope or sights. Measure the height HG, which suppose seven yards one foot two inches. Measure likewise the distance of the points IH, which suppose one thousand three hundred yards; for which distance four inches eight lines must be subtracted from the height HG, which consequently will only leave seven yards nine inches four lines, to be taken down in your book. This done, remove the level forwards to some other eminence, as E, whence the staff H may be viewed; as also another staff at D, near the place whither the water is to be conveyed. The level being again adjusted in the point E, look back to the staff H; and managing the mark as before, the visual ray will give the point F. Measure the height HF, which suppose eleven feet six inches. Measure likewise the distance HE, which suppose a thousand yards, for which there is two inches nine lines of abatement; which being taken from the height HF, there will remain eleven feet three inches three lines; which enter in your book. Lastly, turning the level to look at the next staff D, the visual ray will give the point D. Measure the height of D from the ground, which suppose eight feet three inches. Measure also the distance from the station E to B, which suppose nine hundred yards, for which distance there are two inches three lines of abatement; which being taken from the height BD, there will remain eight feet nine lines; which enter as before.

For the manner of entering down observations in your book, observe, that when a proper place or station for the level between the two points has been pitched upon, write down the two heights observed at that station in two different columns, *viz.* under the first column, those observed in looking through the telescope when the eye was from the spring, or towards the point, which we may call back sights; and under the second column, those observed when the eye was next the spring, which we call foresights. Having summed up the heights of each column separately, subtract the lesser from the greater, the remainder will be the difference of the level between the points A and B. If the distance of the two points be required, add all the distances measured together; and dividing the difference of height by the yards of the distances, for each two hundred yards you will have a descent of about two inches nine lines.

Dr. Halley suggests a new method of levelling, performed wholly by means of the barometer, in which the mercury is found to be suspended to so much the less height, as the place is farther remote from the center of the earth; whence the different heights of the mercury in two places give the difference of level. This method has been put in practice by some of the French academy.

LEVELLING STAVES, instruments used in levelling, serving to carry the marks to be observed, and at the same time to measure the heights of those marks from the ground. They usually consist each of two long wooden rulers, made to slide over one another, and divide into feet, inches, *&c.*

LEVER, or LEAVER, in mechanics. See MECHANICS.

LEVERET, among sportsmen, denotes a hare in the first year of her age.

LEVIGATION, in pharmacy and chemistry, the reducing hard and ponderous bodies to an impalpable powder, by grinding them on a prophyry, or the like.

LEVITE, in a general sense, means all the descendants of Levi, among whom were the Jewish priests themselves, who being descended from Aaron, were likewise of the race of Levi: but it is more particularly used for an order of officers in that church, who were employed in performing the manual service of the temple, such as in fetching wood, water, and other things necessary for the sacrifices, and in singing and playing upon instruments of music.

LEVITICUS, a canonical book of the Old Testament, so called from its containing the laws and regulations relating to the priests, Levites, and sacrifices.

LEVITY, in physiology, the privation or want of weight in any body, when compared with another that is heavier than it, in which sense it stands opposed to gravity.

LEVY, in law, signifies to gather or collect, as to levy money; and to levy a fine of lands, is the passing a fine.

LEWARDEN, a city of the United Provinces, the capital of west Friesland: E. long. 5° 35′, N. lat. 53° 20′.

LEWES, a borough-town of Sussex, forty miles south of London, which sends two members to parliament.

LEWIS, the most northerly of any of the western islands of Scotland, lying in 8° odd minutes W. long. and between 58° and 59° odd minutes N. lat.

LEXICON, the same as dictionary, but chiefly used in speaking of Greek dictionaries. See DICTIONARY.

LEYDEN, a city of Holland, in which there is a famous university, situated twenty miles south of Amsterdam.

LEYTE, one of the Philippine islands, separated from the island Philippina by a narrow channel: E. long. 123°, N. lat. 11°.

LIBANUS, a range of mountains in Asiatic Turky, between Syria and Palestine, which extend from Sidon on the Levant, eastward beyond Damascus.

LIBATION, a religious ceremony among the ancient pagans, which consisted in an effusion of liquors poured on the head of the victims prepared for sacrifice.

LIBAW, a port-town of Poland, in the duchy of Courland, situated on a bay of the Baltic: E. long. 21°, N. lat. 56° 40′.

LIBELLULA, in the history of insects, a genus of four-winged flies, called in English dragon-flies, or adder-flies; the characters of which are these: The mouth is furnished with jaws; the feelers are shorter than the

breaſt; and the tail of the male terminates in a kind of hooked forceps. There are 21 ſpecies, chiefly diſtinguiſhed by their colour.

LIBER, among botaniſts, denotes the rind or inner bark of trees.

LIBERIA, in Roman antiquity, a feſtival obſerved on the ſixteenth of the calends of April, at which time the youth laid aſide their juvenile habit for the toga virilis, or habit peculiar to grown men.

LIBERTUS, in Roman antiquity, a perſon who from being a ſlave had obtained his freedom.

The difference between the liberti and libertini was this: the liberti were ſuch as had been actually made free themſelves, and the libertini were the children of ſuch perſons.

LIBERTY, in general, denotes a ſtate of freedom, in contradiſtinction to ſlavery.

According to Cicero, liberty is the power of living as a man pleaſes, or without being controlled by another.

In a legal ſenſe, liberty ſignifies ſome privilege that is held by charter or preſcription.

LIBRA, the Balance, in aſtronomy. See Astronomy, p. 487.

Libra, in Roman antiquity, a pound weight; alſo a coin, equal in value to twenty denarii.

LIBRARY, an edifice or apartment deſtined for holding a conſiderable number of books placed regularly on ſhelves; or, the books themſelves lodged in it.

The firſt who erected a library at Athens was the tyrant Piſiſtratus, which was tranſported by Xerxes into Perſia, and afterwards brought back by Seleucus Nicanor to Athens. Plutarch ſays, that under Eumenes there was a library at Pergamus that contained 200,000 books. That of Ptolemy Philadelphus, according to A. Gellius, contained 700,000, which were all burnt by Cæſar's ſoldiers. Conſtantine and his ſucceſſors erected a magnificent one at Conſtantinople, which in the eighth century contained 300.000 volumes; and among the reſt, one in which the Iliad and Odyſſey were written in letters of gold, on the guts of a ſerpent: but this library was burnt by order of Leo Iſaurus. The moſt celebrated libraries of ancient Rome, were the Ulpian and the Palatine, and in modern Rome that of the Vatican. The foundation of the Vatican library was laid by pope Nicholas, in the year 1450; it was afterwards deſtroyed in the ſacking of Rome by the conſtable of Bourbon, and reſtored by pope Sixtus V. and has been conſiderably enriched with the ruins of that of Heidelberg, plundered by count Tilly in 1682. One of the moſt complete libraries in Europe, is that erected by Coſmo de Medicis; though it is now exceeded by that of the French king, which was begun by Francis I. augmented by cardinal Richelieu, and completed by M. Colbert. The emperor's library at Vienna, according to Lambecius, conſiſts of 80.000 volumes, and 15,940 curious medals. The Bodleian library at Oxford exceeds that of any univerſity in Europe, and even thoſe of any of the ſovereigns of Europe, except the emperor's and the French king's, which are each of them older by a hundred years. It was firſt opened in 1602, and has ſince been increaſed by a great number of benefactors: indeed the Medicean library, that of Beſſarion at Venice, and thoſe juſt mentioned, exceed it in Greek manuſcripts; but it outdoes them all in Oriental manuſcripts; and as to printed books, Ambroſian at Milan, and that of Wolfembuttle, are two of the moſt famous, and yet both are inferior to the Bodleian. The Cotton library conſiſts wholly of manuſcripts, particularly of ſuch as relate to the hiſtory and antiquities of Britain; which, as they are now bound, make about 1000 volumes.

In Edinburgh there is a good library belonging to the univerſity, well furniſhed with books; which are kept in good order, and cloiſtered up with wire-doors, that none but the keeper can open, and are now lent out only upon conſignation of the price; a method much more commodious than the multitude of chains uſed in other libraries. There is alſo a noble library of books and manuſcripts belonging to the faculty of Advocates. See Advocate.

LIBRATION, in aſtronomy, an apparent irregularity of the moon's motion, whereby ſhe ſeems to librate about her axis, ſometimes from the eaſt to the weſt, and now and then from the weſt to the eaſt. See Astronomy.

LIBYA, in ancient geography, a large extent of Africa, lying ſouth-weſt of Egypt.

LICENCE, in law, an authority given to a perſon to do ſome lawful act.

LICENTIATE, one who has obtained the degree of a licence.

The greateſt number of the officers of juſtice in Spain, are diſtinguiſhed by no other title but that of licentiate. In order to paſs licentiate in common law, civil law, and phyſic, they muſt have ſtudied ſeven years; and in divinity, ten. Among us, a licentiate uſually means a phyſician who has a licence to practiſe, granted by the college of phyſicians.

LICHEN, liver-wort, in botany, a genus of the cryptogamia algæ claſs. The receptacle is roundiſh, plain, and ſhining; and the farina is diſperſed upon the leaves. There are 85 ſpecies, all natives of Britain.

LICTORS, in Roman antiquity, the ſerjeants or beadles who carried the faſces before the ſupreme magiſtrates: it was alſo a part of their office to be the public executioners in beheading, ſcourging, &c.

LIDDESDALE, a county of Scotland, bounded by Tiviotdale, on the north; Cumberland, on the ſouth-eaſt; and Annandale, on the ſouth-weſt.

LIEGE, in law, a term ſometimes uſed for liege lord, or one who owns no ſuperior.

Liege poustie, in Scots law, is oppoſed to death bed; and ſignifies a perſon's enjoying that ſtate of health, in which only he can diſpoſe of his property at pleaſure. See law, Tit. xxvii. 28.

Liege, in geography, the capital of the biſhopric of the ſame name in Germany, ſituated on the river Maes, twelves miles ſouth of Maeſtricht; E. long. 5° 36′, N. lat. 50° 40′.

LIENTERY, is a flux of the belly, in which, whatever is

is taken in is difcharged by ftool as it is fwallowed, or very little altered either in colour or fubftance. See MEDICINE.

LIEUTENANT, an officer who fupplies the place and difcharges the office of a fuperior in his abfence. Of thefe, fome are civil, as the lords-lieutenants of kingdoms, and the lord-lieutenants of counties; and others are military, as the lieutenant general, lieutenant-general of the artillery, lieutenant colonel, lieutenant of the artillery of the tower, lieutenants of horfe, foot, fhips of war, *&c.*

Lord LIEUTENANT *of Ireland*, is properly a viceroy, and has all the ftate and grandeur of a king of England, except being ferved upon the knee. He has the power of making war and peace, of beftowing all the offices under the government, of dubbing knights and of pardoning all crimes except high treafon: he alfo calls and prorogues the parliament, but no bill can pafs without the royal affent. He is affifted in his government by a privy counfel; and, on his leaving the kingdom, he appoints the lords of the regency, who govern in his abfence.

Lords LIEUTENANTS *of counties*, are officers, who, upon any invafion or rebellion, have power to raife the militia, and to give commiffions to colonels and other officers, to arm and form them into regiments, troops and companies. Under the lords lieutenants, are deputy-lietenants, who have the fame power; thefe are chofen by the lords lieutenants out of the principal gentlemen of each county, and prefented to the king for his approbation.

LIEUTENANT-GENERAL, is an officer next in rank to the general: in battle, he commands one of the wings; in a march, a detachment, or a flying camp; alfo a quarter, at a fiege, or one of the attacks, when it is his day of duty.

LIFE, is peculiarly ufed to denote the animated ftate of living creatures, or the time that the union of their foul and body lafts.

LIFERENT, in Scots law. When the ufe or enjoyment of a fubject is given to a perfon during his life, it is faid to belong to him in liferent. See LAW, Tit. xvi. 21.

LIGAMENT, in anatomy, a ftrong compact fubftance, ferving to join two bones together. See ANATOMY.

LIGATURE, in furgery, is a chord, band, or ftring; or the binding any part of the body with a chord, band, fillet, *&c.* whether of leather, linnen, *&c.*

Ligatures are ufed to extend and replace bones that are broken or diflocated; to tie the patients down in lithotomy and amputations; to tie upon the veins in phlebotomy, or the arteries in amputations, or in large wounds; to fecure the fplints that are applied to fractures; to tie up the proceffes of the peritonæum, with the fpermatic veffels in caftration; and, laftly, in taking off warts or other excrefcences by ligature.

LIGHT, in phyfiology, certain fubtile particles of matter, capable of exciting in us the fenfation of colours. See OPTICS.

LIGHTENING, the burfting of fire from a cloud or the earth. See ELECTRICITY.

LIGHTER, in naval achitecture, a large kind of boat ufed in the river of Thames for carrying heavy goods, as coals, timber, *&c.*

LIGNICENSIS *terra*, in the materia medica, the name of a fine yellow hole, dug in many parts of Germany, particularly about Emeric in the circle of Weftphalia, and ufed in cordial and aftringent compofitions.

LIGULATED, among botanifts, an appellation given to fuch flofcules as have a ftraight end turned downwards, with three indentures, but not divided into fegments.

LIGUSTICUM, LOVAGE, in botany, a genus of the pentandria digynia clafs. The fruit is oblong, with five furrows on each fide. There are fix fpecies, two of them natives of Britain, *viz* the fcotticum, or Scottifh fea parfley; and the cornubienfe, or Cornwal faxifrage.

LIGUSTRUM, PRIVET, in botany, a genus of trees belonging to the diandria monogynia clafs. The corolla confifts of four fegments; and the berry has four feeds. There is but one fpecies, *viz.* the vulgare or privet, a native of Britain.

LILIADEOUS, an appellation given to fuch flowers as refemble that of the lily.

LILIUM, in botany, a genus of the hexandria monogynia clafs. The corolla is bell-fhaped, and confifts of fix petals, with a longitudinal nectariferous line; and the valves of the capfule are connected with a lattice-work of hair. There are nine fpecies, none of them natives of Britain. The root of the white lily is reckoned emollient and fuppurative.

LIMA, a province of Peru, in South America; the capital of which, called alfo Lima, was almoft entirely deftroyed by an earthquake in 1746: W. long. 76°, and S. lat. 12° 30′.

LIMAX, in zoology, a genus of infects belonging to the order of vermes mollufca; the characters of which are thefe: The body is oblong, fitted for crawling, with a kind of mufcular coat on the upper part; and the belly is plain: they have a roundifh hole in the fide, near the neck, which ferves the purpofes of genitals, and for voiding their excrements: they have likewife four tentacula or horns, fituate above the mouth, which they extend or retract at pleafure. There are eight fpecies, diftinguifhed entirely by their colour, as the black fnail; the white fnail; the reddifh fnail; the afh-coloured fnail; *&c.* Snails are faid to be hermaphrodites, and mutually impregnate each other.

LIMB, in a general fenfe, denotes the border or edge of a thing: thus, we fay, the limb of a quadrant, of the fun, of a leaf, *&c.*

LIMB, in anatomy, an appellation given to the extremities of the body, as the arms and legs.

LIMB, *limbus*, in the church of Rome, is ufed in two different fenfes. 1. The limb of the patriarchs is faid to be the place where the patriarchs waited the redemption of mankind: in this place, they fuppofe our Saviour's foul continued from the time of his death to his refurrection. 2. The limb of infants, dying without baptifm, a place fuppofed to be diftinct both from heaven and hell; fince, fay they, children dying innocent of any actual fin do not deferve hell, and by reafon of their original fin cannot be admitted into heaven.

LIMBURG,

LIMBURG, the capital of a dutchy of the ſame name, in the Auſtrian Netherlands, twenty miles ſouth-eaſt of Liege: E. long 6° 5′, and N. lat. 50° 37′.

LIME. See CHEMISTRY, p. 76.

LIMERIC, the capital of a county of the ſame name in Ireland, ſituated on the river Shannon, fifty two miles north of Cork: W. long. 8°30′, N. lat 52° 35′.

LIMINGTON, or LEMINGTON, a borough-town of Hampſhire, twelve miles ſouth-weſt of Southampton. It ſends two members to parliament.

LIMIT, in a reſtrained ſenſe, is uſed by mathematicians for a determinate quantity to which a variable one continually approaches; in which ſenſe, the circle may be ſaid to be the limit of its circumſcribed and inſcribed polygons. In algebra, the term limits is applied to two quantities, one of which is greater, and the other leſs, than another quantity: and in this ſenſe it is uſed, in ſpeaking of the limits of equations, whereby their ſolution is much facilitated. See ALGEBRA.

LIMNING, the art of painting in water-colours, in contradiſtinction to painting, which is done in oil-colours. See PAINTING.

Limning is by far more ancient than painting in oil; this laſt being firſt invented by John Van Eych, a Flemiſh painter, in 1410.

In limning, all colours are proper enough, except the white, made of lime, which is only uſed in freſco. The azure and ultramarine muſt always be mixt with ſize or gum: but there are always applied two lays of hot ſize, before the ſize colours are laid on: the colours are all ground in water, each by itſelf, and, as they are required in working, are diluted with ſize water.

When the piece is finiſhed, they go over it with the white of an egg, well beaten; and then with varniſh, if required.

To limn or draw a face in colours: having all the materials in readineſs, lay the prepared colour on the card even and thin, free from hairs and ſpots, over the place where the picture is to be. The ground being laid, and the party placed in a due poſition, begin the work; which is to be done at three ſittings. At the firſt, you are only to dead-colour the face, which will require about two hours. At the ſecond ſitting, go over the work more curiouſly. adding its particular graces or deformities. At the third ſitting, finiſh the whole; carefully remarking whatever may conduce to render the piece perfect, as the caſt of the eyes, moles, ſcars, geſtures, and the like.

LIMODORUM, in botany, a genus of the gynandria diandria claſs. The nectarium conſiſts of one concave, pedicellated leaf, ſituate with the undermoſt petal. There is but one ſpecies, a native of North America.

LIMON. See CITRUS.

LIMOSELLA, in botany, a genus of the didynamia angioſpermia claſs. The calix conſiſts of five ſegments, and the corolla of five equal diviſions; the ſtamina are approximated in pairs; and the capſule has one cell and two valves, containing many ſeeds.

LIMPET. See PATELLA.

LINARIA, in ornithology. See FRINGILLA.

LINCOLN, the capital city of the county of Lincoln: W. long. 27′, N. lat. 53° 16′. It ſends two members to parliament.

LINE, in geometry, a quantity extended in length only, without any breadth or thickneſs. It is formed by the flux or motion of a point. See FLUXIONS, and GEOMETRY.

LINE, in the art of war, is underſtood of the diſpoſition of an army, ranged in order of battle, with the front extended as far as may be, that it may not be flanked.

LINE *of battle*, is alſo underſtood of the diſpoſition of a fleet on the day of the engagement, on which occaſion the veſſels are uſually drawn up as much as poſſible in a ſtraight line, as well to gain and keep the advantage of the wind, as to run the ſame board.

Ship of the LINE, a veſſel large enough to be drawn up in the line, and to have a place in a ſea-fight.

LINE, in genealogy, a ſeries or ſucceſſion of relations in various degrees, all deſcending from the ſame common father.

LINE alſo denotes a French meaſure, containing the twelfth part of an inch, or the hundred and forty-fourth part of a foot. Geometricians conceive the line ſubdivided into ſix points. The French line anſwers to the Engliſh barley corn.

LINES, in heraldry, the figures uſed in armories, to divide the ſhield into different parts, and to compoſe different figures. Theſe lines, according to their different forms and names, give denomination to the pieces or figures which they form, except the ſtraight or plain lines.

LINEA ALBA, in anatomy. See ANATOMY, p. 192.

LINEAMENT, among painters, is uſed for the out-lines of a face.

LINEAR NUMBERS, in mathematics, ſuch as have relation to length only; ſuch is a number which repreſents one ſide of a plane figure. If the plane figure be a ſquare, the linear number is called a root.

LINEAR PROBLEM, that which may be ſolved geometrically by the interſection of two right lines. This is called a ſimple problem, and is capable but of one ſolution.

LINEN. See LINNEN.

LING, in ichthyology. See GADUS.

LINGEN, a town of Germany, in the circle of Weſtphalia, capital of a county of the ſame name, ſituated on the river Ems, forty five miles north of Munſter.

LINGUATULA, in ichthyology. See PLEURONECTES.

LINIMENT, in pharmacy, a compoſition of a conſiſtence ſomewhat thinner than an unguent, and thicker than an oil, uſed for anointing different parts of the body in various intentions.

The materials proper for compoſing of a liniment, are oils, fats, balſams, and whatever enters the compoſition of unguents and plaſters.

LINLITHGOW, a town of Scotland, in the county of Lothian, capital of the county of Linlithgow, ſituated ſixteen miles weſt of Edinburgh.

LINNÆA, in botany, a genus of the didynamia angioſpermia claſs. The calix is double; the corolla is bell-ſhaped; and the berry is dry, and contains two ſeeds.

feeds. There is but one fpecies, a native of Sweeden.

LINNEN, in commerce, a well-known kind of cloth, chiefly made of flax. See FLAX.

In order to fucceed in the linnen-manufacture, one fet of people fhould be confined to the plowing and preparing the foil, fowing and covering the feed, to the weeding, pulling, rippling, taking care of the new feed, and watering and graffing the flax, till it is lodged at home: others fhould be concerned in the drying, breaking, fcutching, and heckling the flax, to fit it for the fpinners; and others in fpinning and reeling it, to fit it for the weaver; others fhould be concerned in taking due care of the weaving, bleaching, beetling, and finifhing the cloth for the market. It is reafonable to believe, that if thefe feveral branches of the manufacture were carried on by diftinct dealers in Scotland and Ireland, where our home-made linnens are manufactured, the feveral parts would be better executed, and the whole would be afforded cheaper, and with greater profit.

LINNET, in ornithology. See FRINGILLA.

LINSEED, the feed of the plant linum. Linfeed bruifed and fteeped in water, gives it very foon a thick mucilaginous nature, and communicates much of its emollient virtues to it.

LINT. See LINNEN and FLAX.

LINTEL, in architecture, a piece of ftone or timber that lies horizontally over door-pofts and window-jambs, as well to bear the thicknefs of the wall over it, as to bind the fides of the wall together.

LINTON, a market-town of Cambridgefhire, fituated ten miles fouth-eaft of Cambridge.

LINTS, or LINTZ, a beautiful city, capital of Upper Auftria, with a ftrong citadel.

LINUM, FLAX, in botany, a genus of the pentandria pentagynia clafs. The calix confifts of five leaves, and the corolla of five petals; the capfule has five valves, and ten cells; and the feeds are folitary. There are 22 fpecies, five of them natives of Britain, *viz.* the ufitatiffimum, or common flax; the perenne, or blue flax; the tenuifolium, or narrow-leaved wild flax; the catharticum, or purging flax; and the radiola, leaft rupture-wort, or all-feed. See FLAX.

LION, in zoology. See FELIS.

LIONCELLES, in heraldry, a term ufed for feveral lions borne in the fame coat of arms.

LIP, in anatomy. See ANATOMY, p. 305.

Hare-LIP, a diforder, in which the upper lip is in a manner flit or divided, fo as to refemble the upper lip of a hare, whence the name. See SURGERY.

LIPOTHYMIA, FAINTING, in medicine, may arife from feveral caufes, as too violent exercifes, fuppreffion of the menfes or other accuftomed evacuations, *&c.* See MEDICINE.

LIPPIA, in botany, a genus of the didynamia angiofpermia clafs. The calix confifts of four roundifh, erect, and membranaceous teeth; the capfule is ftraight, has two valves, one cell, and two feeds. There are two fpecies, none of them natives of Britain.

LIQUIDAMBER, in botany, a genus of the monœcia polyandria clafs. The calix has four leaves; it has no corolla, but numerous filaments: the calix of the male confifts of four leaves in the form of a globe; it has no corolla, but a couple of ftyli; and the capfules, which are numerous, are round, with a double valve, and contains many feeds. There are two fpecies, both natives of America. This tree yields a fragrant refin, called liquidamber, which refolves and opens obftructions.

LIQUOR, a name fignifying any fluid fubftance.

LIQUORICE. See GLYCYRRHIZA.

LIRIODENDRUM, the TULIP-TREE, in botany, a genus of the polyandria polygynia clafs. The calix confifts of three leaves, and the corolla of nine petals; and the feeds are imbricated upon a ftrobilus. There are two fpecies, none of them natives of Britain.

LISBON, the capital of Portugal, fituated on the north bank of the Tagus, about ten miles from its mouth, and eighty miles weft of the frontiers of Spain: W. long. 9° 25′, N. lat. 38° 25′. It is about fix miles long, winding with the river, from whence it rifes with an eafy afcent, and is computed to contain about 30,000 houfes, 200,000 inhabitants, forty parifh-churches, and forty convents of both fexes.

LISIEUX, a large city and bifhop's fee of France, in the province of Normandy: E. long. 16′, and N. lat. 40° 14′.

LISLE, or RYSSEL, a large and populous city, the capital of French Flanders, fituated on the river Deule, twelve miles weft of Tournay: E. long. 3°, and N. lat. 50° 42′,

LIST, in commerce, the bordure of cloth, or of ftuff; ferving not only to fhew their quality, but to preferve them from being torn in the operations of fulling, dying, *&c.*

Lift is ufed on various ocaafions; but chiefly by gardeners for fecuring their wall-trees.

LITANY, a folemn form of fupplication to God, in which the prieft utters fome things fit to be prayed for, and the people join in their interceffion, faying, *We befeech thee to hear us, good Lord,* &c.

LITCHFIELD, a city of Staffordfhire, one hundred miles north-weft of London, and twelve fouth-eaft of Stafford. This city and Coventry have one bifhop between them; it fends two members to parliament.

LITERATI, in general, denotes men of learning; but is more particularly ufed by the Chinefe for fuch perfons as are able to read and write their language.

LITHANTHRAX, PIT-COAL, in natural hiftory, a genus of foffils, defined to be folid, dry, opake, inflammable fubftances, found in large ftrata, fplitting horizontally more eafily than in any other direction, of a gloffy hue, foft and friable, not fufible, but eafily inflammable, and leaving a large refiduum of afhes.

Of this genus there are three fpecies: 1. The hard, dufky, black coal, known by the name of Scotch coal. 2. The hard, gloffy, black coal, known by the fame name. 3. The friable, gloffy, black coal, called Newcaftle coal, as being chiefly dug about that town.

LITHARGE, is properly a recrement of lead, or lead vitrified, either alone, or with a mixture of copper. See CHEMISTRY, p. 84.

LITHIDIA, in natural hiſtory, the name of a large claſs of foſſils, including the flint and pebble kinds.

The lithidia are defined to be ſtones of a debaſed cryſtalline matter, covered by, and ſurrounded with, an opake cruſt, and frequently of great beauty, and conſiderable brightneſs within, though of but a ſlight degree of tranſparency, approaching to the nature of the ſemi pellucid gems, and like them found in not very large maſſes.

LITHOGINESIA, a term uſed by ſome authors for the formation of ſtones. See STONE.

LITHOMARGA, *Stone-marle*, a name given by ſome authors to a ſparry ſubſtance highly debaſed by earth, which is found in great plenty in the caves of the Hart's foreſt in Germany, and uſed there.

LITHONTRIPTICS, medicines which either break, or are ſuppoſed to have the virtue of breaking, ſtones in the urinary paſſages. See MEDICINE.

LITHOPHYTA, the name of Linnæus's third order of vermes. See NATURAL HISTORY.

LITHOSPERMUM, GROMWELL, in botany, a genus of the pentandria monogynia claſs. The corolla is funnel-ſhaped, with a naked perforated faux; and the calix conſiſts of five ſegments. There are ſix ſpecies, three of them natives of Britain; viz. the officinale, or gromwell; the purpuro-cæruleum, or leſſer creeping gromwell; and the arvenſe, or baſtard alkanet. The ſeeds of the officinale are accounted diuretic.

LITHOSTROTION, in natural hiſtory, a name of a ſpecies of foſſil coral, compoſed of a great number of long and ſlender columns, ſometimes round, ſometimes angular, joined nicely to one another, and of a ſtarry or radiated ſurface at their tops. Theſe are found in conſiderable quantities in the northern and weſtern parts of this kingdom, ſometimes in ſingle, ſometimes in complex ſpecimens.

LITHOTOMY, in ſurgery, cutting for the ſtone. See SURGERY.

LITHOZUGIA, in natural hiſtory, a genus of foſſils, compoſed of a ſimple ſtony matter, making a kind of cement, and holding firmly together ſmall pebbles *&c.* embodied in it.

LITHUANIA, a province of Poland, bounded by Samogitia, Livonia, and part of Ruſſia, on the north; by another part of Ruſſia, on the eaſt; by Volhinia and Poleſia, on the ſouth; and by Pruſſia and Polachia, on the weſt.

LITISCONTESTATION, in Scots law. See LAW, Tit. xxx. 33.

LITURGY, a name given to thoſe ſet forms of prayer which have been generally uſed in the Chriſtian church. Of theſe there are not a few aſcribed to the apoſtles and fathers, but they are almoſt univerſally allowed to be ſpurious.

LITUUS, in Roman antiquity, a ſhort ſtraight rod, only bending a little at one end, uſed by the augurs. See AUGUR.

LIVADIA, the capital of a province of European Turky, the ancient Achaia, ſituated on the north ſide of the gulph of Lepanto: E. long. 23° 15′, N. lat. 27° 30′.

LIVER, in anatomy. See ANATOMY, p. 264.

LIVER-WORT, in botany. See LICHEN.

LIVERPOOL, or LEVERPOOL, a port town of Lancaſhire, fifteen miles north of Cheſter, which ſends two members to parliament.

LIVERYMEN *of London* are a number of men choſen from among the freemen of each company. Out of this body the common council, ſheriff, and other ſuperior officers for the government of the city are elected, and they alone have the privilege of giving their votes for members of parliament; from which the reſt of the citizens are excluded.

LIVONIA, a province of Ruſſia, 160 miles long, and 120 broaded; bounded by the gulph of Finland, on the north; by Ingria and great Novogorod, on the eaſt; by Lithuania and Courland, on the ſouth; and by the Baltic, on the weſt: its chief towns are Narva, Revel, and Riga.

LIVONICA TERRA, a kind of fine bole uſed in the ſhops of Germany and Italy. Theſe earths are both dug out of the ſame pit, in the place from whence they have their name, and in ſome other parts of the world. They are generally brought to us made up into little cakes, and ſealed with the impreſſion of a church and an eſcutcheon with two croſs keys. In Spain and Portugal they are much uſed, ſometimes ſingly, ſometimes mixed together, and are good in fevers and in fluxes of all kinds.

LIVRE, a French money of account, containing twenty ſols.

LIXIVIOUS, an appellation given to ſalts obtained from burnt vegetables by lotion.

LIXIVIUM, in pharmacy, *&c.* a ley, obtained by pouring ſome liquor upon the aſhes of plants; which is more or leſs powerful, as it has imbibed the fixed ſalts contained in the aſhes.

LIZZARD, in zoology. See LACERTA.

LIZZARD, in geography, a cape, or promontory of Cornwall, fifteen miles ſouth of Falmouth: W. long. 5° 47′, N. lat. 49° 50′.

LOACH, in ichthyology. See COBITIS.

LOADSTONE. See MAGNET.

LOAMS, in natural hiſtory, are defined to be earths compoſed of diſſimilar particles, hard, ſtiff, denſe, and hard and rough to the touch; not eaſily ductile while moiſt, readily diffuſible in water, and compoſed of ſand and a tough viſcid clay. Of theſe loams, ſome are whitiſh, and others brown or yellow.

LOBE, in anatomy, any fleſhy protuberant part, as the lobes of the lungs, lobes of the ears, *&c.*

LOBELIA, in botany, a genus of the ſyngeneſia monogynia claſs. The calix conſiſts of five ſegments, and the corolla of one irregular petal; and the capſule has two and ſometimes three cells. There are 26 ſpecies, only one of them a native af Britain, *viz.* the dortinanna, or water gladiale.

LOCAL, in law, ſomething fixed to the freehold, or tied to a certain place: thus real actions are local, ſince they muſt be brought in the country where they lie: and local cuſtoms are thoſe peculiar to certain countries and places.

LOCAL MEDICINES, thofe deftined to act upon particular parts; fuch are fomentations, epithems, veficatories, &c.

Decree of LOCALITY, in Scots law, a decree proportioning a minifter's ftipend among the different perfons liable in payment of it. See LAW, Tit. v. 13.

LOCATELLUS's BALSAM, in pharmacy, a celebrated balfam, the preparation whereof is directed in the Edinburgh difpenfatory thus: Take of yellow-wax, one pound; oil olive, a pint and a half; Venice turpentine, a pound and a half; balfam of Peru, two ounces; dragon's blood, one ounce: melt the wax in the oil over a gentle fire; then add the turpentine; and having taken them from the fire, mix in the balfam of Peru and dragon's blood, keeping them continually ftirring till grown cold.

This balfam is ufed in internal bruifes and hæmorrhages, erofions of the inteftines, ulcerations of the lungs, dyfenteries, and in fome coughs and afthmas.

LOCHIA, in medicine, a flux from the uterus, confequent to delivery. See MIDWIFERY.

LOCHMABEN, a town of Scotland, fifteen miles eaft of Dumfries.

LOCK, a well-known inftrument ufed for faftening doors, chefts, &c. generally opened by a key.

LOCKMAN, an officer in the ifle of Man, who executes the orders of the government, much like our under fheriff.

LOCRIDA, a town of Turky in Europe, feventy miles fouth-eaft of Durazzo: E. long. 21°, N. lat. 41.

LOCUS GEOMETRICUS, denotes a line, by which a local or indeterminate problem is folved.

A locus is a line, any point of which may equally folve an indeterminate problem. Thus, if a right line fuffice for the conftruction of the equation, it is called *locus ad rectum;* if a circle, *locus ad circulum;* if a parabola, *locus ad parabolam;* if an ellipfis, *locus ad ellipfin;* and fo of the reft of the conic fections.

LOCULAMENT, among botanifts, denotes a cell, or partition, in a feed pod, for the feed of a plant.

LOCUST, in zoology. See GRYLLUS.

LODGMENT, in military affairs, is a work raifed with earth, gabions, fafcines, wool-packs, or mantelets, to cover the befiegers from the enemies fire, and to prevent their lofing a place which they have gained, and are refolved, if poffible, to keep.

LOEFLINGIA, in botany, a genus of the triandria monogynia clafs. The calix confifts of five leaves, and the corolla of five fmall petals; and the capfule has one cell, and three valves. There is but one fpecies, a native of Spain.

LOESELIA, in botany, a genus of the didynamia angiofpermia clafs. The calix confifts of four fegments; and the capfule has three cells. There is but one fpecies, a native of America.

LOG, in naval affairs, is a flat piece of wood, fhaped fomewhat like a flounder, with a piece of lead faftened to its bottom, which makes it ftand or fwim upright in the water. See Plate CIII. fig. 4.

LOGARITHMIC CURVE. If on the line AN (Plate CIII. fig. 5.) both ways indefinitely extended, be taken, A C, C E, E G, G I, I L, on the right hand; and alfo Ag, g P, &c. on the left, all equal to one another: and if at the points P g, A, C, E, G, I, L, be erected to the right line A N, the perpendiculars P S, g d, A B, C D, E F, G H, I K, L M, which let be continually proportional, and reprefent numbers, *viz.* A B, 1; C D, 10; E F, 100, &c. then fhall we have two progreffions of lines, arithmetical and geometrical: for the lines A C, A E, A G, &c. are in arithmetical progreffion, or as 1, 2, 3, 4, 5, &c. and fo reprefent the logarithms to which the geometrical lines A B, C D, E F, &c. do correfpond. For fince A G is triple of the firft line A C, the number G H fhall be in the third place from unity, if C D be in the firft: fo likewife fhall L M be in the fifth place, fince $AL = 5\ AC$. If the extremities of the proportionals S, d, B, D, F, &c. be joined by right lines, the figures S B M L will become a polygon, confifting of more or lefs fides, according as there are more or lefs terms in the progreffion.

If the parts A C, C E, E G, &c. be bifected in the points, c, e, g, i, l, and there be again raifed the perpendiculars $c\,d$, $e\,f$, $g\,h$, $i\,k$, $l\,m$, which are mean proportionals between A B, C D; C D, E F, &c. then there will arife a new feries of proportionals, whofe terms, beginning from that which immediately follows unity, are double of thofe in the firft feries, and the difference of the terms is become lefs, and approach nearer to a ratio of equality than before. Likewife, in this new feries, the right lines A L, A c, exprefs the diftances of the terms L M, $c\,d$, from unity, *viz.* fince A L is ten times greater than A c, L M fhall be the tenth term of the feries from unity; and becaufe A e is three times greater than A c, $e\,f$ will be the third term of the feries if $c\,d$ be the firft, and there fhall be two mean proportionals between AB and ef, and between A B and L M there will be nine mean proportionals. And if the extremities of the lines B d, D f, F h, &c. be joined by right lines, there will be a new polygon made, confifting of more but fhorter fides than the laft.

If, in this manner, mean proportionals be continually placed between every two terms, the number of terms at laft will be made fo great, as alfo the number of the fides of the polygon, as to be greater than any given number, or to be infinite; and every fide of the polygon fo leffened, as to become lefs than any given right line; and confequently the polygon will be changed into a curve-lined figure; for any curve-lined figure may be conceived as a polygon, whofe fides are infinitely fmall and infinite in number. A curve defcribed after this manner, is called logarithmical.

It is manifeft from this defcription of the logarithmic curve, that all numbers at equal diftances are continually proportional. It is alfo plain, that if there be four numbers, A B, C D, I K, L M, fuch that the diftance between the firft and fecond be equal to the diftance between the third and the fourth, let the diftance from the fecond to the third be what it will, thefe numbers will be proportional. For becaufe the diftances A C, I L, are equal, A B fhall be to the increment D s, as I K is to the increment M T. Where-

fore,

fore, by compofition, AB : DC : : IK : ML. And, contrariwife, if four numbers be proportional, the diftance between the firft and fecond fhall be equal to the diftance between the third and fourth.

The diftance between any two numbers, is called the logarithm of the ratio of thofe numbers; and, indeed, doth not meafure the ratio itfelf, but the number of terms in a given feries of geometrical proportionals, proceeding from one number to another, and defines the number of equal ratios by the compofition whereof the ratio of numbers is known.

LOGARITHMS, are the indexes or exponents (moftly whole numbers and decimal fractions, confifting of feven places of figures at leaft) of the powers or roots (chiefly broken) of a given number; yet fuch indexes or exponents, that the feveral powers or roots they exprefs, are the natural numbers, 1, 2, 3, 4, 5, *&c.* to 10 or 100000, *&c.* (as, if the given number be 10, and its index be affumed 1.0000000, then the 0.0000000 root of 10, which is 1, will be the logarithm of 1; the 0.301036 root of 10, which is 2, will be the logarithm of 2; the 0,477121 root of 10, which is 3, will be the logarithm of 3; the 1.612060 root of 10, the logarithm of 4; the 1.041393 power of 10 the logarithm of 11; the 1.079181 power of 10 the logarithm of 12, *&c.*) being chiefly contrived for eafe and expedition in performing of arithmetical operations in large numbers, and in trigonometrical calculations; but they have likewife been found of extenfive fervice in the higher geometry, particularly in the method of fluxions. They are generally founded on this confideration, that if there be any row of geometrical proportional numbers, as 1, 2. 4, 8, 16, 32, 64, 128, 256, *&c* or 1, 10, 100, 1000, 10000, *&c.* and as many arithmetical progreffional numbers adapted to them, or fet over them, beginning with 0,

thus, $\begin{Bmatrix} 0, & 1, & 2, & 3, & 4, & 5, & 6, & 7, & \&c. \\ 1, & 2, & 4, & 8, & 16, & 32, & 64, & 128, & \&c. \end{Bmatrix}$

or, $\begin{Bmatrix} 0, & 1, & 2, & 3, & 4, & \&c. \\ 1, & 10, & 100. & 1000, & 10000, & \&c. \end{Bmatrix}$

then will the fum of any two of thefe arithmetical progreffionals, added together, be that arithmetical progreffional which anfwers to or ftands over the geometrical progreffional, which is the product of the two geometrical progreffionals over which the two affumed arithmetical progreffionals ftand: again, if thofe arithmetical progreffionals be fubtracted from each other, the remainder will be the arithmetical progreffional ftanding over that geometrical progreffional which is the quotient of the divifion of the two geometrical progreffionals belonging to the two firft affumed arithmetical progreffionals; and the double, triple, *&c.* of any one of the arithmetical progreffionals, will be the arithmetical progreffional ftanding over the fquare, cube, *&c.* of that geometrical progreffional which the affumed arithmetical progreffional ftands over, as well as the $\frac{1}{2}$, $\frac{1}{3}$, *&c.* of that arithmetical progreffional will be the geometrical progreffional anfwering to the fquare root, cube root, *&c.* of the arithmetical progreffional over it; and from hence arifes the following common, though lame and imperfect definition of logarithms; *viz.*

"That they are fo many arithmetical progreffionals, anfwering to the fame number of geometrical ones." Whereas, if any one looks into the tables of logarithms, he will find, that thefe do not all run on in an arithmetical progreffion, nor the numbers they anfwer to in a geometrical one; thefe laft being themfelves arithmetical progreffionals. Dr Wallis, in his hiftory of algebra, calls logarithms the indexes of the ratios of numbers to one another. Dr Halley, in the philofophical tranfactions, n° 216, fays, they are the exponements of the ratios of unity to numbers. So alfo Mr Cotes, in his Harmonia Menfurarum, fays, they are the numerical meafures of ratios. But all thefe definitions convey but a very confufed notion of logarithms. Mr Maclaurin, in his Treatife of Fluxions, has explained the natural and genefis of logarithms agreeably to the notion of their firft inventor lord Naper. Logarithms then, and the quantities to which they correfpond, may be fuppofed to be generated by the motion of a point; and if this point moves over equal fpaces in equal times, the line defcribed by it increafes equally.

Again a line decreafes proportionably, when the point that moves over it defcribes fuch parts in equal times as are always in the fame conftant ratio to the lines from which they are fubducted, or to the diftances of that point, at the beginning of thofe lines, from a given term in that line. In like manner, a line may increafe proportionably, if in equal times the moving point defcribes fpaces proportional to its diftances from a certain term at the beginning of each time. Thus, in the firft cafe, let *a c* (Plate CIV. fig. 3.) be to *a o*, *c d* to *c o*, *d e* to *d o*, *e f* to *e o*, *f g* to *f o*, always in the fame ratio of Q R to Q S; and fuppofe the point P fets out from *a*, defcribing *a c*, *c d*, *d e*, *e f*, *f g*, in equal parts of the time; and let the fpace defcribed by P in any given time be always in the fame ratio to the diftance of P from *o* at the beginning of that time; then will the right line *a o* decreafe proportionably.

In like manner, the line *o a*, (*ibid.* n° 3.) increafes proportionally, if the point *p*, in equal times, defcribes the fpaces *a c*, *c d*, *de*, *f g*, *&c.* fo that *a c* is to *a o*, *c d* to *c o*, *de* to *d o*, *&c.* in a conftant ratio. If we now fuppofe a point P defcribing the line A G (*ibid.* n° 4.) with an uniform motion, while the point *p* defcribes a line increafing or decreafing proportionally, the line A P, defcribed by P, with this uniform motion, in the fame time that *o a*, by increafing or decreafing proportionally, becomes equal to *o p*, is the logarithm of *o p*. Thus A C, A D, A E, *&c.* are the logarithms of *o c*, *o d*, *o e*, *&c.* refpectively; and *o a* is the quantity whofe logarithm is fuppofed equal to nothing.

We have here abftracted from numbers, that the doctrine may be the more general; but it is plain, that if A C, A D, A E, *&c.* be fuppofed, 1, 2, 3, *&c.* in arithmetic progreffion; *o c*, *o d*, *o e*, *&c.* will be in geometric progreffion; and that the logarithm of *o a*, which may be taken for unity, is nothing.

Lord Naper, in his firft fcheme of logarithms, fuppofes, that while *o p* increafes or decreafes proportionally, the uniform motion of the point P, by which the logarithm of *o p* is generated, is equal to the velocity of *p* at *a*; that is, at the term of time when the logarithms begin to be generated.

generated. Hence logarithms, formed after this model, are called Naper's Logarithms, and fometimes Natural Logarithms.

When a ratio is given, the point p defcribes the difference of the terms of the ratio in the fame time. When a ratio is duplicate of another ratio, the point p defcribes the difference of the terms in a double time. When a ratio is triplicate of another, it defcribes the difference of the terms in a triple time; and fo on. Alfo, when a ratio is compounded of two or more ratios, the point p defcribes the difference of the terms of that ratio in a time equal to the fum of the times in which it defcribes the differences of the terms of the fimple ratios of which it is compounded. And what is here faid of the times of the motion of p when op increafes proportionally, is to be applied to the fpaces defcribed by P, in thofe times, with its uniform motion.

Hence the chief properties of logarithms are deduced. They are the meafures of ratios. The excefs of the logarithm of the antecedent above the logarithm of the confequent, meafures the ratio of thofe terms. The meafure of the ratio of a greater quantity to a leffer is pofitive; as this ratio, compounded with any other ratio, increafes it. The ratio of equality, compounded with any other ratio, neither increafes nor diminifhes it; and its meafure is nothing. The meafure of the ratio of a leffer quantity to a greater is negative; as this ratio, compounded with any other ratio, diminifhes it. The ratio of any quantity A to unity, compounded with the ratio of unity to A, produces the ratio of A to A, or the ratio of equality; and the meafures of thofe two ratios deftroy each other when added together; fo that when the one is confidered as pofitive, the other is to be confidered as negative. By fuppofing the logarithms of quantities greater than oa (which is fuppofed to reprefent unity) to be pofitive, and the logarithms of quantities lefs than it to be negative, the fame rules ferve for the operations by logarithms, whether the quantities be greater or lefs than oa. When op increafes proportionally, the motion of p is perpetually accelerated; for the fpaces ac, cd, de, *&c.* that are defcribed by it in any equal times that continually fucceed after each other, perpetually increafe in the fame proportion as the lines oa, oc, od, *&c.* When the point p moves from a towards o, and op decreafes proportionally, the motion of p is perpetually retarded; for the fpaces defcribed by it in any equal times that continually fucceed after each other, decreafe in this cafe in the fame proportion as op decreafes.

If the velocity of the point p be always as the diftance op, then will this line increafe or decreafe in the manner fuppofed by lord Naper; and the velocity of the point p being the fluxion of the line op, will always vary in the fame ratio as this quantity itfelf. This, we prefume, will give a clear idea of the genefis, or nature of logarithms; but for more of this doctrine, fee Maclaurin's Fluxions.

Conftruction of LOGARITHMS.

The firft makers of logarithms had in this a very laborious and difficult tafk to perform; they firft made choice of their fcale or fyftem of logarithms, that is, what fet of arithmetical progreffionals fhould anfwer to fuch a fet of geometrical ones, for this is entirely arbitrary; and they chufe the decuple geometrical progreffionals, 1, 10, 100, 1000, 10000, *&c.* and the arithmetical one, 0, 1, 2, 3, 4, *&c.* or 0,000000; 1,000000; 2,000000; 3,000000; 4,000000, *&c.* as the moft convenient. After this they were to get the logarithms of all the intermediate numbers between 1 and 10, 10 and 100, 100 and 1000, 1000 and 10000, *&c.* But firft of all they were to get the logarithms of the prime numbers 3, 5, 7, 11, 13, 17, 19, 23, *&c.* and when thefe were once had, it was eafy to get thofe of the compound numbers made up of the prime ones, by the addition or fubtraction of their logarithms.

In order to this, they found a mean proportion between 1 and 10, and its logarithm will be $\frac{1}{2}$ that of 10; and fo given, then they found a mean proportional between the number firft found and unity, which mean will be nearer to 1 than that before, and its logarithm will be $\frac{1}{2}$ of the former logarithm, or $\frac{1}{4}$ of that of 10; and having in this manner continually found a mean proportional between 1 and the laft mean, and bifected the logarithms, they at length, after finding 54 fuch means, came to a number 1.0000000000000001278191493200323442, fo near to 1 as not to differ from it fo much as $\frac{1}{100000000000000000}$dth part, and found its logarithm to be 0.0000000000000000555111512312578270 2, and 0000000000000001278191493200323 5 to be the difference whereby 1 exceeds the number of roots or mean proportionals found by extraction; and then, by means of thefe numbers, they found the logarithms of any other numbers whatfoever; and that after the following manner: between a given number, whofe logarithm is wanted, and 1, they found a mean proportional, as above, until at length a number (mixed) be found, fuch a fmall matter above 1, as to have 1 and 15 cyphers after it, which are followed by the fame number of fignificant figures; then they faid, as the laft number mentioned above is to the mean proportional thus found, fo is the logarithm above, *viz.* 0.0000000000000000555111512312578270 2, to the logarithm of the mean proportional number, fuch a fmall matter exceeding 1 as but now mentioned; and this logarithm being as often doubled as the number of mean proportionals (formed to get that number) will be the logarithm of the given number. And this was the method Mr. Briggs took to make the logarithms. But if they are to be made to only feven places of figures, which are enough for common ufe, they had only occafion to find 25 mean proportionals, or, which is the fame thing, to extract the $\frac{1}{33554432}$th root of 10. Now having the logarithms of 3, 5, and 7, they eafily got thofe of 2, 4, 6, 8 and 9; for fince $\frac{10}{5}=2$, the logarithm of 2 will be the difference of the logarithms of 10 and 5, the logarithm of 4 will be two times the logarithm of 2, the logarithm of 6 will be the fum of the logarithm of 2 and 3, and the logarithm of 9 double the logarithm of 3. So, alfo having found the logarithms of 13, 17 and 19, and alfo of 23 and 29, they did eafily get thofe of all the numbers between 10 and 30, by addition and fubtraction only; and fo having found the logarithms of other prime numbers, they got thofe of other numbers compounded of them. But

But ſince the way above hinted at, for finding the logarithms of the prime numbers is ſo intolerably laborious and troubleſome, the more ſkilful mathematicians that came after the firſt inventors, employing their thoughts about abbreviating this method, had a vaſtly more eaſy and ſhort way offered to them from the contemplation and menſuration of hyperbolic ſpaces contained between the portions of an aſymptote, right lines perpendicular to it, and the curve of the hyperbola: for if ECN (Plate CIII. fig. 6. n° 1.) be an hyperbola, and AD, AQ the aſymptotes, and AB, AP, AQ, *&c.* taken upon one of them, be repreſented by numbers, and the ordinates BC, PM, QN, *&c.* be drawn from the ſeveral points B, P, Q, *&c.* to the curve, then will the quadrilinear ſpaces BCMP, PMNQ, *&c. viz.* their numerical meaſures be the logarithms of the quotients of the diviſion of AB by AP, AP by AQ. *&c.* ſince when AB, AP, AQ, *&c.* are continual proportionals, the ſaid ſpaces are equal, as is demonſtrated by ſeveral writers concerning conic ſections. See HYPERBOLA.

Having ſaid that theſe hyperbolic ſpaces, numerically expreſſed, may be taken for logarithms, we ſhall next give a ſpecimen, from the great Sir Iſaac Newton, of the method how to meaſure theſe ſpaces, and conſequently of the conſtruction of logarithms.

Let CA (*ibid.* n° 2.) $=$AF be $=1$, and AB$=$A$b=x$; then will $\frac{1}{1+x}$ be $=$BD, and $\frac{1}{1-x}=bd$; and putting theſe expreſſions into ſerieſes, it will be $\frac{1}{1+x}=1-x+x^2-x^3+x^4-x^5$, *&c.* and $\frac{1}{1-x}=1+x+x^2+x^3+x^4+x^5$, *&c.* and $\frac{\dot{x}}{1+x}=\dot{x}-x\dot{x}+x^2\dot{x}-x^3\dot{x}+x^4\dot{x}-x^5\dot{x}$, *&c.* and $\frac{\dot{x}}{1-x}=\dot{x}+x\dot{x}+x^2\dot{x}+x^3\dot{x}+x^4\dot{x}+x^5\dot{x}$, *&c.* and taking the fluents, we ſhall have the area AFDB $=x-\frac{xx}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\frac{x^5}{5}$, *&c.* and the area AF*db*, $=x+\frac{xx}{2}+\frac{x^3}{3}+\frac{x^4}{4}+\frac{x^5}{5}$, *&c.* and the ſum *bd*DB$=2x+\frac{2x^3}{3}+\frac{2}{5}x^5+\frac{2}{7}x^7+\frac{2}{9}x^9$, *&c.* Now if AB or *ab* be $\frac{1}{10}=x$, C*b* being$=0.9$, and CB$=1.1$, by putting this value of x in the equations above, we ſhall have the area *bd* DB$=$0.2006706954621511 for the terms of the ſeries will ſtand as you ſee in this table,

0.2000000000000000	= firſt	Term of the ſeries.
6666666666666	= ſecond	
40000000000	= third	
285714286	= fourth	
2222222	= fifth	
18182	= fixth	
154	= ſeventh	
1	= eighth	
0.2006706954621511		

If the parts A*d* and AD of this area be added ſeparately, and the leſſer DA be taken from the greater *d*A, we ſhall have A*d*—AD$=x^2+\frac{x^4}{2}+\frac{x^6}{3}+\frac{x^8}{4}$, *&c.* $=$0.0100503358535014, for the terms reduced to decimals will ſtand thus:

0.0100000000000000	= firſt	Term of the ſeries.
50000000000	= ſecond	
3333333333	= third	
25000000	= fourth	
200000	= fifth	
1667	= fixth	
14	= ſeventh	
0.0100503358535014.		

Now if this difference of the areas be added to, and ſubtracted from their ſum before found, half the agregate, *viz.* 0.1053605156578263 will be the greater area A*d*, and half the remainder, *viz.* 0.0953101798043249, will be the leſſer area AD.

By the ſame tables, theſe areas AD and A*d*, will be obtained alſo when AB$=$A*b* are ſuppoſed to be $\frac{1}{100}$ or CB$=$1.01, and C*b*$=$0.99, if the numbers are but duly transferred to lower places, as

0.0200000000000000	= firſt	Term of the ſeries.
6666666666	= ſecond	
400000	= third	
28	= fourth	
Sum$=$0.0200006667066694	= area *b*D.	

0.0001000000000000	= firſt	Term of the ſeries.
50000000	= ſecond	
3333	= third	
0.0001000050003333	= area A*d*—AD.	

Half the agregate 0.0100503358535014$=$A*d*, and half the remainder, *viz.*0.0099503308531681$=$AD.

And ſo putting AB$=$A*b*$=\frac{1}{1000}$, or CB$=$1.001 and C*b*$=$0.999, there will be obtained A*d*$=$0.0010005000333583 5, and AD$=$0.0009995001333083 5.

After the ſame manner, if AB$=$A*b*, be $=$0.2, or 0.02, or 0.002, theſe areas will ariſe.

A*d*$=$0.2231435513142097, and
AD$=$0.1823215576939546, or
A*d*$=$0.0202027073175194, and
AD$=$0.1098026272961797, or
A*d*$=$0.002002, and AD$=$0.001.

From theſe areas thus found, others may be eaſily had from addition and ſubtraction only. For ſince $\frac{1.2}{0.8}\times\frac{1.2}{0.9}=2$, the ſum of the areas belonging to the ratios $\frac{1.2}{0.8}$ and $\frac{1.2}{0.9}$ (that is, inſiſting upon the parts of the abſciſs 1.2, 0.8; and 1.2, 0.9) *viz.*

0.405465, *&c.* and $\left\{\begin{array}{l}\text{AD}=0.18232, \textit{\&c.}\\ \text{A}d=0.10536, \textit{\&c.}\end{array}\right.$

Sum$=$0.28768, *&c.*

added thus, $\left\{\begin{array}{l}0.40546, \textit{\&c.}\\ 0.28768, \textit{\&c.}\end{array}\right.$

Total$=$0.69314, *&c.* $=$ the area of AFHG, when

when CG is $=2$. Alſo, ſince $\frac{1.2}{0.8}\times 2=3$, the ſum 1.0986122, *&c.* of the areas belonging to $\frac{1.2}{0.8}$, and 2, will be the area of AFGH, when CG=3. Again, ſince $\frac{2\times 2}{0.8}=5$, and $2\times 5=10$; by adding Ad=0.2231, *&c.* AD=0.1823, *&c.* and Ad=0.1053, *&c.* together, their ſum is 0.5108, *&c.* and this added to 1.0986, *&c.* the area of AFGH, when CG=3. You will have 1.6093379124341004=AFGH, when CG is 5; and adding that of 2 to this, gives 2.3025850929940457 =AFGH, when CG is equal to 10: and ſince $10\times 10=100$; and $10\times 100=1000$; and $\sqrt{5\times 10\times 0.98}=7$, and $10\times 1.1=11$, and $\frac{1000\times 1.091}{7\times 11}=13$, and $\frac{1000\times 0.998}{2}=499$; it is plain that the area AFGH may be found by the compoſition of the areas found before, when CG=100, 1000, or any other of the numbers above mentioned; and all theſe areas are the hyperbolic logarithms of thoſe ſeveral numbers.

Having thus obtained the hyperbolic logarithms of the numbers 10, 0.98, 0.99, 1.01, 1.02; if the logarithms of the four laſt of them be divided by the hyperbolic logarithm 2.3025850, *&c.* of 10, and the index 2, be added; or, which is the ſame thing, if it be multiplied by its reciprocal 0.4342944819032518, the value of the ſubtangent of the logarithmic curve, to which Briggs's logarithms are adapted, we ſhall have the true tabular logarithms of 98, 99, 100, 101, 102. Theſe are to be interpolated by ten intervals, and then we ſhall have the logarithms of all the numbers between 980 and 1020; and all between 980 and 1000, being again interpolated by ten intervals, the table will be as it were conſtructed. Then from theſe we are to get the logarithms of all the prime numbers, and their multiples leſs than 100, which may be done by addition and ſubtraction only: for $\frac{\sqrt[10]{84\times 1020}}{9945}=2$; $\frac{\sqrt[4]{8\times 9963}}{984}=3$; $\frac{10}{2}=5$; $\frac{\sqrt{98}}{2}=7$; $\frac{99}{9}=11$; $\frac{1001}{7\times 11}=13$; $\frac{102}{6}=17$; $\frac{988}{4\times 13}=19$; $\frac{9936}{16\times 27}=23$; $\frac{986}{2\times 17}=29$; $\frac{992}{32}=31$; $\frac{999}{27}=37$; $\frac{984}{24}=41$; $\frac{989}{23}=43$; $\frac{987}{21}=47$; $\frac{9911}{11\times 17}=53$; $\frac{9971}{13\times 13}=59$; $\frac{9882}{2\times 81}=61$; $\frac{9949}{3\times 49}=67$; $\frac{994}{14}=71$; $\frac{9928}{8\times 17}=73$; $\frac{9954}{7\times 18}=79$; $\frac{996}{12}=83$; $\frac{9968}{7\times 16}=89$; $\frac{9894}{6\times 17}=97$; and thus having the logarithms of all the numbers leſs than 100, you have nothing to do but interpolate the ſeveral times, through ten intervals.

Now the void places may be filled up by the following theorem. Let n be a number, whoſe logarithm is wanted; let x be the difference between that and the two neareſt numbers, equally diſtant on each ſide, whoſe logarithms are already found; and let d be half the difference of their logarithms: then the required logarithm of the number n, will be had by adding $d+\frac{dx}{2n}+\frac{dx^3}{12n^3}$, *&c.* to the logarithm of the leſſer number; for if the numbers are repreſented by C*p*, CG, CP, (*ibid.* n° 2.) and the ordinates *ps*, PQ, be raiſed; if n be wrote for CG, and x for GP, or G*p*, the area *ps*QP, or $\frac{2x}{n}+\frac{x^2}{2n^2}+\frac{x^3}{3n^3}$, *&c.* will be to the area *ps*HG, as the difference between the logarithms of the extreme numbers, or $2d$, is to the difference between the logarithms of the leſſer, and of the middle one; which, therefore, will be

$$\frac{\frac{dx}{n}+\frac{dx^2}{2n}+\frac{dx^3}{3n}, \text{\&c.}}{\frac{x}{n}+\frac{x^3}{3n}+\frac{x^5}{5n}, \text{\&c.}}=d+\frac{dx}{2n}+\frac{dx^3}{12n^3}, \text{\&c.}$$

The two firſt terms $d+\frac{dx}{2n}$ of this ſeries, being ſufficient for the conſtruction of a canon of logarithms, even to 14 places of figures, provided the number, whoſe logarithm is to be found, be leſs than 1000; which cannot be very troubleſome, becauſe x is either 1 or 2: yet it is not neceſſary to interpolate all the places by help of this rule, ſince the logarithms of numbers, which are produced by the multiplication or diviſion of the number laſt found, may be obtained by the numbers whoſe logarithms were had before, by the addition or ſubtraction of their logarithms. Moreover, by the difference of their logarithms, and by their ſecond and third differences, if neceſſary, the void places may be ſupplied more expeditiouſly; the rule afore-going being to be applied only where the continuation of ſome full places is wanted, in order to obtain theſe differences.

By the ſame method rules may be found for the intercalation of logarithms, when of three numbers the logarithm of the leſſer and of the middle number are given, or of the middle number and the greater; and this although the numbers ſhould not be in arithmetical progreſſion. Alſo by purſuing the ſteps of this method, rules may be eaſily diſcovered for the conſtruction of artificial ſines and tangents, without the help of the natural tables. Thus far the great Newton, who ſays, in one of his letters to Mr Leibnitz, that he was ſo much delighted with the conſtruction of logarithms, at his firſt ſetting out in thoſe ſtudies, that he was aſhamed to tell to how many places of figures he had carried them at that time: and this was before the year 1666; becauſe, he ſays, the plague made him lay aſide thoſe ſtudies, and think of other things.

Dr. Keil, in his Treatiſe of Logarithms, at the end of his Commandine's Euclid, gives a ſeries, by means of which may be found eaſily and expeditiouſly the logarithms of large numbers. Thus, let z be an odd number, whoſe logarithm is ſought: then ſhall the numbers $z-1$ and $z+1$ be even, and accordingly their logarithms, and the difference of the logarithms will be had, which let be called y. Therefore, alſo the logarithm of a number, which is a geometrical mean between $z-1$ and $z+1$, will

will be given, *viz.* equal to half the ſum of the logarithms.

Now the ſeries $y\times\frac{1}{4z}+\frac{1}{24z^3}+\frac{181}{15120z^7}+\frac{25200z^9}{13}$, *&c.* ſhall be equal to the logarithm of the ratio, which the geometrical mean between the numbers $z-1$ and $z+1$, has to the arithmetical mean, *viz.* to the number z. If the number exceeds 1000, the firſt term of the ſeries, *viz.* $\frac{y}{4z}$, is ſufficient for producing the logarithm to 13 or 14 places of figures, and the ſecond term will give the logarithm to 20 places of figures. But if z be greater than 10000, the firſt term will exhibit the logarithm to 18 places of figures; end ſo this ſeries is of great uſe in filling up the chiliads omitted by Mr Briggs. For example, it is required to find the logarithm of 20001; the logarithm of 20000 is the ſame as the logarithm of 2, with the index 4 prefixed to it; and the difference of the logarithms of 20000 and 20001, is the ſame as the difference of the logarithms of the numbers 10000 and 10001, *viz.* 0.0000434272, *&c.* And if this difference be divided by $4z$, or 80004, the quotient $\frac{y}{4z}$ ſhall be

0.000000000542813; and if the logarithm of the geometrical mean, *viz.*
4.301051709302416 be added to the quotient, the ſum will be

4.301051709845230= the logarithm of 20001.

Wherefore it is manifeſt that to have the logarithm to 14 places of figures, there is no neceſſity of continuing out the quotient beyond 6 places of figures. But if you have a mind to have the logarithm to 10 places of figures only, the two firſt figures are enough. And if the logarithms of the numbers above 20000 are to be found by this way, the labour of doing them will moſtly conſiſt in ſetting down the numbers. This ſeries is eaſily deduced from the conſideration of the hyperbolic ſpaces aforeſaid. The firſt figure of every logarithm towards the left hand, which is ſeparated from the reſt by a point, is called the index of that logarithm; becauſe it points out the higheſt or remoteſt place of that number from the place of unity in the infinite ſcale of proportionals towards the left hand: thus, if the index of the logarithm be 1. it ſhews that its higheſt place towards the left hand is the tenth place from unity; and therefore all logarithms which have 1 for their index, will be found between the tenth and hundredth place, in the order of numbers. And for the ſame reaſon all logarithms which have 2 for their index, will be found between the hundredth and thouſandth place, in the order of numbers, *&c* Whence univerſally the index or characteriſtic of any logarithm is always leſs by one than the number of figures in whole numbers, which anſwer to the given logarithm; and, in decimals, the index is negative.

As all ſyſtems of logarithms whatever, are compoſed of ſimilar quantities, it will be eaſy to form, from any ſyſtem of logarithms, another ſyſtem in any given ratio; and conſequently to reduce one table of logarithms into another of any given form. For as any one logarithm in the given form, is to its correſpondent logarithm in another form; ſo is any other logarithm in the given form, to its correſpondent logarithm in the required form; and hence we may reduce the logarithms of lord Napier into the form of Briggs's, and contrariwiſe. For as 2.302585092, *&c.* lord Napier's logarithm of 10, is to 1.0000000000, Mr Briggs's logarithm of 10; ſo is any other logarithm in lord Napier's form, to the correſpondent tabular logarithm in Mr Briggs's form; and becauſe the two firſt numbers conſtantly remain the ſame; if lord Napier's logarithm of any one number be divided by 2.302585, *&c.* or multiplied by 4342944, *&c.* the ratio of 1.0000, *&c.* to 2.30258, *&c.* as is found by dividing 1.00000, *&c.* by 2.30258, *&c.* the quotient in the former, and the product in the latter, will give the correſpondent logarithm in Briggs's form, and the contrary. And, after the ſame manner, the ratio of natural logarithms to that of Briggs's, will be found=868588963806.

The uſe and application of LOGARITHMS.

It is evident, from what has been ſaid of the conſtruction of logarithms, that addition of logarithms muſt be the ſame thing as multiplication in common arithmetick; and ſubſtraction in logarithms the ſame as diviſion: therefore, in multiplication by logarithms, add the logarithms of the multiplicand and multiplier together, their ſum is the logarithm of the product.

		num.	logarithms.
Example.	Multiplicand	8.5	0.1294189
	Multiplier	10	1.0000000
	Product	85	1.9294189

And in diviſion, ſubtract the logarithm of the diviſor from the logarithm of the dividend, the remainder is the logarithm of the quotient.

		num.	logarithms.
Example.	Dividend	9712 8	3.9873444
	Diviſor	456	2.6589648
	Quotient	21.3	1.3283796

To find the complement of a LOGARITHM.

Begin at the left hand, and write down what each figure wants of 9, only what the laſt ſignificant figure wants of 10; ſo the complement of the logarithm of 456, *viz.* 2.6589648, is 7.3410352.

In the rule of three. Add the logarithms of the ſecond and third terms together, and from the ſum ſubtract the logarithm of the firſt, the remainder is the logarithm of the fourth. Or, inſtead of ſubtracting a logarithm, add its complement, and the reſult will be the ſame.

To raiſe powers by LOGARITHMS.

Multiply the logarithm of the number given, by the index of the power required, the product will be the logarithm of the power ſought.

Example. Let the cube of 32 be required by logarithms. The logarithm of 32=1.5051500. which multiplied by 3, is 4.5154500, the logarithm of 32768, the cube of 32. But in raiſing powers, *viz.* ſquaring, cubing,

-bing, *&c.* of any decimal fraction by logarithms, it muſt be obſerved, that the firſt ſignificant figure of the power be put ſo many places below the place of units, as the index of its logarithm wants of 10, 100, *&c.* multiplied by the index of the power.

To extract the roots of powers by LOGARITHMS.

Divide the logarithm of the number by the index of the power, the quotient is the logarithm of the root ſought.

To find mean proportionals between any two numbers.

Subtract the logarithm of the leaſt term from the logarithm of the greateſt, and divide the remainder by a number more by one than the number of means deſired; then add the quotient to the logarithm of the leaſt term (or ſubtract it from the logarithm of the greateſt) continually, and it will give the logarithms of all the mean proportionals required.

Example. Let three mean proportionals be ſought, between 106 and 100.

Logarithm of 106 = 2.0253058
Logarithm of 100 = 2.0000000

Divide by 4)0.0253059(0.0063264.75

Logarithm of the leaſt term 100 added		2.0000000
Logarithm of the firſt mean	101.4673846	2.0063264.75
Logarithm of the ſecond mean	102.9563014	2.0126529.5
Logarithm of the third mean	104 4670483	2.0189794.25
Logarithm of the greateſt term	106	2.0253059.

L O G I C.

LOGIC, the art of thinking and reaſoning juſtly; or, it may be defined the ſcience or hiſtory of the human mind, inaſmuch as it traces the progreſs of our knowledge from our firſt and moſt ſimple through all their different combinations, conceptions, and all thoſe numerous deductions that reſult from variouſly comparing them one with another.

The preciſe buſineſs of logic, therefore, is to explain the nature of the human mind, and the proper manner of conducting its ſeveral powers, in order to the attainment of truth and knowledge. It lays open thoſe errors and miſtakes we are apt, through inattention, to run into; and teaches us how to diſtinguiſh between truth, and what only carries the appearance of it. By this means we grow acquainted with the nature and force of the underſtanding; ſee what things lie within its reach; where we may attain certainty and demonſtration; and when we muſt be contented with probability.

This ſcience is generally divided into four parts, *viz. Perception*, *Judgment*, *Reaſoning*, and *Method*. This diviſion comprehends the whole hiſtory of the ſenſations and operations of the human mind. But we muſt refer the reader for the firſt part, *viz. Perception*, and *Ideas*, to METAPHYSICS, where it will be more conveniently and fully treated, and confine ourſelves in this place to the three laſt, *viz. Judgment*, *Reaſoning*, *and Method*.

PART I. *Of* JUDGMENT.

THE mind being furniſhed with ideas, its next ſtep in the way to knowledge is, the comparing theſe ideas together, in order to judge of their agreement or diſagreement. In this joint view of our ideas, if the relation is ſuch, as to be immediately diſcoverable by the bare inſpection of the mind; the judgments thence obtained are called *intuitive*; for in this caſe, a mere attention to the ideas compared, ſuffices to let us ſee, how far they are connected or disjoined. Thus, *that the whole is greater than any of its parts*, is an intuitive judgment, nothing more being required to convince us of its truth, than an attention to the ideas of *whole* and *part*, And this too is the reaſon, why we call the act of the mind forming theſe judgments, *intuition*; as it is indeed no more, than an immediate perception of the agreement or diſagreement of any two ideas.

But it is to be obſerved, that our knowledge of this kind reſpects only our ideas, and the relations between them; and therefore can ſerve only as a foundation to ſuch reaſonings as are employed in inveſtigating theſe relations. Now many of our judgments are converſant about facts, and the real exiſtence of things, which cannot be traced by the bare contemplation of our ideas. It does not follow, becauſe I have the idea of a circle in my mind, that therefore a figure anſwering to that idea, has a real exiſtence in nature. I can form to myſelf the notion of a centaur, or golden mountain, but never imagine on that account, that either of them exiſt. What then are the grounds of our judgment in relation to facts? *Experience* and *teſtimony*. By *experience* we are informed of the exiſtence of the ſeveral objects which ſurround us, and operate upon our ſenſes. *Teſtimony* is of a wider extent, and reaches not only to objects beyond the preſent ſphere of our obſervation, but alſo to facts and

and tranfactions, which being now paft, and having no longer any exiftence, could not without this conveyance, have fallen under our cognizance.

Here then we have three foundations of human judgment, from which the whole fyftem of our knowledge may with eafe and advantage be derived. Firft, *intuition*, which refpects our ideas themfelves, and their relations, and is the foundation of that fpecies of reafoning, which we call *demonftration*. For whatever is deduced from our intuitive perceptions, by a clear and connective feries of proofs, is faid to be demonftrated, and produces abfolute certainty in the mind. Hence the knowledge obtained in this manner, is what we properly term *fcience*; becaufe in every ftep of the procedure, it carries its own evidence along with it, and leaves no room for doubt or hefitation. And, what is highly worthy of notice, as the truths of this clafs exprefs the relations between our ideas, and the fame relations muft ever and invariably fubfift between the fame ideas, our deductions in the way of fcience, conftitute what we call eternal, neceffary, and immutable truths. If it be true that the whole is equal to all its parts, it muft be fo unchangeably; becaufe the relation of equality being attached to the ideas themfelves, muft ever intervene where the fame ideas are compared. Of this nature are all the truths of natural religion, morality, and mathematicks, and in general, whatever may be gathered from the bare view and confideration of our ideas.

The fecond ground of human judgment is *experience;* from which we infer the exiftence of thofe objects that furround us, and fall under the immediate notice of our fenfes. When we fee the fun, or caft our eyes towards a building, we not only have ideas of thefe objects within ourfelves, but afcribe to them a real exiftence out of the mind. It is alfo by the information of the fenfes, that we judge of the qualities of bodies; as when we fay that fnow is white, fire hot, or fteel hard. For as we are wholy unacquainted with the internal ftructure and conftitution of the bodies that produce thefe fenfations in us, and are unable to trace any connection between that ftructure and the fenfations themfelves, it is evident, that we build our judgments altogether upon obfervation, afcribing to bodies fuch qualities, as are anfwerable to the perceptions they excite in us. But this is not the only advantage derived from experience; for we are likewife indebted to it for all our knowledge regarding the coexiftence of fenfible qualities in objects, and the operations of bodies one upon another. Ivory, for inftance, is hard and elaftic; this we know by experience, and indeed by that alone. For being altogether ftrangers to the true nature both of elafticity and hardnefs, we cannot by the bare contemplation of our ideas determine, how far the one neceffarily implies the other, or whether there may not be a repugnance between them. But when we obferve them to exift both in the fame object, we are then affured from experience, that they are not incompatible; and when we alfo find that a ftone is hard and not elaftic, and that air though elaftic is not hard, we alfo conclude upon the fame foundation, that the ideas are not neceffarily conjoined; but may exift feparately in different objects. In like manner with regard to the operations of bodies one upon another, it is evident, that our knowledge this way, is all derived from obfervation. *Aqua regia* diffolves gold, as has been found by frequent trial, nor is there any other way of arriving at the difcovery. Naturalifts may tell us if they pleafe, that the parts of *aqua regia* are of a texture apt to infinuate between the corpufcles of gold, and thereby loofen and fhake them afunder. If this is a true account of the matter, we believe it will notwithftanding be allowed, that our conjecture in regard to the conformation of thefe bodies is deduced from the experiment, and not the experiment from the conjecture. It was not from any previous knowledge of the intimate ftructure of *aqua regia* and *gold*, and the aptnefs of their parts to act or be acted upon, that we came by the conclufion above mentioned. The internal conftitution of bodies is in a manner wholly unknown to us, and could we even furmount this difficulty, yet as the feparation of the parts of gold, implies fomething like an active force in the *menftruum*, and we are unable to conceive how it comes to be poffeffed of this activity; the effect muft be owned to be altogether beyond our comprehenfion. But when repeated trials had once confirmed it, infomuch that it was admitted as an eftablifhed truth in natural knowledge, it was then eafy for men, to fpin out theories of their own invention, and contrive fuch a ftructure of parts, both for *gold* and *aqua regia*, as would beft ferve to explain the phænomenon, upon the principles of that fyftem of philofophy they had adopted.

From what has been faid it is evident, that as intuition is the foundation of what we call *fcientifical* knowledge, fo is experience of *natural*. For this laft, being wholly taken up with objects of fenfe, or thofe bodies that conftitute the natural world; and their properties, as far as we can difcover them, being to be traced only by a long and painful feries of obfervations, it is apparent, that in order to improve this branch of knowledge, we muft betake ourfelves to the method of trial and experiment.

But though experience is what we may term the immediate foundation of natural knowledge, yet with refpect to particular perfons, its influence is very narrow and confined. The bodies that furround us are numerous, many of them lie at a great diftance, and fome quite beyond our reach. Life too is fhort, and fo crouded with cares, that but little time is left for any fingle man to employ himfelf in unfolding the myfteries of nature. Hence it is neceffary to admit many things upon the teftimony of others, which by this means becomes the foundation of a great part of our knowledge of body. No man doubts of the power of *aqua regia* to diffolve gold, though perhaps he never himfelf made the experiment. In thefe therefore and fuch like cafes, we judge of the facts and operations of nature, upon the mere ground of teftimony. However, as we can always have recourfe to experience, where any doubt or fcruple arifes, this is juftly confidered as the true foundation of natural philofophy; being indeed the ultimate fupport upon which our affent refts, and whereto we appeal, when the higheft degree of evidence is required.

But there are many facts that will not allow of an appeal to the fenfes, and in this cafe teftimony is the true and

and only foundation of our judgments. All human actions of whatever kind, when confidered as already paft, are of the nature here defcribed; becaufe having now no longer any exiftence, both the facts themfelves, and the circumftances attending them, can be known only from the relations of fuch as had fufficient opportunities of arriving at the truth. *Teftimony* therefore is juftly accounted a third ground of human judgment; and as from the other two we have deduced *fcientifical* and *natural* knowledge, fo may we from this derive *hiftorical;* by which we mean, not merely a knowledge of the civil tranfactions of ftates and kingdoms, but of all facts whatfoever, where teftimony is the ultimate foundation of our belief.

Of affirmative and negative propofitions.

WHILE the comparing of our ideas, is confidered merely as an act of the mind, affembling them together, and joining or disjoining them according to the refult of its preceptions, we call it *judgment*; but when our judgments are put into words, they then bear the name of *propofitions*. A propofition therefore is a fentence expreffing fome judgment of the mind, whereby two or more ideas are affirmed to agree or difagree. Now as our judgments include at leaft two ideas, one of which is affirmed or denied of the other, fo muft a propofition have terms anfwering to thefe ideas. The idea of which we affirm or deny, and of courfe the term expreffing that idea, is called the *fubject* of the propofition. The idea affirmed or denied, as alfo the term anfwering it is called the *predicate*. Thus in the propofition, *God is omnipotent: God* is the fubject, it being of him that we affirm omnipotence; and *omnipotent* is the predicate, becaufe we affirm the idea expreffed by that word to belong to God.

But as in propofitions, ideas are either joined or disjoined; it is not enough to have terms expreffing thofe ideas, unlefs we have alfo fome words to denote their agreement or difagreement. That word in a propofition which connects two ideas together, is called the *copula*; and if a negative particle be annexed, we thereby underftand that the ideas are disjoined. The *fubftantive verb*, is commonly made ufe of for the copula, as in the abovementioned propofition, *God is omnipotent;* where *is* reprefents the copula, and fignifies the agreement of the ideas of *God* and *omnipotence*. But if we mean to feparate two ideas: then, befides the fubftantive verb, we muft alfo ufe fome particle of negation, to exprefs this repugnance. The propofition, *Man is not perfect;* may ferve as an example of this kind, where the notion of *perfection*, being removed from the idea of *man*, the negative particle *not* is inferted after the copula, to fignify the difagreement between the fubject and predicate.

Every propofition neceffarily confifts of thefe three parts, but then it is not alike needful that they be all feverally expreffed in words; becaufe the copula is often included in the term of the predicate, as when we fay, *He fits;* which imports the fame as *he is fitting*. In the *Latin* language, a fingle word has often the force of a whole fentence. Thus, *ambulat* is the fame as *ille eft ambulans*; *amo*, as *ego fum amans*, and fo in innumerable other inftances; by which it appears, that we are not fo much to regard the number of words in a fentence, as the ideas they reprefent, and the manner in which they are put together. For where ever two ideas are joined or disjoined in an expreffion, though of but a fingle word, it is evident that we have a fubject, predicate, and copula, and of confequence a complete propofition.

When the mind joins two ideas, we call it an *affirmative* judgment; when it feparates them, a *negative*; and as any two ideas compared together, muft neceffarily either agree or not agree, it is evident, that all our judgments fall under thefe two divifions. Hence likewife, the propofitions expreffing thefe judgments, are all either affirmative or negative.

Hence we fee the reafon of the rule commonly laid down by logicians; that in all negative propofitions, the negation ought to affect the copula. For as the copula, when placed by itfelf, between the fubject and the predicate, manifeftly binds them together; it is evident, that in order to render a propofition negative, the particle of negation muft enter it in fuch manner, as to deftroy this union. In a word, then only are two ideas disjoined in a propofition, when the negative particle may be fo referred to the copula, as to break the affirmation included in it, and undo that connection it would otherwife eftablifh. When we fay, for inftance, *No man is perfect*; take away the negation, and the copula of itfelf plainly unites the ideas in the propofition. On the contrary, in this fentence; *The man who departs not from an upright behaviour, is beloved of God*; the predicate *beloved of God*, is evidently affirmed of the fubject *an upright man*; fo that notwithftanding the negative particle, the propofition is ftill affirmative. The reafon is plain; the negation here affects not the copula, but making properly a part of the fubject, ferves with other terms in the fentence, to form one complex idea, of which the predicate *beloved of God*, is directly affirmed.

Of univerfal and particular propofitions.

THE next confiderable divifion of propofition, is into *univerfal and particular*. Our ideas, are all fingular as they enter the mind, and reprefent individual objects. But as by abftraction we can render them univerfal, fo as to comprehend a whole clafs of things, and fometimes feveral claffes at once; hence the terms expreffing thefe ideas, muft be in like manner univerfal. (See METAPHYSICS.) If therefore we fuppofe any general term to become the fubject of a propofition, it is evident, that whatever is affirmed of the abftract idea belonging to that term, may be affirmed of all the individuals to which that idea extends. Thus when we fay, *Men are mortal;* we confider mortality, not as confined to one or any number of particular men, but as what may be affirmed without reftriction of the whole fpecies. By this means the propofition becomes as general as the idea which makes the fubject of it, and indeed derives its univerfality entirely from that idea, being more or lefs fo, according as this may be extended to more or fewer individuals. But thefe general terms fometimes enter a propofition in their full latitude, as in the example given above; and fometimes appear with a mark of limitation. In this laft cafe we are given to underftand, that the predicate agrees not to the whole univerfal idea, but only to a part of it; as in the propofition,

propofition, *fome men are wife:* for here wifdom is not affirmed of every particular man, but reftrained to a few of the human fpecies.

Now from this different appearance of the general idea, that conftitutes the fubject of any judgment, arifes the divifion of propofitions into *univerfal* and *particular*. An *univerfal* propofition is that wherein the fubject is fome general term, taken in its full latitude, infomuch that the predicate agrees to all the individuals comprehended under it, if it denotes a proper fpecies; and to all the feveral fpecies, and their individuals, if it marks an idea of a higher order. The words *all, every, no, none,* &c. are the proper figns of this univerfality; and as they feldom fail to accompany general truths, fo they are the moft obvious criterion whereby to diftinguifh them. *All animals have a power of beginning motion.* This is an univerfal propofition; as we know from the word *all*, prefixed to the fubject *animal*, which denotes that it muft be taken in its full extent. Hence the power of beginning motion, may be affirmed of all the feveral fpecies of animals.

A *particular* propofition has in like manner fome general term for its fubject, but with a mark of limitation added, to denote, that the predicate agrees only to fome of the individuals comprehended under a fpecies, or to one or more of the fpecies belonging to any genus, and not to the whole univerfal idea. Thus, *fome ftones are heavier than iron; fome men have an uncommon fhare of prudence.* In the laft of thefe propofitions, the fubject *fome men*, implies only a certain number of individuals, comprehended under a fingle fpecies. In the former, where the fubject is a genus, that extends to a great variety of diftinct claffes, *fome ftones* may not only imply any number of particular ftones, but alfo feveral whole fpecies of ftones; inafmuch as there may be not a few, with the property there defcribed. Hence we fee, that a propofition does not ceafe to be particular, by the predicate's agreeing to a whole fpecies, unlefs that fpecies fingly and diftinctly confidered, makes alfo the fubject of which we affirm or deny.

There is ftill one fpecies of propofitions that remains to be defcribed; and which the more deferve our notice, as it is not yet agreed among logicians to which of the two claffes mentioned above they ought to be referred, I mean *fingular* propofitions; or thofe where the fubject is an individual. Of this nature are the following: *Sir* Ifaac Newton *was the inventor of fluxions; This book contains many ufeful truths.* What occafions fome difficulty, as to the proper rank of thefe propofitions, is, that the fubject being taken according to the whole of its extenfion, they fometimes have the fame effect in reafoning, as univerfals. But if it be confidered, that they are in truth the moft limited kind of particular propofitions, and that no propofition can with any propriety be called univerfal, but where the fubject is fome univerfal idea; we fhall not be long in determining to which clafs they ought to be referred. When we fay, *Some books contain ufeful truths*; the propofition is particular, becaufe the general term appears with a mark of reftriction. If therefore we fay, *This book contains ufeful truths*; it is evident that the propofition muft be ftill more particular, as the limitation implied in the word *this* is of a more confined nature than in the former cafe.

We fee therefore, that all propofitions are either *affirmative* or *negative*; nor is it lefs evident, that in both cafes they may be *univerfal* or *particular*. Hence arifes that celebrated fourfold divifion of them, into *univerfal, affirmative*, and *univerfal negative*; *particular affirmative*, and *particular negative*; which comprehends indeed all their varieties. The ufe of this method of diftinguifhing them will appear more fully afterwards, when we come to treat of reafoning and fyllogifm.

Of abfolute and conditional propofitions.

THE objects about which we are chiefly converfant in this world, are all of a nature liable to change. What may be affirmed of them at one time, cannot often at another; and it makes no fmall part of our knowledge, to diftinguifh rightly thefe variations, and trace the reafons upon which they depend. For it is obfervable, that amidft all the viciffitudes of nature, fome things remain conftant and invariable; nor are even the changes, to which we fee others liable, effected, but in confequence of uniform and fteady laws, which when known, are fufficient to direct us in our judgments about them. Hence philofophers, in diftinguifhing the objects of our perception into various claffes, have been very careful to note, that fome properties belong effentially to the general idea, fo as not to be feparable from it, but by deftroying its very nature: while others are only accidental, and may be affirmed or denied of it in different circumftances. Thus, folidity, a yellow colour, and great weight, are confidered as effential qualities of gold; but whether it fhall exift as an uniform conjoined mafs, is not alike neceffary. We fee that, by a proper menftruum, it may be reduced to a fine powder; and that intenfe heat will bring it into a ftate of fufion.

From this diverfity in the feveral qualities of things, arifes a confiderable difference as to the manner of our judging about them. For all fuch properties as are infeparable from objects, when confidered as belonging to any genus or fpecies, are affirmed abfolutely and without referve of that general idea. Thus we fay, *Gold is very weighty, a ftone is hard, animals have a power of felf-motion.* But in the cafe of mutable or accidental qualities, as they depend upon fome other confideration, diftinct from the general idea; that alfo muft be taken into the account, in order to form an accurate judgment. Should we affirm, for inftance, of fome ftones, that they are very fufceptible of a rolling motion; the propofition while it remains in the general form, cannot with any advantage be introduced into our reafonings. An aptnefs to receive that mode of motion, flows from the figure of the ftone; which, as it may vary infinitely, our judgment then only becomes applicable and determinate, when the particular figure, of which volubility is a confequence, is alfo taken into the account. Let us then bring in this other confideration, and the propofition will run as follows: *Stones of a fpherical form, are eafily put into a rolling motion.* Here we fee the condition upon which the predicate is affirmed, and therefore know in what particular cafes the propofition may be applied.

This confideration of propofitions, refpecting the manner in which the predicate is affirmed of the fubject, gives rife to the divifion of them into *abfolute* and *conditional*. *Abfolute* propofitions are thofe, wherein we affirm fome property infeparable from the idea of the fubject, and which therefore belongs to it in all poffible cafes; as, *God is infinitely wife. Virtue tends to the ultimate happinefs of man.* But where the predicate is not neceffarily connected with the idea of the fubject, unlefs upon fome confideration diftinct from that idea, there the propofition is called *conditional*. The reafon of the name is taken from the fuppofition annexed, which is of the nature of a condition, and may be expreffed as fuch. Thus, *If a ftone is expofed to the rays of the fun, it will contract fome degree of heat. If a river runs in a very declining channel, its rapidity will conftantly increafe.*

There is not any thing of greater importance in philofophy, than a due attention to this divifion of propofitions. If we are careful never to affirm things abfolutely, but where the ideas are infeparably conjoined; and if in our other judgments, we diftinctly mark the conditions which determine the predicate to belong to the fubject, we fhall be the lefs liable to miftake in applying general truths to the particular concerns of human life. It is owing to the exact obfervance of this rule, that mathematicians have been fo happy in their difcoveries, and that what they demonftrate of magnitude in general, may be applied with eafe in all obvious occurrences.

The truth is, particular propofitions are then known to be true, when we can trace their connection with univerfals; and it is accordingly the great bufinefs of fcience, to find out general truths, that may be applied with fafety in all obvious inftances. Now the great advantage arifing from determining with care the conditions upon which one idea may be affirmed or denied of another, is this; that thereby particular propofitions really become univerfal, may be introduced with certainty into our reafonings, and ferve as ftandards to conduct and regulate our judgments. To illuftrate this by a familiar inftance. If we fay, *Some water acts very forcibly;* the propofition is particular: And as the conditions on which this forcible action depends, are not mentioned, it is as yet uncertain in what cafes it may be applied. Let us then fupply thefe conditions, and the propofition will run thus: *Water conveyed in fufficient quantity, along a fteep defcent, acts very forcibly.* Here we have an univerfal judgment, inafmuch as the predicate *forcible action*, may be afcribed to all water under the circumftances mentioned. Nor is it lefs evident, that the propofition in this new form is of eafy application; and in fact we find, that men do apply it, in inftances where the forcible action of water is required; as in corn-mills, and many other works of art.

Of fimple and compound propofitions.

Hitherto we have treated of propofitions, where only two ideas are compared together. Thefe are in the general called *fimple;* becaufe having but one fubject and one predicate, they are the effect of a fimple judgment, that admits of no fubdivifion. But if feveral ideas offer themfelves to our thoughts at once, whereby we are led to affirm the fame thing of different objects, or different things of the fame object; the propofitions expreffing thefe judgments are called *compound:* becaufe they may be refolved into as many others as there are fubjects or predicates in the whole complex determination of the mind. Thus: *God is infinitely wife, and infinitely powerful.* Here there are two predicates, *infinite wifdom, and infinite power*, both affirmed of the fame fubject; and accordingly, the propofition may be refolved into two others, affirming thefe predicates feverally, in like manner in the propofition, *neither kings nor people are exempt from death:* the predicate is denied of both fubjects, and may therefore be feparated from them, in diftinct propofitions. Nor is it lefs evident, that if a complex judgment confifts of feveral fubjects and predicates, it may be refolved into as many fimple propofitions as are the number of different ideas compared together. *Riches and honours are apt to elate the mind, and increafe the number of our defires.* In this judgment, there are two fubjects and two predicates, and it is at the fame time apparent, that it may be refolved into four diftinct propofitions. *Riches are apt to elate the mind. Riches are apt to increafe the number of our defires.* And fo of honours.

Logicians have divided thefe compound propofitions into a great many different claffes; but not with a due regard to their proper definition. Thus, *conditionals, caufals, relatives*, &c. are mentioned as fo many diftinct fpecies of this kind, though in fact they are no more than fimple propofitions. To give an inftance of a conditional: *If a ftone is expofed to the rays of the fun, it will contract fome degree of heat.* Here we have but one fubject and one predicate; for the complex expreffion, *a ftone expofed to the rays of the fun*, conftitutes the proper fubject of this propofition, and is no more than one determinate idea. The fame thing happens in caufals. Rehoboam *was unhappy becaufe he followed evil counfel.* There is here an appearance of two propofitions, arifing from the complexity of the expreffion; but when we come to confider the matter more nearly, it is evident, that we have but a fingle fubject and predicate. *The purfuit of evil counfel brought mifery upon* Rehoboam. It is not enough therefore, to render a propofition compound, that the fubject and predicate are complex notions, requiring fometimes a whole fentence to exprefs them: For in this cafe, the comparifon is ftill confined to two ideas, and conftitutes what we call a fimple judgment. But where there are feveral fubjects, or predicates, or both, as the affirmation or negation may be alike extended to them all, the propofition expreffing fuch a judgment, is truly a collection of as many fimple ones as there are different ideas compared. Confining ourfelves therefore to this more ftrict and juft notion of compound propofitions, they are all reducible to two kinds, *viz. copulatives* and *disjunctives*.

A *copulative* propofition is, where the fubjects and predicates are fo linked together, that they may be all feverally affirmed or denied one of another. Of this nature are the examples of compound propofitions given above. *Riches and honours are apt to elate the mind, and increafe the number of our defires. Neither kings nor people are exempt from death.* In the firft of thefe, the

two predicates may be affirmed feverally of each fubject, whence we have four diftinct propofitions. The other furnifhes an example of the negative kind, where the fame predicate being disjoined from both fubjects, may be alfo denied of them in feparate propofitions.

The other fpecies of compound propofitions are thofe called disjunctives; in which, comparing feveral predicates with the fame fubject, we affirm that one of them neceffarily belongs to it, but leave the particular predicate undetermined. If any one, for example, fays, *This world either exifts of itfelf, or is the work of fome all-wife and powerful caufe*; it is evident, that one of the two predicates muft belong to the world; but as the propofition determines not which, it is therefore of the kind we call *disjunctive*. Such too are the following. *The fun either moves round the earth, or is the centre about which the earth revolves. Friendfhip finds men equal, or makes them fo.* It is the nature of all propofitions of this clafs, fuppofing them to be exact in point of form, that upon determining the particular predicate, the reft are of courfe to be removed; or if all the predicates but one are removed, that one neceffarily takes place. Thus in the example given above; if we allow the world to be the work of fome wife and powerful caufe, we of courfe deny it to be felf-exiftent; or if we deny it to be felf-exiftent, we muft neceffarily admit that it was produced by fome wife and powerful caufe. Now this particular manner of linking the predicates together, fo that the eftablifhing of one difplaces all the reft, or the excluding all but one neceffarily eftablifhes that one, cannot otherwife be effected than by means of *disjunctive* particles. And hence it is, that propofitions of this clafs take their name from thefe particles, which make fo neceffary a part of them, and indeed conftitute their very nature confidered as a diftinct fpecies.

Of the divifion of propofitions into felf-evident and demonftrable.

When any propofition is offered to the view of the mind, if the terms in which it is expreffed are underftood; upon comparing the ideas together, the agreement or difagreement afferted is either immediately perceived, or found to lie beyond the prefent reach of the underftanding. In the firft cafe, the propofition is faid to be *felf-evident*, and admits not of any proof, becaufe a bare attention to the ideas themfelves produces full conviction and certainty; nor is it poffible to call in any thing more evident, by way of confirmation. But where the connection or repugnance comes not fo readily under the infpection of the mind, there we muft have recourfe to reafoning; and if by a clear feries of proofs we can make out the truth propofed, infomuch that felf-evidence fhall accompany every ftep of the procedure, we are then able to demonftrate what we affert, and the propofition itfelf is faid to be *demonftrable*. When we affirm, for inftance, *that it is impoffible for the fame thing to be and not to be*; whoever underftands the terms made ufe of, perceives at firft glance the truth of what is afferted; nor can he by any efforts bring himfelf to believe the contrary. The propofition therefore is *felf evident*, and fuch that it is impoffible by reafoning to make it plainer; becaufe there is no truth more obvious, or better known, from which as a confequence it may be deduced. But if we fay, *This world had a beginning*; the affertion is indeed equally true, but fhines not forth with the fame degree of evidence. We find a great difficulty in conceiving how the world could be made out of nothing; and are not brought to a free and full confent, until by reafoning we arrive at a clear view of the abfurdity involved in the contrary fuppofition. Hence this propofition is of the kind we call *demonftrable*, in as much as its truth is not immediately perceived by the mind, but yet may be made appear by means of others more known and obvious, whence it follows as an unavoidable confequence.

From what has been faid it appears, that reafoning is employed only about demonftrable propofitions, and that our intuitive and felf-evident perceptions are the ultimate foundation on which it refts.

Self-evident propofitions furnifh the firft principles of reafoning; and it is certain, that if in our refearches we employ only fuch principles as have this character of felf evidence, and apply them according to the rules to be afterwards explained, we fhall be in no danger of error in advancing from one difcovery to another. For this we may appeal to the writings of the mathematicians, which being conducted by the exprefs model here mentioned, are an inconteftable proof of the firmnefs and ftability of human knowledge, when built upon fo fure a foundation. For not only have the propofitions of this fcience ftood the teft of ages; but are found attended with that invincible evidence, as forces the affent of all who duly confider the proofs upon which they are eftablifhed.

Firft then it is to be obferved, that they have been very careful in afcertaining their ideas, and fixing the fignification of their terms. For this purpofe they begin with *definitions*, in which the meaning of their words is fo diftinctly explained, that they cannot fail to excite in the mind the very fame ideas as are annexed to them by the writer. And indeed the clearnefs and irrefiftable evidence of mathematical knowledge is owing to nothing fo much as this care in laying the foundation. Where the relation between any two ideas is accurately and juftly traced, it will not be difficult for another to comprehend that relation, if, in fetting himfelf to difcover it, he brings the very fame ideas into comparifon. But if, on the contrary, he affixes to his words ideas different from thofe that were in the mind of him who firft advanced the demonftration; it is evident, that, as the fame ideas are not compared, the fame relation cannot fubfift, infomuch that a propofition will be rejected as falfe, which, had the terms been rightly underftood, muft have appeared unexceptionably true. A fquare, for inftance, is a figure bounded by four equal right lines, joined together at right angles. Here the nature of the angles makes no lefs a part of the idea, than the equality of the fides; and many properties demonftrated of the fquare flow entirely from its being a rectangular figure. If therefore we fuppofe a man, who has formed a partial notion of a fquare, comprehending only the equality of its fides without regard to the angles, reading fome demonftration that implies alfo this latter confideration; it is plain he would reject it as not univerfally true, in as much as it could not be applied where the fides were joined together

gether at unequal angles. For this laſt figure, anſwering ſtill to his idea of a ſquare, would be yet found without the property aſſigned to it in the propoſition. But if he comes afterwards to correct his notion, and render his idea complete, he will then readily own the truth and juſtneſs of the demonſtration.

We ſee therefore, that nothing contributes ſo much to the improvement and certainty of human knowledge, as the having determinate ideas, and keeping them ſteddy and invariable in all our diſcourſes and reaſonings about them. And on this account it is, that mathematicians always begin by defining their terms, and diſtinctly unfolding the notions they are intended to expreſs. Hence ſuch as apply themſelves to theſe ſtudies, having exactly the ſame views of things, and bringing always the very ſame ideas into compariſon, readily diſcern the relations between them.

When they have taken this firſt ſtep, and made known the ideas whoſe relations they intend to inveſtigate; their next care is, to lay down ſome ſelf evident truths, which may ſerve as a foundation for their future reaſonings. And here indeed they proceed with remarkable circumſpection, admitting no principles but what flow immediately from their definitions, and neceſſarily force themſelves upon the mind. Thus a *circle* is a figure formed by a right line, moving round ſome fixed point in the ſame plane. The fixed point round which the line is ſuppoſed to move, and where one of its extremities terminates, is called the *centre* of the circle. The other extremity, which is conceived to be carried round, until it returns to the point whence it firſt ſet out, deſcribes a curve running into itſelf, and termed the *circumference*. All right lines drawn from the centre to the circumference, are called *radii*. From theſe definitions compared, geometricians derive this ſelf-evident truth, *That the radii of the ſame circle are all equal one to another*.

We now obſerve, that, in all propoſitions, we either affirm or deny ſome property of the idea that conſtitutes the ſubject of our judgment, or we maintain that ſomething may be done or effected. The firſt ſort are called *ſpeculative* propoſitions, as in the example mentioned above, *the radii of the ſame circle are all equal one to another*. The others are called *practical*, for a reaſon too obvious to be mentioned; thus, *that a right line may be drawn from one point to another*, is a practical propoſition, inaſmuch as it expreſſes that ſomething may be done.

From this twofold conſideration of propoſitions ariſes the twofold diviſion of mathematical principles into *axioms* and *poſtulates*. By an *axiom* they underſtand any ſelf-evident *ſpeculative* truth: as, *that the whole is greater than its parts; that things equal to one and the ſame things are equal to one another*. But a ſelf-evident *practical* propoſition is what they call a *poſtulate*. Such are thoſe of *Euclid*; *That a finite right line may be continued directly forwards: That a circle may be deſcribed about any centre with any diſtance*. And as, in an *axiom*, the agreement or diſagreement between the ſubject and predicate muſt come under the immediate inſpection of the mind; ſo, in a *poſtulate*, not only the poſſibility of the thing aſſerted muſt be evident at firſt view, but alſo the manner in which it may be effected. For where this manner is not of itſelf apparent, the propoſition comes under the notion of the demonſtrable kind, and is treated as ſuch by geometrical writers. Thus, *to draw a right line from one point to another*, is aſſumed by *Euclid* as a *poſtulate*, becauſe the manner of doing it is ſo obvious as to require no previous teaching. But then it is not equally evident, *how we are to conſtruct an equilateral triangle*. For this reaſon he advances it as a demonſtrable propoſition, lays down rules for the exact performance, and at the ſame time proves, that if theſe rules are followed, the figure will be juſtly deſcribed.

This leads us to take notice, that as *ſelf-evident truths* are diſtinguiſhed into different kinds, according as they are ſpeculative or practical; ſo is it alſo with *demonſtrable* propoſitions. A demonſtrable ſpeculative propoſition, is by mathematicians called a *theorem*. Such is the 47th propoſition of the firſt book of the *Elements*, *viz. that in every right-angled triangle, the ſquare deſcribed upon the ſide ſubtending the right-angle is equal to both the ſquares deſcribed upon the ſides containing the right-angle*. On the other hand, a demonſtrable practical propoſition, is called a *problem*; as where *Euclid* teaches us *to deſcribe a ſquare upon a given right-line*.

It may not be amiſs to add, that beſides the four kinds of propoſitions already mentioned, mathematicians have alſo a fifth, known by the name of *corollaries*. Theſe are uſually ſubjoined to *theorems*, or *problems*, and differ from them only in this; that they flow from what is there demonſtrated, in ſo obvious a manner, as to diſcover their dependence upon the propoſition whence they are deduced, almoſt as ſoon as propoſed. Thus *Euclid* having demonſtrated, *that in every right lined triangle all the three angles taken together are equal to two right angles*; adds by way of corollary, *that all the three angles of any one triangle taken together are equal to all the three angles of any other triangle taken together*: which is evident at firſt ſight; becauſe in all caſes they are equal to two right ones, and things equal to one and the ſame thing are equal to one another.

The ſcholia of mathematicians are indifferently annexed to definitions, propoſitions, or corollaries; and anſwer the ſame purpoſes as annotations upon a claſſic author. For in them occaſion is taken to explain whatever may appear intricate and obſcure in a train of reaſoning; to anſwer objections; to teach the application and uſes of propoſitions; to lay open the original and hiſtory of the ſeveral diſcoveries made in the ſcience; and in a word, to acquaint us with all ſuch particulars as deſerve to be known, whether conſidered as points of curioſity or profit.

PART II. *Of* REASONING.

IT often happens, in comparing ideas together, that their agreement or diſagreement cannot be diſcerned at firſt view, eſpecially if they are of ſuch a nature as not to admit of an exact application one to another. When, for inſtance,

inſtance, we compare two figures of a different make, in order to judge of their equality or inequality, it is plain, that by barely conſidering the figures themſelves we cannot arrive at an exact determination; becauſe, by reaſon of their diſagreeing forms, it is impoſſible ſo to put them together, as that their ſeveral parts ſhall mutually coincide. Here then it becomes neceſſary to look out for ſome third idea, that will admit of ſuch an application as the preſent caſe requires; wherein if we ſucceed, all difficulties vaniſh, and the relation we are in queſt of may be traced with eaſe. Thus right-lined figures are all reducible to ſquares, by means of which we can meaſure their areas, and determine exactly their agreement or diſagreement in point of magnitude.

But how can any third idea ſerve to diſcover a relation between two others, by being compared ſeverally with theſe others? for ſuch a compariſon enables us to ſee how far the ideas with which this third is compared are connected or disjoined between themſelves. In the example mentioned above, of two right-lined figures, if we compare each of them with ſome ſquare whoſe area is known, and find the one exactly equal to it, and the other leſs by a ſquare-inch, we imediately conclude, that the area of the firſt figure is a ſquare-inch greater than that of the ſecond. This manner of determining the relation between any two ideas, by the intervention of ſome third with which they may be compared, is that which we call *reaſoning*. The great art lies, in finding out ſuch intermediate ideas, as, when compared with the others in the queſtion, will furniſh evident and known truths, becauſe it is only by means of them that we arrive at the knowledge of what is hidden and remote.

Hence it appears, that every act of reaſoning neceſſarily includes three diſtinct judgments; two wherein the ideas whoſe relation we want to diſcover are ſeverally compared with the middle idea, and a third wherein they are themſelves connected or disjoined according to the reſult of that compariſon. Now, as, in the firſt part of logic, our judgments, when put into words, were called propoſitions; ſo here, in the ſecond part, the expreſſions of our reaſonings are termed *ſyllogiſms*. And hence it follows, that as every act of reaſoning implies three ſeveral judgments, ſo very ſyllogiſm muſt include three diſtinct propoſitions. When a reaſoning is thus put into words, and appears in form of a ſyllogiſm, the intermediate idea made uſe of to diſcover the agreement or diſagreement we ſearch for is called the *middle term*; and the two ideas themſelves, with which this third is compared, go by the name of the *extremes*.

But as theſe things are beſt illuſtrated by examples; let us, for inſtance, ſet ourſelves to inquire, *whether men are accountable for their actions*. As the relation between the ideas of *man* and *accountableneſs*, comes not within the immediate view of the mind, our firſt care muſt be, to find out ſome third idea, that will enable us the more eaſily to diſcover and trace it. A very ſmall meaſure of reflection is ſufficient to inform us, that no creature can be accountable for his actions, unleſs we ſuppoſe him capable of diſtinguiſhing the good from the bad. Nor is this alone ſufficient. For what would it avail him to know good from bad actions, if he had no freedom of choice, nor could avoid the one and purſue the other? hence it becomes neceſſary to take in both conſiderations in the preſent caſe. It is at the ſame time equally apparent, that where-ever there is this ability of diſtinguiſhing good from bad actions, and of purſuing the one and avoiding the other, there alſo a creature is accountable. We have then got a third idea, with which *accountableneſs* is inſeparably connected, *viz. reaſon and liberty*; which are here to be conſidered as making up one complex conception. Let us now take this middle idea, and compare it with the other term in the queſtion, *viz. man*; and we all know by experience, that it may be affirmed of him. Having thus, by means of the intermediate idea, formed two ſeveral judgments, *viz. that man is poſſeſſed of reaſon and liberty*; and *that reaſon and liberty imply accountableneſs*; a third obviouſly and neceſſarily follows, *viz. that man is accountable for his actions*. Here then we have a complete act of reaſoning, in which there are three diſtinct judgments; two that may be ſtyled previous, in as much as they lead to the other, and ariſe from comparing the middle idea with the two ideas in the queſtion: the third is a conſequence of theſe previous acts, and flows from combining the extreme ideas between themſelves. If now we put this reaſoning into words, it exhibits what logicians term a ſyllogiſm, and runs this:

Every creature poſſeſſed of reaſon and liberty is accountable for his actions.

Man is a creature poſſeſſed of reaſon and liberty.

Therefore man is accountable for his actions.

In this ſyllogiſm there are three ſeveral propoſitions, expreſſing the three judgments implied in the act of reaſoning, and ſo diſpoſed as to repreſent diſtinctly what paſſes within the mind in tracing the more diſtant relations of its ideas. The two firſt propoſitions anſwer the two previous judgments in reaſoning, and are called the *premiſſes*, becauſe they are placed before the other. The third is termed the *concluſion*, as being gained in conſequence of what was aſſerted in the premiſſes. The terms expreſſing the two ideas whoſe relation we inquire after, as here *man* and *accountableneſs*, are in general called the *extremes*; and the intermediate idea, by means of which the relation is traced, *viz. a creature poſſeſſed of reaſon and liberty*, takes the name of the *middle term*. Hence it follows, that by the *premiſſes* of a ſyllogiſm we are always to underſtand the two propoſitions where the middle term is ſeverally compared with the *extremes*; for theſe conſtitute the previous judgments, whence the truth we are in queſt of is by reaſoning deduced. The *concluſion* is that other propoſition, in which the *extremes* themſelves are joined or ſeparated, agreeably to what appears upon the above compariſon.

The concluſion is made up of the extreme terms of the ſyllogiſm; and the extreme, which ſerves as the predicate of the concluſion, goes by the name of the *major term*; the other extreme, which makes the ſubject in the ſame propoſition, is called the *minor term*. From this diſtinction of the extremes, ariſes alſo a diſtinction between the premiſſes, where theſe extremes are ſeverally compared with the middle term. That propoſition which compares the greater extreme, or the predicate of the concluſion, with the middle term, is called the *major*

propoſition;

proposition; the other, wherein the same middle term is compared with the subject of the conclusion, or lesser extreme, is called the *minor proposition*. All this is obvious from the syllogism already given, where the conclusion is, *Man is accountable for his actions*. For here the predicate, *accountable for his actions*, being connected with the middle term in the first of the two premisses, *every creature possessed of reason and liberty is accountable for his actions*, gives what we call the *major proposition*. In the second of the premisses, *Man is a creature possessed of reason and liberty*, we find the lesser extreme, or subject of the conclusion, *viz. man*, connected with the same middle term, whence it is known to be the *minor proposition*. When a syllogism is proposed in due form, the major proposition is always placed first, the minor next, and the conclusion last.

These things premised, we may in the general define reasoning *to be an act or operation of the mind, deducing some unknown proposition from other previous ones that are evident and known*. These previous propositions, in a simple act of reasoning, are only two in number; and it is always required that they be of themselves apparent to the understanding, insomuch that we assent to and perceive the truth of them as soon as proposed. In the syllogism given above, the premisses are supposed to be self-evident truths, otherwise the conclusion could not be inferred by a single act of reasoning. If, for instance, in the major, *every creature possessed of reason and liberty is accountable for his actions*, the connection between the subject and predicate could not be perceived by a bare attention to the ideas themselves; it is evident, that this proposition would no less require a proof than the conclusion deduced from it. In this case a new middle term must be sought for, to trace the connection here supposed; and this of course furnishes another syllogism, by which having established the proposition in question, we are then, and not before, at liberty to use it in any succeeding train of reasoning. And should it so happen, that in this second essay there was still some previous proposition whose truth did not appear at first sight, we must then have recourse to a third syllogism in order to lay open that truth to the mind; because, so long as the premisses remain uncertain, the conclusion built upon them must be so too. When by conducting our thoughts in this manner, we at last arrive at some syllogism, where the previous propositions are intuitive truths; the mind then rests in full security, as perceiving that the several conclusions it has passed through stand upon the immoveable foundation of self-evidence, and when traced to their source terminate in it.

We see therefore, that in order to infer a conclusion by a single act of reasoning, the premisses must be intuitive propositions. Where they are not, previous syllogisms are required; in which case reasoning becomes a complicated act, taking in a variety of successive steps. This frequently happens in tracing the more remote relations of our ideas, where many middle terms being called in, the conclusion cannot be made out, but in consequence of a series of syllogisms following one another in a train. But although in this concatenation of propositions, those that form the premisses of the last syllogism are often considerably removed from self-evidence; yet if we trace the reasoning backwards, we shall find them the conclusions of previous syllogisms, whose premisses approach nearer and nearer to intuition in proportion as we advance, and are found at last to terminate in it. And if, after having thus unravelled a demonstration, we take it the contrary way; and observe how the mind, setting out with intuitive perceptions, couples them together to form a conclusion; how, by introducing this conclusion into another syllogism, it still advances one step farther; and so proceeds, making every new discovery subservient to its future progress; we shall then perceive clearly, that reasoning, in the highest exercise of that faculty, is no more than an orderly combination of those simple acts which we have already so full explained.

Thus we see, that reasoning, beginning with first principles, rises gradually from one judgment to another, and connects them in such a manner, that every stage of the progression brings intuitive certainty along with it. And now at length we may clearly understand the definition given above of this distinguishing faculty of the human mind. Reason is the ability of deducing unknown truths from principles or propositions that are already known. This evidently appears by the foregoing account, where we see, that no proposition is admitted into a syllogism, to serve as one of the previous judgments on which the conclusion rests, unless it is itself a known and established truth, whose connection with self-evident principles has been already traced.

Of the several kinds of reasoning; and first of that by which we determine the genera and species of things.

All the aims of human reason may be reduced to these two: 1. To rank things under those universal ideas to which they truly belong; and, 2. To ascribe to them their several attributes and properties in consequence of that distribution.

One great aim of human reason is, to determine the genera and species of things. Now, as in universal propositions we affirm some property of a genus or species, it is plain, that we cannot apply this property to particular objects, till we have first determined whether they are comprehended under that general idea of which the property is affirmed. Thus there are certain properties belonging to all *even* numbers, which nevertheless cannot be applied to any particular number, until we have first discovered it to be of the species expressed by that general name. Hence reasoning begins with referring things to their several divisions and classes in the scale of our ideas; and as these divisions are all distinguished by peculiar names, we hereby learn to apply the terms expressing general conceptions to such particular objects as come under our immediate observation.

Now, in order to arrive at these conclusions by which the several objects of perception are brought under general names, two things are manifestly necessary. First, that we take a view of the idea itself denoted by that general name, and carefully attend to the distinguishing marks which serve to characterize it. Secondly, that we compare this idea with the object under consideration, observing diligently wherein they agree or differ. If the

the idea is found to correſpond with the particular object, we then without heſitation apply the general name; but if no ſuch correſpondence intervenes, the concluſion muſt neceſſarily take a contrary turn. Let us, for inſtance, take the number *eight*, and conſider by what ſteps we are led to pronounce it an *even* number. Firſt then we call to mind the idea ſignified by the expreſſion *an even number, viz.* that it is *a number diviſible into two equal parts.* We then compare this idea with the number *eight*, and, finding them manifeſtly to agree, ſee at once the neceſſity of admitting the concluſion. Theſe ſeveral judgments therefore, transferred into language, and reduced to the form of a ſyllogiſm, appear thus:

Every number that may be divided into two equal parts is an EVEN *number.*

The number EIGHT *may be divided into two equal parts.*

Therefore the number EIGHT *is an* EVEN *numder.*

Here it may be obſerved, that where the general idea to which particular objects are referred is very familiar to the mind, this reference, and the application of the general name, ſeem to be made without any apparatus of reaſoning. When we ſee a horſe in the fields, or a dog in the ſtreet, we readily apply the name of the ſpecies; habit, and a familiar acquaintance with the general idea, ſuggeſting it inſtantaneouſly to the mind. We are not however to imagine on this account, that the underſtanding departs from the uſual rules of juſt thinking. A frequent repetition of acts begets a habit; and habits are attended with a certain promptneſs of execution that prevents our obſerving the ſeveral ſteps and gradations by which any courſe of action is accompliſhed. But in other inſtances, where we judge not by pre-contracted habits, as when the general idea is very complex, or leſs familiar to the mind; we always proceed according to the form of reaſoning eſtabliſhed above. A goldſmith, for inſtance, who is in doubt as to any piece of metal, whether it be of the ſpecies called *gold*; firſt examines its properties, and then comparing them with the general idea ſignified by that name, if he finds a perfect correſpondence, no longer heſitates under what claſs of metals to rank it.

But the great importance of this branch of reaſoning, and the neceſſity of care and circumſpection in referring particular objects to general ideas, is ſtill farther evident from the practice of the mathematicians. Every one who has read *Euclid* knows, that he frequently requires us to draw lines through certain points, and according to ſuch and ſuch directions. The figures thence reſulting are often ſquares, parallelograms, or rectangles. Yet *Euclid* never ſuppoſes this from their bare appearance, but always demonſtrates it upon the ſtricteſt principles of geometry. Nor is the method he takes in any thing different from that deſcribed above. Thus, for inſtance, having defined a ſquare to be a figure bounded by four equal ſides, joined together at right angles; when ſuch a figure ariſes in any conſtruction previous to the demonſtration of a propoſition, he yet never calls it by that name, until he has ſhewn that its ſides are equal, and all its angles right ones. Now this is apparently the ſame form of reaſoning we have before exhibited, in proving *eight* to be an even number.

Having thus explained the rules by which we are to conduct ourſelves in ranking particular objects under general ideas, and ſhewn their conformity to the practice and manner of the mathematicians; it remains only to obſerve, that the true way of rendering this part of knowledge both eaſy and certain, is, by habituating ourſelves to clear and determinate ideas, and keeping them ſteadily annexed to their reſpective names. For as all our aim is, to apply general words aright; if theſe words ſtand for invariable ideas, that are perfectly known to the mind, and can be readily diſtinguiſhed upon occaſion, there will be little danger of miſtake or error in our reaſonings. Let us ſuppoſe, that by examining any object, and carrying our attention ſucceſſively from one part to another, we have acquainted ourſelves with the ſeveral particulars obſervable in it. If among theſe we find ſuch as conſtitute ſome general idea, framed and ſettled beforehand by the underſtanding, and diſtinguiſhed by a particular name; the reſemblance, thus known and perceived, neceſſarily determines the ſpecies of the object, and thereby gives it a right to the name by which that ſpecies is called. Thus four equal ſides, joined together at right angles, made up the notion of a ſquare. As this is a fixed and invariable idea, without which the general name cannot be applied, we never call any particular figure a *ſquare*, until it appears to have theſe ſeveral conditions; and contrarily, where-ever a figure is found with theſe conditions, it neceſſarily takes the name of a *ſquare*. The ſame will be found to hold in all our other reaſonings of this kind; where nothing can create any difficulty but the want of ſettled ideas. If, for inſtance, we have not determined within ourſelves the preciſe notion denoted by the word *manſlaughter*; it will be impoſſible for us to decide, whether any particular action ought to bear that name: becauſe however nicely we examine the action itſelf, yet being ſtrangers to the general idea with which it is to be compared, we are utterly unable to judge of their agreement or diſagreement. But if we take care to remove this obſtacle, and diſtinctly trace the two ideas under conſideration, all difficulties vaniſh, and the reſolution becomes both eaſy and certain.

Thus we ſee, of what importance it is, towards the improvement and certainty of human knowledge, that we accuſtom ourſelves to clear and determinate ideas, and a ſteady application of words.

Of Reaſoning, as it regards the powers and properties of things, and the relations of our general ideas.

WE come now to the ſecond great end which men have in view in their reaſonings, namely, The diſcovering and aſcribing to things their ſeveral attributes and properties. And here it will be neceſſary to diſtinguiſh between reaſoning as it regards the ſciences, and as it concerns common life. In the ſciences, our reaſon is employed chiefly about univerſal truths, it being by them alone that the bounds of human knowledge are enlarged. Hence the diviſion of things into various claſſes, called otherwiſe genera and ſpecies. For theſe univerſal ideas, being ſet up as the repreſentatives of many particular things, whatever is affirmed of them may be alſo affirmed of all the individuals to which they belong. *Murder*, for inſtance, is

is a general idea, reprefenting a certain fpecies of human actions. Reafon tells us that the punifhment due to it is *death*. Hence every particular action coming under the notion of *murder*, has the punifhment of *death* allotted to it. Here then we apply the general truth to fome obvious inftance, and this is what properly conftitutes the reafoning of common life. For men, in their ordinary tranfactions and intercourfe one with another, have for the moft part to do only with particular objects. Our friends and relations, their characters and behaviour, the conftitution of the feveral bodies that furround us, and the ufes to which they may be applied, are what chiefly engage our attention. In all thefe we reafon about particular things; and the whole refult of our reafoning is, the applying the general truths of the fciences to the ordinary tranfactions of human life. When we fee a viper, we avoid it. Where-ever we have occafion for the forcible action of water, to move a body that makes confiderable refiftance, we take care to convey it in fuch a manner that it fhall fall upon the object with impetuofity. Now all this happens in confequence of our familiar and ready application of thefe two general trruths. *The bite of a viper is mortal. Water falling upon a body with impetuofity, acts very forcibly towards fetting it in motion.* In like manner, if we fet ourfelves to confider any particular character, in order to determine the fhare of praife or difpraife that belongs to it, our great concern is, to afcertain exactly the proportion of virtue and vice. The reafon is obvious. A juft determination in all cafes of this kind depends entirely upon an application of thefe general maxims of morality: *Virtuous actions deferve praife. Vicious actions deferve blame.*

Henceit appears, that reafoning, as it regards common life, is no more than the afcribing the general properties of things to thofe feveral objects with which we are more immediately concerned, according as they are found to be that particular divifion or clafs to which the properties belong. The fteps then by which we proceed are manifeftly thefe. Firft, we refer the object under confideration to fome general idea or clafs of things. We then recollect the feveral attributes of that general idea. And laftly, afcribe all thofe attributes to the prefent object. Thus, in confidering the character of *Sempronius*, if we find it to be of the kind called *virtuous*; when we at the fame time reflect, that a *virtuous* character is deferving of efteem, it naturally and obvioufly follows that *Sempronius* is fo too. Thefe thoughts put into a *fyllogifm*, in order to exhibit the form of reafoning here required, run thus.

Every virtuous man is worthy of efteem.

SEMPRONIUS *is a virtuous man.*

Therefore SEMPRONIUS *is worthy of efteem.*

By this *fyllogifm* it appears, that before we affirm any thing of a particular object, that object muft be referred to fome general idea. *Sempronius* is pronounced worthy of efteem, only in confequence of his being a virtuous man. Hence we fee the neceffary connection of the various parts of reafoning, and the dependence they have one upon another. The determining the genera and fpecies of things is, as we have faid, one exercife of human reafon; and here we find, that this exercife is the firft in order, and previous to the other, which confifts in afcribing to them their powers, properties, and relations. But when we have taken this previous ftep, and brought particular objects under general names; as the properties we afcribe to them are no other than thofe of the general idea, it is plain, that in order to a fuccefsful progrefs in this part of knowledge, we muft thoroughly acquaint ourfelves with the feveral relations and attributes of thefe our general ideas. When this is done, the other part will be eafy, and require fcarce any labour of thought, as being no more than an application of the general form of reafoning reprefented in the foregoing *fyllogifm*. Now as we have already fufficiently fhewn how we are to proceed in determining the genera and fpecies of things, all that is farther wanting towards a due explanation of it is, to offer fome confiderations as to the manner of inveftigating the general relations of our ideas. This is the higheft exercife of the powers of the underftanding, and that by means whereof we arrive at the difcovery of univerfal truths, infomuch that our deductions in this way conftitute that particular fpecies of reafoning which we have before faid regards principally the fciences.

But that we may conduct our thoughts with fome order and method, we fhall begin with obferving, that the relations of our general ideas are of two kinds. Either fuch as immediately difcover themfelves, upon comparing the ideas one with another; or fuch as, being more remote and diftant, require art and contrivance to bring them into view. The relations of the firft kind furnifh us with intuitive and felf-evident truths; thofe of the fecond are traced by reafoning and a due application of intermediate ideas. It is of this laft kind that we are to fpeak here, having difpatched what was neceffary with regard to the other in the former part. As therefore, in tracing the more diftant relations of things, we muft always have recourfe to intervening ideas, and are more or lefs fuccefsful in our refearches, according to our acquaintance with thefe ideas, and ability of applying them; it is evident, that to make a good reafoner, two things are principally required. *Firft*, an extenfive knowledge of thofe intermediate ideas, by means of which things may be compared one with another. *Secondly*, the fkill and talent of applying them happily, in all particular inftances that come under confideration.

In order to our fuccefsful progrefs in reafoning, we muft have an extenfive knowledge of thofe intermediate ideas by means of which things may be compared one with another. For as it is not every idea that will anfwer the purpofe of our inquiries, but fuch only as are peculiarly related to the objects about which we reafon, fo as, by a comparifon with them, to furnifh evident and known truths; nothing is more apparent, than that the greater variety of conceptions we can call into view, the more likely we are to find fome among them that will help us to the truths here required. And indeed it is found to hold in experience, that in proportion as we enlarge our views of things, and grow acquainted with a multitude of different objects, the reafoning faculty gathers ftrength. For by extending our fphere of knowledge, the mind acquires a certain force and penetration, as being accuftomed to examine the feveral appearances of its ideas, and obferve what light they caft one upon another.

This

This is the reason, why, in order to excel remarkably in any one branch of learning, it is necessary to have at least a general acquaintance with the whole circle of arts and sciences. The truth is, all the various divisions of human knowledge are very nearly related among themselves, and in innumerable instances serve to illustrate and set off each other. And altho' it is not to be denied, that, by an obstinate application to one branch of study, a man may make considerable progress and acquire some degree of eminence in it; yet his views will be always narrow and contracted, and he will want that masterly discernment, which not only enables us to pursue our discoveries with ease, but also, in laying them open to others, to spread a certain brightness around them. But when our reasoning regards a particular science, it is farther necessary, that we more nearly acquaint ourselves with whatever relates to that science. A general knowledge is a good preparation, and enables us to proceed with ease and expedition, in whatever branch of learning we apply to. But then in the minute and intricate questions of any science we are by no means qualified to reason with advantage, until we have perfectly mastered the science to which they belong.

We come now to the second thing required, in order to a successful progress in reasoning, namely, the skill and talent of applying intermediate ideas happily in all particular instances that come under consideration. Use and exercise are the best instructors in the present case. And therefore the true way to acquire this talent is, by being much conversant in those sciences where the art of reasoning is allowed to reign in the greatest perfection. Hence it was that the ancients, who so well understood the manner of forming the mind, always began with *mathematicks*, as the foundation of their philosophical studies. Here the understanding is by degrees habituated to truth, contracts insensibly a certain fondness for it, and learns never to yield its assent to any proposition, but where the evidence is sufficient to produce full conviction. For this reason *Plato* has called mathematical demonstrations the *catharticks* or purgatives of the soul, as being the proper means to cleanse it from error, and restore that natural exercise of its faculties, in which just thinking consists.

If therefore we would form our minds to a habit of reasoning closely and in train, we cannot take any more certain method, than the exercising ourselves in mathematical demonstrations, so as to contract a kind of familiarity with them. Not that we look upon it as necessary that all men should be deep mathematicians, but that, having got the way of reasoning which that study necessarily brings the mind to, they may be able to transfer it to other parts of knowledge, as they shall have occasion.

But although the study of mathematicks be of all others the most useful to form the mind, and give it an early relish of truth, yet ought not other parts of philosophy to be neglected. For there also we meet with many opportunities of exercising the powers of the understanding: and the variety of subjects naturally leads us to observe all those different turns of thinking that are peculiarly adapted to the several ideas we examine and the truths we search after. For this purpose, besides the study of mathematicks, we ought to apply ourselves diligently to the reading of such authors as have distinguished themselves for strength of reasoning, and a just and accurate manner of thinking. For it is observable, that a mind exercised and seasoned to truth, seldom rests satisfied in a bare contemplation of the arguments offered by others, but will be frequently essaying its own strength, and pursuing its discoveries upon the plan it is most accustomed to. Thus we insensibly contract a habit of tracing truth from one stage to another, and of investigating those general relations and properties, which we afterwards ascribe to particular things, according as we find them comprehended under the abstract ideas to which the properties belong.

Of the forms of Syllogisms.

Hitherto we have contented ourselves with a general notion of syllogisms, and of the parts of which they consist. It is now time to enter a little more particularly into the subject, to examine their various forms, and lay open the rules of argumentation proper to each. In the syllogisms mentioned in, we may observe, that the *middle term* is the subject of the *major* proposition, and the predicate of the *minor*. This disposition, though the most natural and obvious, is not however necessary; it frequently happenning, that the *middle term* is the subject in both the premisses, or the predicate in both; and sometimes directly contrary, the predicate in the *major*, and the subject in the *minor*. Hence the distinction of syllogisms into various kinds, called *figures* by logicians. For *figure*, according to their use of the word, is nothing else but the order and disposition of the *middle term* in any syllogism. And as this disposition is fourfold, so the figures of syllogisms thence arising are four in number. When the *middle term* is the subject of the *major* proposition, and the predicate of the *minor*, we have what is called the *first figure*. If, on the other hand, it is the predicate of both the premisses, the syllogism is said to be in the *second figure*. Again, in the *third figure*, the *middle term* is the subject of the two premisses. And lastly, by making it the predicate of the *major*, and subject of the *minor*, we obtain syllogisms in the *fourth figure*.

But besides this fourfold distinction of syllogisms, there is also a farther subdivision of them in every figure, arising from the *quantity* and *quality*, as they are called, of the propositions. By *quantity* we mean the consideration of propositions as universal or particular; by *quality*, as affirmative or negative. Now as, in all the several dispositions of the *middle term*, the proposition of which a syllogism consists may be either universal or particular, affirmative or negative; the due determination of these, and so putting them together as the laws of argumentation require, constitute what logicians call the *moods* of syllogisms. Of these *moods* there are a determinate number to every figure, including all the possible ways in which propositions differing in *quantity* or *quality* can be combined, according to any disposition of the *middle term*, in order to arrive at a just conclusion.

The division of syllogisms according to mood and figure,

gure, refpects thofe efpecially which are known by the name of plain fimple fyllogifms; that is, which are bounded to three propofitions, all fimple, and where the extremes and middle term are connected according to the rules laid down above. But as the mind is not tied down to any one precife form of reafoning, but fometimes makes ufe of more, fometimes of fewer premiffes, and often takes in compound and conditional propofitions, it may not be amifs to take notice of the different forms derived from this fource. and explain the rule by which the mind conducts itfelf in the ufe of them.

When, in any fyllogifm, the *major* is a conditional propofition, the fyllogifm itfelf is termed *conditional*. Thus:

If there is a God, he ought to be worfhipped.
But there is a God:
Therefore he ought to be worfhipped.

In this example, the *major* is conditional, and therefore the fyllogifm itfelf is alfo of the kind called by that name. All conditional propofitions are made up of two diftinct parts: one expreffing the condition upon which the predicate agrees or difagrees with the fubject, as in this now before us, *if there is a God;* the other joining or disjoining the faid predicate and fubject, as here, *he ought to be worfhipped.* The firft of thefe parts, or that which implies the condition, is called the *antecedent*; the fecond, where we join or disjoin the predicate and fubject, has the name of the *confequent*.

In all propofitions of this kind, fuppofing them to be exact in point of form, the relation between the antecedent and confequent muft ever be true and real; that is, the antecedent muft always contain fome certain and genuine condition, which neceffarily implies the confequent; for otherwife the propofition itfelf will be falfe, and therefore ought not to be admitted into our reafonings. Hence it follows, that when any conditional propofition is affumed, if we admit the antecedent of that propofition, we muft at the fame time neceffarily admit the confequent; but if we reject the confequent, we are in like manner bound to reject alfo the antecedent. For as the antecedent always expreffes fome condition, which neceffarily implies the truth of the confequent; by admitting the antecedent we allow of that condition, and therefore ought alfo to admit the confequent. In like manner if it appears that the confequent ought to be rejected, the antecedent evidently muft be fo too; becaufe the admitting of the antecedent would neceffarily imply the admiffion alfo of the confequent.

There are two ways of arguing in *hypothetical* fyllogifms, which lead to a certain and unavoidable conclufion. For as the *major* is always a conditional propofition, confifting of an antecedent and a confequent; if the *minor* admits the antecedent, it is plain that the conclufion muft admit the confequent. This is called arguing from the admiffion of the antecedent to the admiffion of the confequent, and conftitutes that mood or fpecies of *hypothetical* fyllogifms which is diftinguifhed in the fchools by the name of the *modus ponens*, in as much as by it the whole conditional propofition both antecedent and confequent is eftablifhed. Thus:

If God is infinitely wife, and acts with perfect freedom, he does nothing but what is beft.
But God is infinitely wife, and acts with perfect freedom:
Therefore he does nothing but what is beft.

Here the antecedent or firft part of the conditional propofition is eftablifhed in the *minor*, and the confequent or fecond part in the conclufion; whence the fyllogifm itfelf is an example of the *modus ponens*. But if we, on the contrary, fuppofe, that the *minor* rejects the confequent; then it is apparent, that the conclufion muft alfo reject the antecedent. In this cafe we are faid to argue from the removal of the confequent to the removal of the antedent, and the particular mood or fpecies of fyllogifms thence arifing is called by logicians the *modus tollens*; becaufe in it both antecedent and confequent are rejected or taken away, as appears by the following example.

If God were not a being of infinite goodnefs, neither would he confult the happinefs of his creatures.
But God does confult the happinefs of his creatures;
Therefore he is a being of infinite goodnefs.

Thefe two fpecies take in the whole clafs of *conditional* fyllogifms, and include all the poffible ways of arguing that lead to a legitimate conclufion; becaufe we cannot here proceed by a contrary procefs of reafoning, that is, from the removal of the antecedent to the removal of the confequent, or from the eftablifhing of the confequent to the eftablifhing of the antecedent. For although the antecedent always expreffes fome real condition, which once admitted neceffarily implies the confequent, yet it does not follow that there is therefore no other condition; and if fo, then, after removing the antecedent, the confequent may ftill hold, becaufe of fome other determination that infers it. When we fay: *If a ftone is expofed fome time to the rays of the fun, it will contract a certain degree of heat*; the propofition is certainly true; and admitting the antecedent, we muft alfo admit the confequent. But as there are other ways by which a ftone may gather heat, it will not follow, from the ceafing of the before-mentioned condition, that therefore the confequent cannot take place. In other words, we cannot argue: *But the ftone has not been expofed to the rays of the fun; therefore neither has it any degree of heat:* in as much as there a great many other ways by which heat might have been communicated to it. And if we cannot argue from the removal of the antecedent to the removal of the confequent, no more can we from the admiffion of the confequent to the admiffion of the antecedent; becaufe as the confequent may flow from a great variety of different fuppofitions, the allowing of it does not determine the precife fuppofition, but only that fome one of them muft take place. Thus, in the foregoing propofition, *If a ftone is expofed fome time to the rays of the fun, it will contract a certain degree of heat;* admitting the confequent, *viz. that it has contracted a certain degree of heat*, we are not therefore bound to admit the antecedent, *that it has been fome time expofed to the rays of the fun*, becaufe there are many other caufes whence that heat may have proceeded. Thefe two ways of arguing, therefore, hold not in conditional fyllogifms.

As from the *major's* being a conditional propofition, we obtain the fpecies of conditional fyllogifms; fo where it is

is a disjunctive proposition, the syllogism to which it belongs is also called *disjunctive*, as in the following example:

The world is either self-existent, or the work of some finite, or of some infinite being.

But it is not self-existent, nor the work of a finite being.

Therefore it is the work of an infinite being.

Now a disjunctive proposition is that where, of several predicates, we affirm one necessarily to belong to the subject, to the exclusion of all the rest, but leave that particular one undetermined. Hence it follows, that as soon as we determine the particular predicate, all the rest are of course to be rejected; or, if we reject all the predicates but one, that one necessarily takes place. When therefore, in a *disjunctive* syllogism, the several predicates are enumerated in the *major*; if the *minor* establishes any one of these predicates, the conclusion ought to remove all the rest; or if, in the *minor*, all the predicates but one are removed, the conclusion must necessarily establish that one. Thus, in the *disjunctive* syllogism given above, the *major* affirms one of three predicates to belong to the earth, *viz. self-existence*, or that it is *the work of a finite* or that it is *the work of an infinite being*. Two of these predicates are removed in the *minor*, viz. *self-existence*, and *the work of a finite being*. Hence the conclusion necessarily ascribes to it the third predicate, and affirms that it is *the work of an infinite being*. If now we give the syllogism another turn, insomuch that the minor may establish one of the predicates, by affirming the earth to be *the production of an infinite being*; then the conclusion must remove the other two, asserting it to be neither *self-existent*, nor *the work of a finite being*. These are the forms of reasoning in this species of syllogisms, the justness of which appears at first sight; and that there can be no other, is evident from the very nature of a disjunctive proposition.

In the several kinds of syllogisms hitherto mentioned, the parts are complete, that is, the three propositions of which they consist are represented in form. But it often happens, that some one of the premisses is not only an evident truth, but also familiar and in the minds of all men; in which case it is usually omitted, whereby we have an imperfect syllogism, that seems to be made up of only two propositions. Should we, for instance, argue in this manner;

Every man is mortal;

Therefore every king is mortal:

the syllogism appears to be imperfect, as consisting but of two propositions. Yet it is really complete, only the *minor* [*Every king is a man*] is omitted, and left to the reader to supply, as being a proposition so familiar and evident, that it cannot escape him.

These seemingly imperfect syllogisms are called *enthymemes*, and occur very frequently in reasoning, especially where it makes a part of common conversation. Nay, there is a particular elegance in them; because, not displaying the argument in all its parts, they leave somewhat to the exercise and invention of the mind. By this means we are put upon exerting ourselves, and seem to share in the discovery of what is proposed to us. Now this is the great secret of fine writing, so to frame and put together our thoughts, as to give full play to the reader's imagination, and draw him insensibly into our very views and course of reasoning. This gives a pleasure not unlike to that which the author himself feels in composing. It besides shortens dicourse, and adds a certain force and liveliness to our arguments, when the words in which they are conveyed favour the natural quickness of the mind in its operations, and a single expression is left to exhibit a whole train of thoughts.

But there is another species of reasoning with two propositions, which seems to be complete in itself, and where we admit the conclusion without supposing any tacit or suppressed judgment in the mind from which it follows syllogistically. This happens between propositions where the connection is such that the admission of the one necessarily and at the first sight implies the admission also of the other. For if it so falls out, that the proposition on which the other depends is self-evident, we content ourselves with barely affirming it, and infer that other by a direct conclusion. Thus, by admitting an universal proposition, we are forced also to admit of all the particular propositions comprehended under it, this being the very condition that constitutes a proposition universal. If then that universal proposition chances to be self-evident, the particular ones follow of course, without any farther train of reasoning. Whoever allows, for instance, *that things equal to one and the same things are equal to one another*, must at the same time allow, *that two triangles, each equal to a square whose side is three inches, are also equal between themselves*. This argument therefore,

Things equal to one and the same thing are equal to one another;

Therefore these two triangles, each equal to the square of a line of three inches, are equal between themselves,

is complete in its kind, and contains all that is necessary towards a just and legitimate conclusion. For the first or universal proposition is self-evident, and therefore requires no farther proof. And as the truth of the particular is inseparably connected with that of the universal, it follows from it by an obvious and unavoidable consequence.

Now in all cases of this kind, where propositions are deduced one from another, on account of a known and evident connection, we are said to reason by *immediate consequence*. Such a coherence of propositions, manifest at first sight, and forcing itself upon the mind, frequently occurs in reasoning. Logicians have explained at some length the several suppositions upon which it takes place, and allow of all *immediate consequences* that follow in conformity to them. It is however observable, that these arguments, though seemingly complete, because the conclusion follows necessarily from the single proposition that goes before, may yet be considered as real *enthymemes*, whose *major*, which is a conditional proposition, is wanting. The syllogism but just mentioned, when represented according to this view, will run as follows:

If things equal to one and the same thing are equal to one another; these two triangles, each equal to a square whose side is three inches, are also equal between themselves.

But things equal to one and the ſame thing, are equal to one another;

Therefore alſo theſe triangles, &c. *are equal between themſelves*.

This obſervation will be found to hold in all *immediate conſequences* whatſoever, inſomuch that they are in fact no more than *enthymemes* of hypothetical ſyllogiſms. But then it is particular to them, that the ground on which the concluſion reſts, namely, its coherence with the *minor*, is of itſelf apparent, and ſeen immediately to flow from the rules and reaſons of logic.

The next ſpecies of reaſoning we ſhall take notice of is what is known by the name of a *ſorites*. This is a way of arguing, in which a great number of propoſitions are ſo linked together, that the predicate of one becomes continually the ſubject of the next following, until at laſt a concluſion is formed, by bringing together the ſubject of the firſt propoſition, and the predicate of the laſt. Of this kind is the following argument.

God is omnipotent.

An omnipotent being can do every thing poſſible.

He that can do every thing poſſible, can do whatever involves not a contradiction.

Therefore God can do whatever involves not a contradiction.

This particular combination of propoſitions, may be continued to any length we pleaſe, without in the leaſt weakening the ground upon which the concluſion reſts. The reaſon is, becauſe the *ſorites* itſelf may be reſolved into as many ſimple ſyllogiſms as there are middle terms in it; where this is found univerſally to hold, that when ſuch a reſolution is made, and the ſyllogiſms are placed in train, the concluſion of the laſt in the ſeries is alſo the concluſion of the *ſorites*. This kind of argument therefore, as it ſerves to unite ſeveral ſyllogiſms into one, muſt ſtand upon the ſame foundation with the ſyllogiſms of which it conſiſts, and is indeed, properly ſpeaking, no other than a compendious way of reaſoning ſyllogiſtically.

What is here ſaid of plain ſimple propoſitions, may be as well applied to thoſe that are conditional; that is, any number of them may be ſo joined together in a ſeries, that the conſequent of one ſhall become continually the antecedent of the next following; in which caſe, by eſtabliſhing the antecedent of the firſt propoſition, we eſtabliſh the conſequent of the laſt, or, by removing the laſt conſequent, remove alſo the firſt antecedent. This way of reaſoning is exemplified in the following argument.

If we love any perſon, all emotions of hatred towards him ceaſe.

If all emotions of hatred towards a perſon ceaſe, we cannot rejoice in his misfortunes.

If we rejoice not in his misfortunes, we certainly wiſh him no injury.

Therefore if we love a perſon, we wiſh him no injury.

It is evident that this *ſorites*, as well as the laſt, may be reſolved into a ſeries of diſtinct ſyllogiſms; with this only difference, that here the ſyllogiſms are all conditional.

We come now to that kind of argument which logicians called *induction*; in order to the right underſtanding of which, it will be neceſſary to obſerve, that our general ideas are for the moſt part capable of various ſubdiviſions. Thus the idea of the loweſt ſpecies may be ſubdivided into its ſeveral individuals, the idea of any genus into the different ſpecies it comprehends, and ſo of the reſt. If then we ſuppoſe this diſtribution to be duly made, and ſo as to take in the whole extent of the idea to which it belongs; then it is plain, that all the ſubdiviſions or parts of any idea together conſtitute that whole idea. Thus the ſeveral individuals of any ſpecies taken together conſtitute the whole ſpeeies, and all the various ſpecies comprehended under any genus make up the whole genus. This being allowed, whatever may be affirmed of all the ſeveral ſubdiviſions and claſſes of any idea, ought to be affirmed of the whole general idea to which theſe ſubdiviſions belong. What may be affirmed of all the individuals of any ſpecies, may be affirmed of the whole ſpecies, and what may be affirmed of all the ſpecies of any genus may be alſo affirmed of the whole genus; becauſe all the individuals taken together are the ſame with the ſpecies, and all the ſpecies taken together the ſame with the genus.

This way of arguing, where we infer univerſally concerning any idea what we had before affirmed or denied ſeparately of all its ſeveral ſubdiviſions and parts, is called reaſoning by *induction*. Thus if we ſuppoſe the whole tribe of animals, ſubdivided into men, beaſts, birds, inſects, and fiſhes, and then reaſon concerning them after this manner: *All men have a power of beginning motion; all beaſts, birds, and inſects, have a power of beginning motion; all fiſhes have a power of beginning motion; therefore all animals have a power of beginning motion*: the argument is an *induction*. When the ſubdiviſions are juſt, ſo as to take in the whole general idea, and the enumeration is perfect, that is, extends to all and every of the inferior claſſes or parts; there the *induction* is compleat, and the manner of reaſoning by *induction* is apparently concluſive.

The laſt ſpecies of ſyllogiſms we ſhall take notice of, is that commonly diſtinguiſhed by the name of a *dilemma*. A *dilemma* is an argumeet, by which we endeavour to prove the abſurdity or falſehood of ſome aſſertion. In order to this we aſſume a conditional propoſition, the antecedent of which is the aſſertion to be diſproved, and the conſequent a disjunctive propoſition, enumerating all the poſſible ſuppoſitions upon which that aſſertion can take place. If then it appears, that all the ſeveral ſuppoſitions ought to be rejected, it is plain that the antecedent or aſſertion itſelf muſt be ſo too. When therefore ſuch a propoſition as that before-mentioned is made the *major* of any ſyllogiſm; if the *minor* rejects all the ſuppoſitions contained in the conſequent, it follows neceſſarily, that the concluſion ought to reject the antecedent, which, as we have ſaid, is the very aſſertion to be diſproved. This particular way of arguing is that which logicians call a *dilemma*; and from the account here given of it, it appears, that we may in the general define it to be *a hypothetical ſyllogiſm, where the conſequent of the major is a disjunctive propoſition, which is wholly taken away or removed in the minor*. Of this kind is the following;

If God did not create the world perfect in its kind it muſt

must either proceed from want of inclination, or from want of power.

But it could not proceed either from want of inclination, or from want of power:

Therefore he created the world perfect in its kind; or, which is the same thing, *It is absurd to say that he did not create the world perfect in its kind.*

The nature then of a *dilemma* is universally this. The *major* is a conditional proposition, whose consequent contains all the several suppositions upon which the antecedent can take place. As therefore these suppositions are wholly removed in the *minor*, it is evident that the antecedent must be so too; insomuch that we here always argue from the removal of the consequent to the removal of the antecedent. That is, a *dilemma* is an argument in the *modus tollens* of hypothetical syllogisms, as logicians speak. Hence it is plain, that if the antecedent of the *major* is an affirmative proposition, the conclusion of the *dilemma* will be negative; but if it is a negative proposition, the conclusion will be affirmative.

Of Demonstration.

Having dispatched what seemed necessary with regard to the forms of syllogisms, we shall now explain their use and application in reasoning. We have seen, that in all the different appearances they put on, we still arrive at a just and legitimate conclusion: now it often happens, that the conclusion of one syllogism becomes a previous proposition in another, by which means great numbers of them are sometimes linked together in a series, and truths are made to follow one another in train. And as in such a concatenation of syllogisms, all the various ways of reasoning that are truly conclusive may be with safety introduced; hence it is plain, that in deducing any truth from its first principles, especially where it lies at a considerable distance from them, we are at liberty to combine all the several kinds of arguments above explained, according as they are found best to suit the end and purpose of our inquiries. When a proposition is thus, by means of syllogisms, collected from others more evident and known, it is said to be *proved;* so that we may in the general define *the proof of the proposition* to be a syllogism, or series of syllogisms, collecting that proposition from known and evident truths. But more particularly, if the syllogisms of which the proof consists admit of no premisses but definitions, self-evident truths, and propositions already established, then is the argument so constituted called a *demonstration*; whereby it appears, that demonstrations are ultimately founded on definitions and self-evident propositions.

All syllogisms whatsoever, whether compound, multiform, or defective, are reducible to plain simple syllogisms in some one of the four figures. But this is not all. Syllogisms of the first figure in particular, admit of all possible conclusions: that is, any proposition whatsoever, whether an universal affirmative, or universal negative, a particular affirmative, or particular negative, which fourfold division embraces all their varieties: any one of these may be inferred, by virtue of some syllogism in the first figure. By this means the syllogisms of all the other figures are reducible also to syllogisms of the first figure, and may be considered as standing on the same foundation with them. We cannot here demonstrate and explain the manner of this reduction. It is enough to take notice, that the thing is universally known and allowed among logicians, to whose writings we refer such as desire farther satisfaction in this matter. This then being laid down, it is plain, that any demonstration whatsoever may be considered as composed of a series of syllogisms, all in the first figure. For since all the syllogisms that enter the demonstration are reducible to syllogisms of some one of the four figures, and since the syllogisms of all the other figures are farther reducible to syllogisms of the first figure, it is evident, that the whole demonstration may be resolved into a series of these last syllogisms. Let us now, if possible, discover the ground upon which the conclusion rests, in syllogisms of the first figure; because, by so doing, we shall come at an universal principle of certainty, whence the evidence of all demonstrations in all their parts may be ultimately derived.

The rules then of the first figure are these. The *middle term* is the subject of the *major* proposition, and the predicate of the *minor*. The *major* is always an universal proposition, and the *minor* always affirmative. Let us now see what effect these rules will have in reasoning. The *major* is an universal proposition, of which the *middle term* is the subject, and the *predicate of the conclusion* the predicate. Hence it appears, that in the *major*, the *predicate of the conclusion* is always affirmed or denied universally of the *middle term*. Again, the *minor* is an affirmative proposition, whereof the *subject of the conclusion* is the subject, and the *middle term* the predicate. Here then the *middle term* is affirmed of the *subject of the conclusion;* that is, the *subject of the conclusion* is affirmed to be comprehended under, or to make a part of the *middle term*. Thus then we see what is done in the *premisses* of a syllogism of the first figure. The *predicate of the conclusion* is universally affirmed or denied of some idea. The *subject of the conclusion* is affirmed to be or to make a part of that idea. Hence it naturally and unavoidably follows, that the *predicate of the conclusion* ought to be affirmed or denied of the subject. To illustrate this by an example, we shall resume one of the former syllogisms.

Every creature possessed of reason and liberty is accountable for his actions.

Man is a creature possessed of reason and liberty.

Therefore man is accountable for his actions.

Here, in the first proposition, the predicate of the conclusion, *accountableness*, is affirmed of all creatures that have *reason and liberty*. Again, in the second proposition, *man*, the subject of the conclusion, is affirmed to be or to make a part of the class of creatures. Hence the conclusion necessarily and unavoidably follows, *viz. that man is accountable for his actions;* because if reason and liberty be that which constitutes a creature *accountable*, and *man* has reason and liberty, it is plain he has that which constitutes him *accountable*. In like manner, where the *major* is a negative proposition, or denies the *predicate of the conclusion* universally of the *middle term*, as the *minor* always asserts the *subject of the conclusion*, to be or make a part of that *middle term*, it is no less evident, that the *predicate of* the

the conclusion ought in this case to be denied of the *subject*. So that the ground of reasoning in all syllogisms of the first figure is manifestly this. *Whatever may be affirmed universally of any idea, may be affirmed of every or any number of particulars comprehended under that idea.* And again: *Whatever may be denied universally of any idea, may be in like manner denied of every or any number of its individuals.* These two propositions are called by logicians the *dictum de omni*, and *dictum de nullo*, and are indeed the great principles of syllogistic reasoning, inasmuch as all conclusions whatsoever either rest immediately upon them, or upon propositions deduced from them. But what adds greatly to their value is, that they are really self-evident truths, and such as we cannot gainsay without running into an express contradiction. To affirm, for instance, that *no man is perfect*, and yet argue that *some men are perfect*; or to say that *all men are mortal*, and yet that *some men are not mortal*, is to assert a thing to be and not to be at the same time.

And now we may affirm, that in all syllogisms of the first figure, if the *premisses* are true, the *conclusion* must needs be true. If it be true that the *predicate of the conclusion*, whether affirmative or negative, agrees universally to some idea, and if it be also true that the *subject of the conclusion* is a part of or comprehended under that idea, then it necessarily follows, that the *predicate of the conclusion* agrees also to the *subject*. For to assert the contrary, would be to run counter to some one of the two principles before established; that is, it would be to maintain an evident contradiction. And thus we are come at last to the point we have been all along endeavouring to establish, namely, That every proposition which can be demonstrated is necessarily true. For as every demonstration may be resolved into a series of syllogisms all in the first figure, and as, in any one of these syllogisms, if the premisses are true, the conclusion must be so too; it evidently follows, that if all the several premisses are true, all the several conclusions are so, and consequently the conclusion also of the last syllogism, which is always the proposition to be demonstrated. Now that all the premisses of a demonstration are true, will easily appear from the very nature and definition of that form of reasoning. A demonstration is a series of syllogisms, all whose premisses are either definitions, self-evident truths, or propositions already established. Definitions are identical propositions, wherein we connect the description of an idea with the name by which we chuse to have that idea called; and therefore as to their truth there can be no dispute. Self-evident propositions appear true of themselves, and leave no doubt or uncertainty in the mind. Propositions before established are no other than conclusions gained by one or more steps from definitions and self-evident principles, that is, from true premisses, and therefore must needs be true. Whence all the previous propositions of a demonstration being manifestly true, the last conclusion or proposition to be demonstrated must be so too. So that demonstration not only leads to certain truth, but we have here also a clear view of the ground and foundation of that certainty. For as, in demonstrating, we may be said to do nothing more than combine a series of syllogisms together, all resting on the same bottom; it is plain, that one uniform ground of certainty runs through the whole, and that the conclusions are every where built upon some one of the two principles before established as the foundation of all our reasoning. These two principles are easily reduced into one, and may be expressed thus. *Whatever predicate, whether affirmative or negative, agrees universally to any idea, the same must needs agree to every or any number of individuals comprehended under that idea.* And thus we have reduced the certainty of demonstration to one simple and universal principle, which carries its own evidence along with it, and which is indeed the ultimate foundation of all syllogistic reasoning.

Demonstration therefore serving as an infallible guide to truth, and standing on so sure and unalterable a basis, we may now venture to assert, that the rules of logic furnish a sufficient *criterion* for the distinguishing between truth and falsehood. For since every proposition that can be demonstrated is necessarily true, he is able to distinguish truth from falsehood, who can with certainty judge when a proposition is duly demonstrated. Now a demonstration is nothing more than a concatenation of syllogisms, all whose premisses are definitions, self-evident truths, or propositions previously established. To judge therefore of the validity of a demonstration, we must be able to distinguish, whether the definitions that enter it are genuine, and truly descriptive of the ideas they are meant to exhibit; whether the propositions assumed without proof as intuitive truths have really that self-evidence to which they lay claim; whether the syllogisms are drawn up in due form, and agreeable to the laws of argumentation; in fine, whether they are combined together in a just and orderly manner, so that no demonstrable propositions serve any where as premisses, unless they are conclusions of previous syllogisms. Now it is the business of logic, in explaining the several operations of the mind, fully to instruct us in all these points. It teaches the nature and end of definitions, and lays down the rules by which they ought to be framed. It unfolds the several species of propositions, and distinguishes the self-evident from the demonstrable. It delineates also the different forms of syllogisms, and explains the laws of argumentation proper to each. In fine, it describes the manner of combining syllogisms, so as that they may form a train of reasoning, and lead to the successive discovery of truth. The precepts of logic therefore, as they enable us to judge with certainty when a proposition is duly demonstrated, furnish a sure *criterion* for the distinguishing between truth and falsehood.

But perhaps it may be objected, that demonstration is a thing very rare and uncommon, as being the prerogative of but a few sciences, and therefore the *criterion* here given can be of no great use. But where ever, by the bare contemplation of our ideas, truth is discoverable, there also demonstration may be attained. Now that is an abundantly sufficient *criterion*, which enables us to judge with certainty in all cases where the knowledge of truth comes within our reach; for with discoveries, that lie beyond the limits of the human mind, we have properly no business. When a proposition is demonstrated, we are certain of its truth. When, on the contrary, our ideas

ideas are ſuch as have no viſible connection nor repugnance, and therefore furniſh not the proper means of tracing their agreement or diſagreement, there we are ſure that ſcientifical knowledge is not attainable. But where there is ſome foundation of reaſoning, which yet amounts not to the full evidence of demonſtration, there the precepts of logic, by teaching us to determine aright of the degree of proof, and of what is ſtill wanting to render it full and complete, enable us to make a due eſtimate of the meaſures of probability, and to proportion our aſſent to the grounds on which the propoſition ſtands. And this is all we can poſſibly arrive at, or even ſo much as hope for, in the exerciſe of faculties ſo imperfect and limited as ours.

We conclude it may not be improper to take notice of the diſtinction of demonſtration into *direct* and *indirect*. A *direct demonſtration* is, when beginning with definitions, ſelf-evident propoſitions, or known and allowed truths, we form a train of ſyllogiſms, and combine them in an orderly manner, continuing the ſeries through a variety of ſucceſſive ſteps, until at laſt we arrive at a ſyllogiſm, whoſe concluſion is the propoſition to be demonſtrated. Proofs of this kind leave no doubt or uncertainty behind them, becauſe all the ſeveral premiſſes being true, the concluſions muſt be ſo too, and of courſe the very laſt concluſion or propoſition to be proved. The other ſpecies of demonſtration is the *indirect*, or, as it is ſometimes called, the *apogogical*. The manner of proceeding here is, by aſſuming a propoſition which directly contradicts that we mean to demonſtrate, and thence by a continued train of reaſoning, in the way of a direct demonſtration, deducing ſome abſurdity or manifeſt untruth. For hereupon we conclude that the propoſition aſſumed was falſe, and thence again, by an immediate conſequence, that the propoſition to be demonſtrated is true. Thus *Euclid*, in his third book, being to demonſtrate, *that circles which touch one another inwardly have not the ſame centre*, aſſumes the direct contrary to this, *viz. that they have the ſame centre*, and thence by an evident train of reaſoning proves *that a part is equal to the whole*. That ſuppoſition therefore, leading to this abſurdity, he concludes to be falſe, *viz. that circles touching one another inwardly have the ſame centre*, and thence again immediately infers *that they have not the ſame centre*.

Now becauſe this manner of demonſtration is accounted by ſome not altogether ſo clear and ſatisfactory, we ſhall therefore endeavour here to ſhew, that it equally with the other leads to truth and certainty. Two propoſitions are ſaid to be *contradictory* one of another, when that which is aſſerted to be in the one is aſſerted not to be in the other. Thus the propoſitions, *circles that touch one another inwardly have the ſame centre*, and *circles that touch one another inwardly have not the ſame centre*, are *contradictories*; becauſe the ſecond aſſerts the direct contrary of what is aſſerted in the firſt. Now in all contradictory propoſitions this holds univerſally, that one of them is neceſſarily true, and the other neceſſarily falſe. For if it be true, that circles which touch one another inwardly have not the ſame centre, it is unavoidably falſe that they have the ſame centre. On the other hand, if it be falſe that they have the ſame centre, it is neceſſarily true that they have not the ſame centre. Since therefore it is impoſſible for them to be both true or both falſe at the ſame time, it unavoidably follows, that one is neceſſarily true, and the other neceſſarily falſe. This then being allowed, if any two contradictory propoſitions are aſſumed, and one of them can by a clear train of reaſoning be demonſtrated to be falſe, it neceſſarily follows that the other is true. For as the one is neceſſarily true, and the other neceſſarily falſe, when we come to diſcover which is the falſe propoſition, we thereby alſo know the other to be true.

Now this is preciſely the manner of an indirect demonſtration. For there we aſſume a propoſition, which directly contradicts that we mean to demonſtrate, and having by a continued ſeries of proofs ſhewn it to be falſe, thence infer that its contradictory, or the propoſition to be demonſtrated, is true. As therefore this laſt concluſion is certain and unavoidable, let us next inquire, after what manner we come to be ſatisfied of the falſehood of the aſſumed propoſition, that ſo no poſſible doubt may remain as to the force and validity of demonſtrations of this kind. The manner then is plainly this. Beginning with the aſſumed propoſition, we, by the help of definitions, ſelf-evident truths, or propoſitions already eſtabliſhed, continue a ſeries of reaſoning in the way of a direct demonſtration, until at length we arrive at ſome abſurdity or known falſehood. Thus *Euclid*, from the ſuppoſition that circles touching one another inwardly have the ſame centre, deduces *that a part is equal to the whole*. Since therefore, by a due and orderly proceſs of reaſoning, we come at laſt to a falſe concluſion, it is manifeſt that all the premiſſes cannot be true. For were all the premiſſes true, the laſt concluſion muſt be ſo too. Now as to all the other premiſſes made uſe of in the courſe of reaſoning, they are manifeſt and known truths by ſuppoſition, as being either definitions, ſelf-evident propoſitions, or truths previouſly eſtabliſhed. The aſſumed propoſition is that only as to which any doubt or uncertainty remains. That alone therefore can be falſe, and indeed, from what has been already ſhewn, muſt unavoidably be ſo. And thus we ſee, that, in indirect demonſtrations, two contradictory propoſitions being laid down, one of which is demonſtrated to be falſe, the other, which is always the propoſition to be proved, muſt neceſſarily be true; ſo that here, as well as in the direct way of proof, we arrive at a clear and ſatisfactory knowledge of truth.

This is univerſally the method of reaſoning in all apogogical or indirect demonſtrations; but if any propoſition is aſſumed, from which in a direct train of reaſoning we can deduce its contradictory, the propoſition ſo aſſumed is falſe, and the contradictory one true. For if we ſuppoſe the aſſumed propoſition to be true, then, ſince all the other premiſſes that enter the demonſtration are alſo true, we ſhall have a ſeries of reaſoning, conſiſting wholly of true premiſſes; whence the laſt concluſion or contradictory of the aſſumed propoſition muſt be true likewiſe. So that by this means we ſhould have two contradictory propoſitions both true at the ſame time, which is manifeſtly impoſible. The aſſumed propoſition therefore, whence this abſurdity flows, muſt neceſſarily be falſe, and conſequently its contradictory, which is here

here the propofition deduced from it, muft be true. If then any propofition is propofed to be demonftrated, and we *affume* the *contradictory* of that propofition, and thence directly infer the propofition to be demonftrated, by this very means we know that the propofition fo inferred is true. For fince from an affumed propofition we have deduced its contradictory, we are thereby certain that the affumed propofition is falfe; and if fo, then its contradictory, or that deduced from it, which in this cafe is the fame with the propofition to be demonftrated, muft be true.

We have a curious inftance of this in the twelfth propofition of the ninth book of the elements. *Euclid* there propofes to demonftrate, *that in any feries of numbers, rifing from unity in geometrical progreffion, all the prime numbers that meafure the laft term in the feries will alfo meafure the next after unity.* In order to this, he affumes the contradictory of the propofition to be demonftrated, namely; *that fome prime number meafuring the laft term in the feries, does not meafure the next after unity;* and thence, by a continued train of reafoning, proves, that it actually does meafure it. Hereupon he concludes the affumed propofition to be falfe, and that which is deduced from it, or its contradictory, which is the very propofition he propofed to demonftrate, to be true. Now that this is a juft and conclufive way of reafoning, is abundantly manifeft from what we have fo clearly eftablifhed above.

Having thus fufficiently evinced the certainty of demonftration in all its branches, and fhewn the rules by which we ought to proceed, in order to arrive at a juft conclufion, according to the various ways of arguing made ufe of; it is needlefs to enter upon a particular confideration of thofe feveral fpecies of falfe reafoning, which logicians diftinguifh by the name of *fophifms*. He that throughly underftands the form and ftructure of a good argument, will of himfelf readily difcern every deviation from it. And although *fophifms* have been divided into many claffes, which are all called by founding names, that therefore carry in them much appearance of learning; yet are the errors themfelves fo very palpable and obvious, that it is loft labour to write for a man capable of being mifled by them. Here therefore we chufe to conclude this fecond part of logic, and fhall in the next part give fome account of *method*, which, though infeparable from reafoning, is neverthelefs always confidered by logicians as a diftinct operation of the mind; becaufe its influence is not confined to the mere exercife of the reafoning faculty, but extends in fome degree to all the tranfactions of the underftanding.

PART III. *Of* METHOD.

Of method in general, and the divifion of it into analytick and fynthetick.

WE have now done with the two firft operations of the mind, whofe office it is to fearch after truth, and enlarge the bounds of human knowledge. There is yet a third, which regards the difpofal and arrangement of our thoughts, when we endeavour fo to put them together that their mutual connection and dependence may be clearly feen. This is what logicians call *method*, and place always the laft in order in explaining the powers of the underftanding; becaufe it neceffarily fuppofes a previous exercife of our other faculties, and fome progrefs made in knowledge, before we can exert it in any extenfive degree.

In this view it is plain, that we muft be before-hand well acquainted with the truths we are to combine together; otherwife how could we difcern their feveral connections and relations, or fo difpofe of them as their mutual dependence may require? But it often happens, that the underftanding is employed, not in the arrangement and compofition of known truths, but in the fearch and difcovery of fuch as are unknown. And here the manner of proceeding is very different. We affemble at once our whole ftock of knowledge relating to any fubject; and, after a general furvey of things, begin with examining them feparately and by parts. Hence it comes to pafs, that whereas, at our firft fetting out, we were acquainted only with fome of the grand ftrokes and outlines of truth, by thus purfuing her through her feveral windings and receffes we gradually difcover thofe more inward and finer touches whence fhe derives all her ftrength, fymmetry, and beauty. And here it is, that when, by a narrow fcrutiny into things, we have unravelled any part of knowledge, and traced it to its firft and original principles, infomuch that the whole frame and contexture of it lies open to the view of the mind; here it is, that taking it the contrary way, and beginning with thefe principles, we can fo adjuft and put together the parts, as the order and method of fcience requires.

But as thefe things are beft underftood when illuftrated by examples; let us fuppofe any machine, for inftance a watch, prefented to us, whofe ftructure and compofition we are as yet unacquainted with, but want if poffible to difcover. The manner of proceeding in this cafe is, by taking the whole to pieces, and examining the parts feparately one after another. When by fuch a fcrutiny we have throughly informed ourfelves of the frame and contexture of each, we then compare them together, in order to judge of their mutual action and influence. By this means we gradually trace out the inward make and compofition of the whole, and come at length to difcern, how parts of fuch a form, and fo put together, as we found in unravelling and taking them afunder, conftitute that particular machine called a watch, and contribute to all the feveral motions and phænomena obfervable in it. This difcovery being made, we can take things the contrary way, and, beginning with the parts, fo difpofe and connect them, as their feveral ufes and ftructures require, until at length we arrive at the whole itfelf, from the unravelling of which thefe parts refulted.

And as it is in tracing and examining the works of art, fo is it in a great meafure in unfolding any part of human knowledge. For the relations and mutual habitudes of things do not always immediately appear upon comparing them one with another. Hence we have recourfe to intermediate ideas, and by means of them are furnifhed with

with thoſe previous propoſitions, that lead to the concluſion we are in queſt of. And if it ſo happen, that the previous propoſitions themſelves are not ſufficiently evident, we endeavour by new middle terms to aſcertain their truth, ſtill tracing things backward in a continued ſeries, until at length we arrive at ſome ſyllogiſm where the premiſſes are firſt and ſelf-evident principles. This done, we become perfectly ſatisfied as to the truth of all the concluſions we have paſſed through, in as much as they are now ſeen to ſtand upon the firm and immoveable foundation of our intuitive perceptions. And as we arrived at this certainty by tracing things backward to the original principles whence they flow, ſo may we at any time renew it by a direct contrary proceſs, if, beginning with theſe principles, we carry the train of our thoughts forward, until they lead us by a connected chain of proofs to the very laſt concluſion of the ſeries.

Hence it appears, that in diſpoſing and putting together our thoughts, either for our own uſe, that the diſcoveries we have made may at all times lie open to the review of the mind, or where we mean to communicate and unfold theſe diſcoveries to others, there are two ways of proceeding equally within our choice. For we may ſo propoſe the truths relating to any part of knowledge, as they preſented themſelves to the mind in the manner of inveſtigation, carrying on the ſeries of proofs in a reverſe order, until they at laſt terminate in firſt principles: or, beginning with theſe principles, we may take the contrary way, and from them deduce, by a direct train of reaſoning, all the ſeveral propoſitions we want to eſtabliſh. This diverſity in the manner of arranging our thoughts gives riſe to the twofold diviſion of method eſtabliſhed among logicians. For method, according to their uſe of the word, is nothing elſe but the order and diſpoſition of our thoughts relating to any ſubject. When truths are ſo propoſed and put together, as they were or might have been diſcovered, this is called the *analytick method*, or the *method of reſolution;* in as much as it traces things backward to their ſource, and *reſolves* knowledge into its firſt and original principles. When, on the other hand, they are deduced from theſe principles, and connected according to their mutual dependence, inſomuch that the truths firſt in order tend always to the demonſtration of thoſe that follow, this conſtitutes what we call the *ſynthetick method*, or *method of compoſition*; for here we proceed by gathering together the ſeveral ſcattered parts of knowledge, and *combining* them into one whole ſyſtem, in ſuch manner, that the underſtanding is enabled diſtinctly to follow truth through all her different ſtages and gradations.

There is this farther to be taken notice of, in relation to theſe two ſpecies of method; that the firſt has alſo obtained the name of the *method of invention*, becauſe it obſerves the order in which our thoughs ſucceed one another in the *invention* or diſcovery of truth. The other again is often denominated the *method of doctrine* or *inſtruction;* in as much as, in laying our thoughts before others, we generally chuſe to proceed in the *ſynthetick* manner, deducing them from their firſt principles. For we are to obſerve, that although there is great pleaſure in purſuing truth in the method of inveſtigation, becauſe it places us in the condition of the inventor, and ſhews the particular train and proceſs of thinking by which he arrived at his diſcoveries; yet is it not ſo well accommodated to the purpoſes of evidence and conviction. For at our firſt ſetting out, we are commonly unable to divine where the analyſis will lead us, inſomuch that our reſearches are for ſome time little better than a mere groping the dark. And even after light begins to beak in upon us, we are ſtill obliged to many reviews, and a frequent compariſon of the ſeveral ſteps of the inveſtigation among themſelves. Nay, when we have unravelled the whole, and reached the very foundation on which our diſcoveries ſtand, all our certainty in regard to their truth will be found in a great meaſure to ariſe from that connection we are now able to diſcern between them and firſt principles taken in the order of compoſition. But in the ſynthetick manner of diſpoſing our thoughts, the caſe is quite different. For as we here begin with intuitive truths, and advance by regular deductions from them, every ſtep of the procedure brings evidence and conviction along with it; ſo that in our progreſs from one part of knowledge to another, we have always a clear perception of the ground on which our aſſent reſts. In communicating therefore our diſcoveries to others, this method is apparently to be choſen, as it wonderfully improves and enlightens the underſtanding, and leads to an immediate perception of truth.

LOHOCH, or LOCH, in pharmacy, a compoſition of a middle conſiſtence between a ſoft electuary and a ſyrup, principally uſed in diſorders of the lungs.

There are ſeveral kinds of lohochs, denominated from the principal ingredient that enters into their compoſition. The common lohoch is made thus: take of freſh drawn oil of ſweet almonds, and of pectoral or balſamic ſyrup, one ounce; white-ſugar, two drams: mix, and make them into a lohoch.

LOINS, in anatomy. the two lateral parts of the umbilical region of the abdomen. See ANATOMY.

LOIRE, the largeſt river in France, riſes in the mountains of the Cevennes, and, after running a courſe of about five hundred miles, falls into the bay of Biſcay.

LOLIUM, DARNEL, in botany, a genus of the triandria digynia claſs. The involucrum conſiſts of one leaf; it has no calix; and the ſtipula conſiſts of many flowers. There are three ſpecies, two of them natives of Britain, *viz.* the perenne, or perennial darnel-graſs; and the temulentum, or annual darnel-graſs.

LOMBARDY, a kingdom which comprehended almoſt all Italy. It was erected by the Longobards, or Lombards, a German nation, about the year 598, and laſted till Charlemain put an end to it about the year 760.

LOMMOND, a lake in the county of Lenox, in Scotland, which runs almoſt the whole length of the county.

LONCHITIS, SPLEEN-WORT, in botany, a genus of the cryptogamia filicum claſs of plants, the fructifications of which are arranged into lunulated ſeries, and diſpoſed ſeparately under the ſinuſes of the leaves.

There

There are four ſpecies, none of them natives of Britain.

LONDON, the metropolis of Great Britain, where the firſt meridian is fixed on the Britiſh maps, lies in 51° 32′ N. lat. on the river Thames, and the greateſt part on the north ſide of that river. The form of London, including Weſtminſter and Southwark, comes pretty near an oblong ſquare, five miles in length, if meaſured in a direct line from Hyde-Park to the end of Limehouſe, and ſix miles if we follow the windings of the ſtreets; the greateſt breadth is two miles and a half, and the circumference of the whole ſixteen or ſeventeen miles, but it is not eaſy to meaſure it exactly, on account of its irregular form. The principal ſtreets are generally level, exceeding well built, and extended to a very great length; theſe are inhabited by tradeſmen, whoſe houſes and ſhops make a much better figure than thoſe of any tradeſmen in Europe. People of diſtinction uſually reſide in elegant ſquares, of which there are great numbers at the weſt end of the town near the court. What moſtly contributes to the riches and glory of this city, is the port, whither ſeveral thouſand ſhips of burden annually reſort from all countries, and where the greateſt fleets never fail to meet with wealthy merchants ready to take off the richeſt cargoes. The number of perſons in the whole place are computed to be about eight hundred thouſand.

LONDONDERRY, a city of Ireland, in the province of Ulſter, and county of Londonderry, ſituated on the river Mourn, near its mouth, in W. long. 7° 40′, N. lat. 54° 52′.

LONG, an epithet given to whatever exceeds the uſual ſtandard of length; thus, we ſay a long-boat, long accent, *&c.*

LONGÆVITY, length of life.

Lord Bacon obſerves, that the ſucceſſion of ages, and of the generation of men, ſeems no way to ſhorten the length of human life, ſince the age of man, down from Moſes's time to the preſent, has ſtood at about eighty years, without gradually declining, as one might have expected. The greateſt inſtances of longævity in theſe our iſlands, are that of old Parr, who lived almoſt 153 years; of Jenkins, of Yorkſhire, who lived 169 years; or of the counteſs Deſmond, or Mr Eckleſton, both of Ireland, who each exceeded 140 years.

LONGFORD, a county of Ireland, in the province of Leinſter, bounded by the county of Letrim and Cavan on the north, by Meath on the eaſt and ſouth, and by Roſcommon on the weſt.

LONG-ISLAND, an iſland belonging to New-York in North America, lying between 71° and 74° W. long. and in 41° 30′ N. lat.

LONGIMETRY, the art of meaſuring lengths, both acceſſible and inacceſſible. See GEOMETRY.

LONGINICO, a town of the Morea, in Europe, ſituated on the river Alpheus, fifty miles ſouth of Lepanto: being the ancient Olympia, where Hercules inſtituted the Olympic games.

LONGISSMUS DORSI, in anatomy. See ANATOMY, p. 218.

LONGITUDE *of a ſtar*, in aſtronomy, an arch of the ecliptic, intercepted between the beginning of aries, and the point of the ecliptic cut by the ſtar's circle of longitude.

LONGITUDE *of a place*. See GEOGRAPHY.

In the philoſophical tranſactions, n° 1, we have an account of a ſucceſsful experiment in finding the longitude at ſea, made with two pendulum-watches by major Holmes, in a voyage from the coaſt of Guinea homewards. This and ſome other ſucceſſes encouraged Monſieur Huygens ſo far, that, after he had improved the ſtructure of theſe watches, he publiſhed an account at large for the ſhewing how and in what manner theſe watches are to be uſed in finding the longitude at ſea, with directions for adjuſting of them and keeping a journal by them; which account the curious reader may ſee at large in the Philoſophical tranſactions, n° 47.

The chief objection againſt pendulum clocks and watches, is the effects that heat and cold have upon the ſpring and pendulum, which make the ſpring in watches draw ſtronger at ſome times than at other times, and cauſes the pendulum to lengthen and ſhorten, according as the weather is hotter or colder; but theſe effects are ſo regular, that without doubt they may be accounted for.

But the moſt ingenious and ſucceſsful machines for this purpoſe have been invented by Mr. John Harriſon, who, at different times, contrived three different time-pieces for determining the longitude at ſea.

The firſt of Mr. Harriſon's machines was tried in May 1736, when it was put on board a man of war; and by its exact meaſure of time, in its return from Liſbon, corrected an error of almoſt a degree and an half in the computations of the reckoning of a ſhip. In 1739, Mr. Harriſon finiſhed his ſecond machine, which, from various experiments made upon it, was ſufficiently regular and exact for finding the longitude of a ſhip within the neareſt limits propoſed by parliament. Upon the ſucceſs of this, Mr. Harriſon, in 1741, undertook ſtill a more advantageous machine, which he finiſhed in 1758, when he applied to the commiſſioners of longitude for orders to make a trial of that inſtrument to ſome part in the Weſt Indies, as directed by the ſtatutes for the diſcovery of the longitude at ſea. In conſequence of this application, Mr. Harriſon received orders for his ſon to proceed from Portſmouth to Jamaica, in one of his majeſty's ſhips of war, with his third inſtrument, in November 1761; and the commiſſioners having directed that every requiſite ſtep and precaution ſhould be taken, for making, with care, the proper experiments, and aſcertaining their accuracy, not only going to Jamaica, but in the return, it appears, from the calculations made from the experiments in going to Jamaica, that the difference between the longitude, as found by the time-piece, and calculated by the obſervations of the tranſit of mercury in 1743 at Jamaica and London, is five ſeconds of time, which at Jamaica is little more than a geographical mile.

During the voyage, Mr. Harriſon's time-piece corrected the ſhip's reckoning, which ſometimes erred about a degree and a half: and in going from Madeira

to

to Jamaica, it alſo corrected the errors of the log, and ſhewed the longitude ſo exactly, that the ſhip made the iſland of Deſeada, and all the other iſlands, until they arrived at Jamaica, as foretold by the time-piece. At the arrival at Jamaica, the obſervations for finding the time were made by equal altitudes; and the longitude ſhewn by the time-piece, being within 5″ of time of the longitude ſhewn by the moſt accurate obſervations of mercury in its tranſit over the ſun in the year 1743, and with which all the obſervations at London and Paris agreeing within 23″, amounts to a demonſtration, that Mr. Harriſon has performed all that is required by the ſtatute of the 12th of queen Anne, to entitle him to the greateſt reward mentioned in that act. In returning from Jamaica, the weather was very tempeſtuous, ſo that the time piece was forced to be placed on the counter, to avoid being perpetually expoſed to the ſea water; there it ſuffered continual violent agitations, which, though they neceſſarily retarded its motion, yet did not occaſion any ſuch conſiderable error, as would have made Mr. Harriſon's right to the greateſt reward queſtionable, had it depended on this voyage only; for the time-keeper, in its going and return, loſt only 1′ 54″ and ½, which, in the latitude of Portſmouth, amounts to about eighteen geographical miles or minutes of a great circle, whereas the act required only that it ſhould come within the diſtance of thirty geographical miles or minutes of a great circle.

LONGITUDINAL, in general, denotes ſomething placed lengthwiſe; thus ſome of the fibres of the veſſels in the human body are placed longitudinally, others tranſverſely or acroſs.

LONGUEVILLE, a town of Normandy in France, twenty miles north of Rouen: E. long. 1° 10′, N. lat. 49° 50′

LONICERA, in botany, a genus of the pentandria monogynia claſs. The corolla conſiſts of one irregular petal; and the berry of two cells containing many ſeeds. There are 13 ſpecies, only one of which, *viz.* the periclymenum, or common honey-ſuckle, is a native of Britain.

LOOF, in the ſea language, is a term uſed in various ſenſes: thus, the loof of a ſhip is that part of her aloft, which lies juſt before the cheſt tree; hence the guns which lie there are called loof-pieces: keep your loof, ſignifies, keep the ſhip near to the wind; to loof into a harbour, is to ſail into it cloſe by the wind; loof up, is to keep nearer the wind; to ſpring the loof, is when a ſhip that was going large before the wind, is brought cloſe by the wind.

LOOKING-GLASSES, are nothing but plain mirrours of glaſs; which being impervious to the light, reflect the images of things placed before them; for the theory whereof, ſee OPTICS.

LOOM, a frame compoſed of a variety of parts, uſed in all the branches of weaving. See WEAVING.

LOOSING of arreſtment, in Scots law. See LAW, Tit. xxv. 6.

LOPHIUS, in zoology, a genus of the branchioſtegious order of fiſhes, whoſe head is in ſize equal to all the reſt of the body: the head and body are both of a depreſſed form: there are a number of fleſhy pinnules or apendages ſurrounding the whole body of the fiſh. There are three ſpecies.

LORANTHUS, in botany, a genus of the hexandria monogynia claſs. The margin of the calix is entire; the corolla conſiſts of ſix ſegments folded backwards; and the berry contains one ſeed. There are five ſpecies, none of them natives of Britain.

LORD, a title of honour, given to thoſe who are noble, either by birth or creation; in this ſenſe it amounts to much the ſame as peer of the realm, or lord of Parliament. This title is, by courteſy, alſo given to all the ſons of dukes and marquiſes, and to the eldeſt ſons of earls; and it is alſo a title of honour beſtowed on thoſe who are honourable by their employments, as lord advocate, lord chamberlain, lord chancellor, *&c.*

LORETTO, a city of Italy, in the marquiſate of Ancona, in the pope's territories, 145 miles eaſt of Rome. This place is famous for the chamber of the bleſſed Virgin, which, according to the Roman catholic tradition, was brought by angels from Paleſtine to Dalmatia, and from thence tranſported over into Italy, and fixed at Loretto.

LORN, the north part of Argyleſhire in Scotland, bounded by Lochabar on the north, by Broadalbin on the eaſt, by the reſt of Argyleſhire on the ſouth, and by the ſea on the weſt.

LORRAIN, a duchy formerly belonging to the circle of the Upper Rhine in Germany, but now united to the crown of France. It is bounded by the duchy of Luxemburg on the north; by Alſatia, the duchy of Deux ponts, and the palatinate of the Rhine, on the eaſt; by the county of Burgundy, on the ſouth; and by Champaign, on the weſt.

LOTHIAN, a county of Scotland, bounded by the frith of Forth on the north; by the German ſea, on the eaſt; by Clydeſdale, Tweedale, and Merſe, on the ſouth; and by Stirling, on the weſt. The capital of this county is Edinburgh.

LOTION is, ſtrictly ſpeaking, ſuch waſhing as concerns beautifying the ſkin, by cleanſing it of thoſe deformities which a diſtempered blood ſometimes throws upon it, or rather are made by a preternatural ſecretion: for according to Quincy, generally thoſe diſtempers of the ſkin, commonly accounted ſigns of a foul blood, are, from thoſe ſalts which are natural in the beſt conſtitution, thrown off by the cutaneous glands, which ought to be waſhed away through the kidney; ſo that inſtead of thoſe inſignificant and ridiculous tribes of ſweeteners, which in this caſe are frequently uſed, promoting the urinary diſcharge, or rectifying that of the ſkin by proper waſhes, frictions, or ointments, or both together, is the only way to get rid of ſuch diſorders.

LOTTERY, a kind of public game at hazard, frequent in Britain, France, and Holland, in order to raiſe money for the ſervice of the ſtate; being appointed with us by the authority of parliament, and managed by commiſſioners appointed by the lords of the treaſury for that purpoſe. It conſiſts of ſeveral numbers of blanks and prizes, which are drawn out of wheels, one of

of which contains the numbers, and the other the corresponding blanks or prizes.

LOTUS, in botany, a genus of the diadelphia decandria class. The legumen is cylindrical; the wings are connivent above; and the calix is tubular. There are 17 species, only one of which, *viz.* the corniculata, or birds-foot trefoil, is a native of Britain.

LOVAGE, in botany. See LIGUSTICUM.

LOVE APPLE. See SOLANUM.

LOUIS, or *Knights of St.* LOUIS, the name of a military order in France, instituted by Louis XIV. in 1693. Their collars are of a flame colour, and pass from left to right; the king is their grand master. There are in it eight great crosses, and twenty four commanders; the number of knights is not limited. At the time of their institution, the king charged his revenue with a fund of three hundred thousand livres for the pensions of the commanders and knights.

LOUISIANA, or NEW FRANCE, a country of north America, bounded by the river and lake of Illenois on the north, North Carolina on the east, and the gulph of Mexico on the south.

LOUSE, in zoology. See PEDICULUS.

LOUTH, a county of Ireland, in the province of Leinster, bounded by Monaghan and Armagh on the north, by the Irish Channel on the east, by East Meath on the south; and by Cavan on the west.

LOUVAIN, a city of the Austrian Netherlands, in the province of Brabant, situated on the river Dyle, fifteen miles north-east of Brussels.

LOWERING, among distillers, a term used to express the debasing the strength of any spiritous liquors, by mixing water with it.

LOXIA, in zoology, the name of a genus of birds of the order of the passeres; the distinguishing characters of which are, that the tongue is plain, equal and whole; the beak large, thick, and short, and crooked and convex both ways. There are 48 species, principally distinguished by their colour.

LOZENGE, in heraldry, a rhombus, or figure of equal sides, but unequal angles, resembling a quarry of glass in our old windows, placed erect, point ways. It is in this figure that all unmarried gentlewomen and widows bear their coats of arms, because, as some say, it was the figure of the Amazonian shield; or, as others, because it is the ancient figure of the spindle. Plate CIII. fig. 8. represents an ordinary of lozenges.

The lozenge differs from the fusil, in that the latter is narrower in the middle, and not so sharp at the ends.

LUBEC, a city and port-town of Germany, in the circle of Lower Saxony, and duchy of Holstein, situated ten miles south-west of the Baltic sea: E. long. 10° 35′, N. lat. 54° 20′.

LUBEN, a town of Germany, in the circle of Upper Saxony, and marquisate of Lusatia: E. long. 14° 25′, N. lat. 52°.

LUBLIN, a city of Poland, in the palatinate of the same name: E. long. 22° 15′, N. lat. 51° 30′.

LUBOW, a town of Poland, in the palatinate of Cracow: E. long. 20° 30′, N. lat. 49° 30′.

LUC, a town of Provence, in France, twenty-three miles north-east of Toulon.

LUCAR, or *St* LUCAR, a port-town of Spain, in the province of Andalusia: W. long. 6° 38, N. lat 36° 42′.

St LUCAR is also a town of Andalusia, in Spain: W. long. 8° 12, N. lat. 37° 20.

St LUCAR is also the name of another town of Spain, fifteen miles west of Seville.

LUCARNO, a town of the duchy of Milan, situated on the lake of Maggiore, but subject to Switzerland.

LUCCA, the capital of the republic of the same name in Italy, situated twelve miles east of the Tuscan sea: E. long. 11° 20′, N. lat. 43° 45′.

LUCERN, the capital of the canton of the same name in Switzerland, situated on the lake Lucern, to which it gives its name: E. long. 8° 12′, N. lat. 47°.

LUCERNE, in botany. See MEDICAGO. For the culture of lucerne, see AGRICULTURE, p. 65.

LUCIA-ISLANDS, one of the Caribbee islands in America, situated seventy miles north-west of Barbadoes, being twenty-two miles long, and eleven broad.

St. LUCIA, one of the Cape Verd islands in Africa, lying in W. long. 25°, N. lat. 16° 30′.

LUCIOPERCA, in ichthyology. See PERCA.

LUCIUS, in ichthyology. See ESOX.

LUCONIA, or MANILLA, the chief of the Philippine islands, situated between 117° and 123° E. long. and between 12° and 19° of N. lat.

LUDLOW, a borough of Shropshire, situated on the river Corve; eighteen miles south of Shrewsbury. It sends two members to parliament.

LUDWIGIA, in botany, a genus of the tetrandria monogynia class. The corolla consists of four petals, and the calix of four segments; the capsule has four sides and four cells, with many seeds. There are two species, none of them natives of Britain.

LUES, among physicians, is, in general, used for a disease of any kind; but, in a more particular sense, is restrained to contagious and pestilential diseases: thus, the lues gallica, or venerea, signifies the venereal disease. See MEDICINE.

LUGGERSHAL, a borough-town, ten miles north of Salisbury. It sends two members to parliament.

LUGO, a city and bishop's see of Spain, sixty miles east of Compostella: W. long. 7° 50′, and N. lat. 43° 5′.

LUKE, or *gospel of St.* LUKE, a canonical book of the New Testament.

Some think it was properly St. Paul's gospel, and that when that apostle speaks of his gospel, he means what is called St. Luke's. Irenæus says, that St. Luke digested into writing what St. Paul preached to the Gentiles; and Gregory Nazianzen tells us, that St. Luke wrote with the assistance of St. Paul.

St. LUKE *the evangelist's day*, a festival in the Christian church, observed on the 18th of October.

LULA-LAPMARK, a province of Sweden, bounded on the north by that of Torne; on the east, by the Bothnic gulph; on the south, by Pithia-lapmark; and on the west, by Norway.

LUMBAGO,

LUMBAGO, in medicine, denotes a pain about the loins, as that preceding fevers, agues, and the rheumatiſm.

LUMBARIS, a name given to the arteries and veins which ſpread over the loins. See ANATOMY.

LUMBRICAL, a name given to four muſcles of the fingers, and to as many of the toes. See ANATOMY, part II.

LUMBRICUS, the EARTH-WORM, in zoology, a genus of inſects belonging to the order of vermes inteſtina. The body is cylindrical, annulated, with an elevated belt near the middle. There is but one ſpecies of this animal. It lives under ground, and feeds upon the ſeeds and roots of plants. It comes above ground in the night, or during rain, for the purpoſe of copulation. For the effects of theſe animals in the human body, and the method of expelling them, ſee MEDICINE.

LUMME, in ornithology. See COLYMBUS.

LUMP-FISH. See CYCLOPTERUS.

LUNA, in aſtronomy, the moon. See ASTRONOMY.

LUNAR, ſomething belonging to the moon; thus we ſay, lunar month, lunar year, &c.

LUNARIA, HONESTY, in botany, a genus of the tetradynamia ſiliculoſa claſs. The ſilicula, or pod, is entire, elliptical, and compreſſed; with plain, equal, parallel valves There are two ſpecies, none of them natives of Britain.

LUNATIC, a perſon affected with lunacy. See MEDICINE.

LUND, or LUNDEN, a city of Sweden, in the province of Gothland, the capital of the territory of Schonen, ſituated thirty miles eaſt of Copenhagen.

LUNDY, a little iſland in the mouth of the Briſtol-channel: W. long. 4° 50′, N. lat. 51° 25′.

LUNENBURG, the capital of the duchy of the ſame name, thirty miles ſouth-eaſt of Hamburg: E. long. 10° 20′, N. lat. 53° 35′.

LUNGS. See ANATOMY, p. 280.

LUNG-WORT, in botany. See PULMONARIA.

LUNISOLAR YEAR, in chronology, the ſpace of 532 common years; found by multiplying the cycle of the ſun by that of the moon.

LUNULA, in geometry, a plane figure like a creſcent or half moon.

LUPERCALIA, a feſtival of the ancient Romans in honour of the god Pan, obſerved on the 15th of February, and ſo called from luperci, the prieſts of that fabulous deity.

LUPINUS, in botany, a genus of the diadelphia decandria claſs. The calix conſiſts of two lips; five of the antheræ are oblong, and the other five round; and the pod is coreaceous. There are ſeven ſpecies, none of them natives of Britain.

LUPULUS, in botany, &c. See HUMULUS.

LUPUS, in zoology. See CANIS.

LUPUS MARINUS. See ANARRICHAS.

LUPUS, in aſtronomy See ASTRONOMY, p. 487.

LURE, in falconry, a device of leather, in the form of a bird, with two wings ſtuck with feathers and baited with a piece of fleſh; wherewith to reclaim or call back a hawk, when at a conſiderable diſtance.

LUSATIA, a marquiſate of Upper Saxony, bounded by Brandenburg, on the north; by Sileſia, on the eaſt; by Bohemia, on the ſouth; and by the duchy of Saxony, on the weſt: it is ſubject to the king of Poland.

LUSTRATION, in antiquity, ſacrifices or ceremonies by which the ancients purified their cities, fields, armies, or people, defiled by any crime or impurity.

Some of theſe luſtrations were public, others private. There were three ſpecies or manners of performing luſtration, *viz.* by fire and ſulphur, by water, and by air; which laſt was done by fanning and agitating the air round the thing to be purified. Some of theſe luſtrations were neceſſary, that is, could not be diſpenſed with, as luſtrations of houſes in time of a plague, or upon the death of any perſon; others again were done out of choice, and at pleaſure. The public luſtrations at Rome were celebrated every fifth year, in which they led a victim thrice round the place to be purified, and in the mean time burnt a great quantity of perfumes.

LUSTRE, the gloſs or brightneſs appearing on any thing, particularly on manufactures of ſilk, wool, or ſtuff. It is likewiſe uſed to denote the compoſition or manner of giving that gloſs.

The luſtre of ſilks is given them by waſhing in ſoap, then clear water, and dipping them in alum water cold. To give ſtuffs a beautiful luſtre, for every eight pounds of ſtuff allow a quarter of a pound of linſeed; boil it half an hour, and then ſtrain it through a cloth, and let it ſtand till it is turned almoſt to a jelly: afterwards put an ounce and a half of gum to diſſolve twenty four hours; then mix the liquor, and put the cloth into this mixture; take it out, dry it in the ſhade, and preſs it. If once doing is not ſufficient, repeat the operation. Curriers give a luſtre to black leather firſt with juice of bar berries, then with gum arabic, ale, vinegar, and flanders glue, boiled together. For coloured leather, they uſe the white of an egg beaten in water. Moroccoes have their luſtre from juice of bar-berries and lemon or orange. For hats, the luſtre is frequently given with common water, ſometimes a little black dye is added: the ſame luſtre ſerves for furs, except that for very black furs they ſometimes prepare a luſtre of galls, copperas, Roman alum, ox's marrow, and other ingredients.

LUSTRUM, in Roman antiquity, a general muſter and review of all the citizens and their goods, which was performed by the cenſors every fifth year, who afterwards made a ſolemn luſtration. See LUSTRATION.

LUTE, or LUTING, among chemiſts. See CHEMISTRY, p. 116.

LUTE, is alſo a muſical inſtrument with ſtrings.

The lute conſiſts of four parts, *viz.* the table; the body or belly, which has nine or ten ſides; the neck, which has nine or ten ſtops or diviſions, marked with ſtrings; and the head, or croſs, where the ſcrew for raiſing and lowering the ſtrings to a proper pitch of tone are fixed. In the middle of the table there is a roſe or paſſage for the ſound; there is alſo a bridge that the ſtrings are faſtened to, and a piece of ivory between

between the head and the neck to which the other extremities of the ftrings are fitted. In playing, the ftrings are ftruck with the right hand, and with the left the ftops are preffed. The lutes of Bologna are efteemed the beft, on account of the wood, which is faid to have an uncommon difpofition for producing a fweet found.

LUTHERANS, the Chriftians who follow the opinions of Martin Luther, one of the principal reformers of the church in the fixteenth century.

This fect took its rife from the diftafte taken at the indulgences which were granted in 1517, by pope Leo X. to thofe who contributed towards finifhing St. Peter's church at Rome. John Stuptize, vicar general of the Auguftines in Germany, was the firft who took occafion to declare againft thefe abufes, for which purpofe he made ufe of Martin Luther, the moft learned of all the Auguftines. Luther was a native of Eifleben, in the county of Mansfield in Saxony, and taught divinity at the univerfity of Wirtemberg; he mounted the pulpit, and declaimed vehemently againft the abufe of indulgences, and even fixed ninety-five propofitions upon the church-doors of Wirtemberg, in order to their being confidered and examined in a public conference: againft thefe John Tetzel, a Dominican, publifhed a hundred and fix pofitions at Francfort upon the Oder; and by virtue of his office of inquifitor, ordered thofe of Luther to be burnt; when his adherents, to revenge the affront, publicly burnt at Wirtemberg thofe of Tetzel. Thus war was declared between the Dominicans and Auguftines, and foon after between the Roman catholic and the Lutheran party. In 1520, Luther fent his book De Libertate Chriftiana, to the pope; in which he grounds juftification upon faith alone, without the affiftance of good works; and afferts, that Chriftian liberty refcues us from the bondage of human traditions, and particularly the flavery of papal impofitions; and afterwards, in a remonftrance written in high Dutch, he proceeded to deny the authority of the church of Rome. He was the fame year excommunicated by the pope; upon which Luther caufing a large fire to be made without the walls of Wirtemberg, threw the pope's bull into it with his own hands, together with the decretals, extravagants, and clementines; and this example was followed by his difciples in other towns. The next year the emperor Charles V. ordered his books to be burnt, and put him under the ban of the empire as a heretic and fchifmatic; and about this time king Henry VIII. of England wrote againft him in defence of the feven facraments, to which Luther wrote a reply.

The elector of Saxony, who had for fome time kept him concealed in his caftle of Wefburg, now gave him leave to reform the churches of Wirtemberg as he thought fit; when this reformer propofed, that the bifhops, abbots, and monks, fhould be expelled; that all the lands and revenues of the bifhoprics, abbeys, and monafteries, fhould efcheat to the refpective princes; and that all the convents of mendicant friars fhould be turned into public fchools and hofpitals: this year, Luther had the fatisfaction to fee a league contracted between Guftavus king of Sweden, and Frederick king of Denmark, who both agreed to eftablifh Lutheranifm in their dominions: and now Luther's perfuafion, which from the Upper Saxony had fpread into the northern provinces, began to be perfectly fettled in the duchies of Lunenburgh, Brunfwick, Mecklenburgh, and Pomerania, and in the archbifhoprics of Magdeburgh and Bremen; in the towns of Hamburgh, Wifmar, Roftock, and along the Baltic as far as Livonia and Pruffia. Luther maintained the doctrine of confubftantiation; and at a general diet at Ratifbon for reconciling both parties, the divines could agree to no more than five or fix articles concerning juftification, free-will, original fin, baptifm, good works, and epifcopacy.

LUTHERN, in architecture, a kind of window over the corniche, in the roof of a building; ftanding perpendicularly over the naked of a wall, and ferving to illuminate the upper ftory.

Lutherns are of various forms, as fquare, femi-circular, round, called bulls-eyes, flat arches, *&c.*

LUTON, a market town, fourteen miles fouth of Bedford.

LUTRA, in zoology. See MUSTELA.

LUXATION, in furgery, is when any bone is moved out of its place, or articulation, fo as to impede or deftroy its proper motion or office. See SURGERY.

LUXEMBURG, the capital of the duchy of the fame name, fituated an hundred miles fouth-eaft of Bruffels, is a fmall but ftrong fortrefs: E. long. 6° 8′, N. lat. 49° 45′.

LYBIA, a name anciently given to all the coaft of Barbary, efpecially that part lying weftward of Egypt.

LYCEUM, in Grecian antiquity, an academy fituated upon the banks of the Iliffus at Athens. It was compofed of porticoes and walks, where Ariftotle taught philofophy; walking there conftantly every day till the hour of anointing, whence he and his followers were called peripatetics.

LYCHNIS, in botany, a genus of the decandria pentagynia clafs. The calix confifts of one oblong fmooth leaf, and the corolla of five unguiculated petals, with a bifid limbus; and the capfule has three cells. There are feven fpecies, three of them natives of Britain, *viz.* the flos cuculi, meadow-pinks, or cuckow-flower; the vifcaria, or red German catchfly; and the dioica, or white campion.

LYCIUM, in botany, a genus of the petandria monogynia clafs. The corolla is tubular, the faux being fhut up by the beard of the filaments; and the berry has two cells. There are three fpecies, none of them natives of Britain.

LYCODONTES, in natural hiftory, the petrified teeth of the lupus-pifcis, or wolf-fifh, frequently found foffile. They are of different fhapes; but the moft common kind rife into a femiorbicular form, and are hollow within, fomewhat refembling an acorn-cup: this hollow is found fometimes empty, and fometimes filled with the ftratum in which it is immerfed. Many of them have an outer circle, of a different colour from the reft.

LYCOPERDON, in botany, a genus of the cryptogamia fungi claſs: It is roundiſh, and replete with farinaceous ſeeds. There are ten ſpecies, ſix of them natives of Britain, *viz.* the tuber, or ſolid puff-balls; the cervinum, or branny puff-ball; the boviſta, or common puff-ball; the ſtellatum, or ſtar puff-ball; the fornicatum, or turret puff-ball; and the pedunculatum, or ſtalked puff-ball.

LYCOPODIUM, in botany, a genus of the cryptogamia muſci claſs. The anthera is double-valved, and ſeſſile; the calyptra is wanting. There are 24 ſpecies, of which ſix are natives of Britain, *viz.* the clavatum, or common club-moſs; the inundatum, or marſh club-moſs; the annotinum, or Welſh club-moſs; the alpinum, or mountain club-moſs; the ſelago, or firr club-moſs; and the ſelaginoides, or prickly club-moſs.

LYCOPSIS, in botany, a genus of the pentandria monogynia claſs. The tube of the corolla is incurvated. There are ſeven ſpecies, only one of which, *viz.* the arvenſis, or ſmall wild bugloſs, is a native of Britain.

LYCOPUS, in botany, a genus of the diandria monogynia claſs. The corolla conſiſts of four ſegments, one of them emarginated; the ſtamina are diſtant; and there are four ſeeds. There are two ſpecies; only one of them, *viz.* the europeus, or water-borehound, is a native of Britain.

LYDIA, an ancient province of leſſer Aſia, in which was the city of Philadelphia.

LYGEUM, in botany, a genus of the triandria monogynia claſs. The ſpatha conſiſts of one leaf; there are two corollæ above the ſame germen; and the nut has two cells. There is but one ſpecies, a native of Spain.

LYING-IN WOMEN. See MIDWIFERY.

LYME, a borough and port-town of Dorſetſhire, E. long. 3° 5′, and N. lat. 50° 44′.

It ſends two members to parliament.

LYMPH, a fine fluid, ſeparated in the body from the maſs of blood, and contained in peculiar veſſels.

Dr Keil ſays, that the lymph being chemically examined, will be found to contain a great deal of volatile, but no fixed ſalt, ſome phlegm, ſome ſulphur, and a little earth. The uſe of the lymph, he obſerves, may be gathered from the conſideration of the parts into which it diſcharges itſelf: that which comes from the head, neck and arms, is thrown into the jugular and ſubclavian veins; all the lymphatics which the parts in the cavity of the thorax ſend out, empty themſelves into the thoracic duct; and the lymph from all the reſt of the body, flows to the receptacle of the chyle; ſo that there can be no doubt but its chief uſe is to dilute and perfect the chyle before it mixes with the blood. See ANATOMY, Part III.

LYMPHATICS, in anatomy. See ANATOMY, p. 308.

LYNN-REGIS, a port-town of Norfolk, ſituated at the mouth of the river Ouſe, on a bay of the German ſea, thirty-two miles weſt of Norwich.

It ſends two members to parliament.

LYNX, in zoology. See FELIS.

LYONS, the capital of the Lyonois, a province of France, bounded by Orleanois and Burgundy on the north, by la Breſſe and Dauphine on the eaſt, by Languedoc and Guienne on the ſouth, and by another part of Guienne and Orleanois on the weſt. This city lies upon the confluence of the rivers Rhone and Soan, in E. lon. 4° 55′, and N. lat. 5° 50′. Next to Paris, it is eſteemed the place of greateſt trade in France.

LYRA, in ichthyology. See CALLYONIMUS.

LYRE, a muſical inſtrument of the ſtring-kind, much uſed by the ancients.

LYRE, in aſtronomy. See ASTRONOMY, p. 486.

LYRIC, in general, ſignifies ſomething ſung or played on the lyre: but it is more particularly applied to the ancient odes and ſtanzas, anſwering to our airs and ſongs, and may be played on inſtruments. This ſpecies of poetry was originally employed in celebrating the praiſes of gods and heroes, though it was afterwards introduced into feaſts and public diverſions.

LYSIMACHIA, in botany, a genus of the pentandria monogynia claſs. The calix is rotated; and the capſule is roundiſh, with a ſharp point, and contains ten valves. There are eleven ſpecies, five of them natives of Britain, *viz.* the vulgaris, or yellow willow-herb; the thirſiflora, or tufted looſe-ſtrife; the nemorum, or yellow pimpernell of the woods; the nummularia, or money wort; and the tenella, or purple money-wort.

LYTHRUM, in botany, a genus of the dodecandria monogynia claſs. The calix conſiſts of twelve ſegments, and the corolla of ſix petals inſerted into the calix; and the capſule has two cells, and many ſeeds. There are ten ſpecies, two of them natives of Britain, *viz.* the ſalicaria, or purple ſpiked looſe-ſtrife; and the hyſſopifolia, or ſmall hedge-hyſſop.

END OF THE SECOND VOLUME.

ERRATA.

End of the article CATASTROPHE. For *See* Epic *and* Dramatic *compositions*, read, *See* Composition.

CHEVRON. Read *Plate LXV.*

CIRCUMDUCTION. For *addigeamus*, read *alledgeances*;—and for *Pobation*, read *Probation*.

DECLINATURE *of judges*. For *legal obligation*, read *legal objection*.

Page 424. column 2. line 39. For *fig.* 31. read *fig.* 3.

P. 425. col. 1. In paragr. 4. there ſhould have been a reference to *fig.* 6.—N. B. In any Treatiſe, or long article, illuſtrated by plates, when a figure is referred to without repeating the N° of the plate, let it be underſtood that the plate laſt mentioned is meant.

P. 426. col. 1. l. 35. For *fig.* 9. read *fig.* 3.—N. B. Fol. 425 & 426 are, by overſight, twice repeated.

P. 429. col. 1. l. 41. For *Fig.* 5. read *Fig.* 3.

P. 437. col. 2. l. 12. For *gait*, read *gate*.

DIODON. Omitted the reference to the figure, *viz.* Plate LXVIII. fig. 4.

DIPONDIUS. For *two ſparrows*, read *five ſparrows*.

DRACO. Omitted to refer to Plate LXVIII. fig. 5.

ECHENEIS. Omitted to refer to Plate LXXIV. fig. 4.

P. 477. col. 1. l. 43. For *Plate LXXV.* read *Plate LXXIV.*

P. 616. col. 1. l. *ult.* Read *Plate LXXX. fig.* 3.

P. 684. col. 1. By miſtake Florida is placed under the Spaniſh empire, and Canada under that of France; whereas they were both ceded to Britain by the late treaty of peace.

GIRONNE'. For *fig.* 5. read *fig.* 4.

GORE. For *fig.* 4. read *fig.* 5.

P. 729. col. 2. l. 28. For *as to language*, read *as eſſential to language*.

P. 731. col. 2. l. penult. For *remain changed*, read *remain unchanged*.

P. 735. col. 1. l. 43. For *to write*, read *to unite*.

P. 742. col. 1. l. 26. For *was it not*, read *it was not*.

GRYLLUS. For *fig.* 3, 4, 5. read *fig.* 4, 5, 6.

GULES. For *Plate CI. fig.* 6. read *Plate XCVII. fig.* 7.

P. 805. col. 2. l. 29. For *fig.* 4. read *fig.* 5.

INTERLOCUTOR. For *extacted*, read *extracted*.

P. 863. col. 1. l. 40. For "*increaſe. However, the voice*," &c. read "*increaſe; and the voice*," &c.

P. 864. col. 1. Inſtead of l. 17, 18, 19. read thus: "But although it may be conſidered as a general rule, "that the language of any nation is a very exact index of the ſtate of their mind, yet it admits of ſome "particular exceptions; for as man," *&c.*

Ibid. l. 9. *Dele* the words *in time*.

Ibid. col. 2. Inſtead of l. 11, 12. read thus:—"little "advantage from it, as the antiquity of a language "does not neceſſarily imply any degree of excellence, "ſeeing we all know that ſome nations," *&c.*

P. 865. col. 2. l. 34. For *word*, read *words*.

P. 866. col. 1. l. 6. For *one*, read *on*;—and in l. 24. *dele* the word *all*.

Ibid. col. 2. l. 22. For "and the *pluperfect* in issem "and ero," read "the *pluperfect* in issem, and the "*future* in ero."

Ibid. col. 1. and 2. Delete *Loqueo, Odio, Loque-bam, Odie-bam*, with the Engliſh words accompanying them; —and for *Faceo, Pona bam, Obie-bam, Gaudie bam*, and *Abſtinie-bam*, read *Facio, Pone bam, Obi bam, Gaude-bam*, and *Abſtine-bam*.

P. 868. For "Tu, *Tytere, lentis in umbra*," &c. read "Tu, *Tityre, lentus in umbra*," &c.

Ibid. col. 1. l. 28. For *contract*, read *contraſt*;—l. 37. for *paſion*, read *paſſion*;—and delete the ſyllable *con* at the beginning of l. 45.

P. 869. col. 2. l. 7. from the bottom. For *as they ought to have*, read *as they might have*.

P. 870. col. 2. lines 22, 23, 24, 25, and 26. read thus: "For all their nouns in um of the ſecond declenſion, "in e of the third, and in u of the fourth, have each "their nominative and accuſative ſingular alike. Nor "in the plural number is there any diſtinction between "theſe two caſes," *&c.*

Ibid. col. 2. l. 19. from the bottom. For *language*, read *languages*.

P. 872. col. 1. l. 13. For *by accumulated*, read *by the accumulated*;—and l. 25. for *any grammatical errors*, read *any conſiderable grammatical errors*.

P. 873. col. 1. l. 10. from the bottom: for *commutation*, read *communication*;—col. 2. l. 5. for *more naturally adapted to the genius of the language*, read *more agreeable to the genius of the language in which he wrote*;—and col. 2. l. 38. for *that*, read *their*.

P. 874. col. 2. l. 23. For *languages far leſs capable*, read *languages, far leſs capable*.—Ibid. l. penult. for *quite*, read *too*.

P. 875. col. 2. l. 24. For *into*, read *in*.

P. 875.

ERRATA.

P. 875. col. 2. l. 31. For *new-moulded ſhould at this juncture partake*, read *new-moulded at this juncture ſhould partake*.

P. 876. col. 1. l. 15. For *ſtanzas*, read *ſcenes*;—col. 2. l. 3. for *is it poſſible*, read, *is it, as we imagine, poſſible*;—and l. 16. for *is it*, read *it is*.

P. 877. col. 1. l. 10. Read *Madam Deſhouliers*.

P. 883. col. 2. l. 7. from the bottom, read thus: "Hence, as one ſtatute may be explained or repealed "by another," *&c.*—and in l. 6. delete the words *or repealed*.

P. 885. col. 1. l. 13. from the bottom. For *enexed*, read *annexed*.

P. 887. col. 1. l. 11. from the bottom. For 1972, read 1672.

P. 889. col. 1. l. 16. For *give*, read *given*.

P. 890. col. 1. l. 43. For *confirmed*, read *conferred*.

P. 895. col. 1. l. 31. For "*of the tocher and the wife*," &c. read, "*of the tocher; and the wife*," &c.

P. 904 col. 2. l. 8, 9. For "*ward-holding was* in dubio," read "*ward-holding was* in dubio *preſumed*."

P. 905. col. 2. l. 32. For *commiſſion*, read *commiſſioners*.

P. 908. col. 1. l. 5. For *eſtabliſh as the full right*, read *eſtabliſhes the full right*.

P. 909. col. 2. l. 8. For *again*, read *againſt*;—l. 9, 10. for *hypothec payment*, read *hypothec for payment*;—and in l. 41. for 1755, read 1756.

P. 914. col. 1. l. 2. For *brought*, read *bought*;—l. 10. for *of general terms*, read *in general terms*;—and l. 11. for *in the ſervitude*, read *of the ſervitude*.

P. 916. col. 2. l. 13. For *p.* 159, read *p.* 259.

P. 920. col. 1. l. 18. Delete the word *be*;—and in col. 2. l. 6. from the botom, for *of diviſion*, read *or diviſion*.

P. 921. col. 2. l. 26. For *ſtatem*, read *ſtatim*;—and in l. 31. for *may exiſt*, read *may never exiſt*.

P. 931. col. 2. l. 18. For *ſeiſin has actually followed*, read *ſeiſin has not actually followed*.

P. 947. col. 2. l. 11. from the bottom. For *action*, read *actions*.

P. 951. col. 2. l. 13. For *or law*, read *of law*.

P. 953. col. 2. For *Tit.* 26. read *Tit.* 33.;—and in l. 5. from the bottom, for *hin*, read *kin*.

P. 958. col. 2. l. 12. from the bottom. For *forms of law*, read *forms of trial*.

The page following 958 is numbered 949 inſtead of 959. In col. 2. l. 25. of ſaid page, for *It is neceſſary*, read *It is not neceſſary*.

LOGIC. Read lines 3d, 4th, and 5th, of the firſt paragraph thus: "Inaſmuch as it traces the progreſs "of our knowledge from our firſt and moſt ſimple con-"ceptions through all their different combinations, "and all thoſe numerous deductions," *&c.*